GRAND CANYON MONITORING PROJECT 1992–1999: SYNTHESIS AND ANNUAL REPORT FY99

Lisa M. Leap (MA), Jennifer L. Kunde (MA),
Duane C. Hubbard (MA, IP), Christian E. Downum (PhD),
Nancy Andrews (MA), Janet R. Balsom (MA),
and Andrea Miller (MA, IP)

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PREFACE

The purpose of this report is two-fold: (1) to summarize the outcomes of more than a decade's worth of archaeological survey and monitoring of cultural resources in the river corridor of Grand Canyon National Park, and (2) to provide an annual report on the results of archaeological site monitoring and remedial actions conducted by the Grand Canyon River Corridor Monitoring Project (RCMP) under a cooperative agreement between the Grand Canyon National Park Service (GRCA) and Northern Arizona University (NAU; CA 8210-97-002). Previous annual reports have summarized only the RCMP activities conducted during the preceding fiscal year. This year's report departs considerably from that format because it presents a synthesis of the legal frameworks, objectives, and accomplishments of collaborative GRCA-NAU survey and monitoring efforts.

Reflecting its dual purpose, this report is organized into two major parts. Part I, consisting of three chapters, presents a synthesis of the history of the program including the legal framework, contributions of the river corridor monitoring project (archaeological survey, monitoring, and remedial actions conducted from 1990 through 1999), and archaeological survey and monitoring conducted by GRCA and NAU. Chapter 1 gives a history of the project, beginning with the first perception of a need to consider impacts of the operation of Glen Canyon Dam, and continuing through the present day. Chapter 2 provides a discussion of the legal context of the project, and outlines various federal laws, regulations, and other mandates that guide its operation. Chapter 2 also discusses the "area of potential effect" of dam operations, with special emphasis on indirect effects such as side-canyon erosion and altered patterns of human visitation at archaeological sites. Chapter 3 suggests a framework for considering the significance and integrity of river corridor sites, especially as these issues affect the eligibility of the sites for inclusion in the National Register of Historic Places.

Part II of this report presents the outcomes of the monitoring history of all sites within the area of potential effect. Monitoring the condition of the sites and damage remediation efforts are conducted under the GRCA-NAU program. Chapter 4 begins by presenting a summary of the geomorphological background relevant to the archaeological sites monitored. It also briefly describes the methods used to evaluate the monitoring database from FY92 to FY99. Chapters 5 through 8 present detailed evaluations of individual monitored sites, organized according to geomorphologically based categories of site setting. Chapter 9 is a summary discussion of the physical impacts recorded from FY92 to FY99, and Chapter 10 is a summary of visitor-related impacts recorded from FY92 to FY99. Chapter 11 is an evaluation of the reliability of the GRCA-NAU monitoring program to date. It also includes suggestions for future modifications and improvements to the program. Chapter 12 presents the scope of work proposed for FY2000.

The RCMP and this report would not have been possible without the efforts of many people. All of the various field and laboratory crews over the years are thanked for their efforts, from the first pioneering surveys and evaluations of sites to the monitoring and mitigation efforts conducted during the past fiscal year. The fiscal and administrative support of Northern Arizona University, the U.S. Bureau of Reclamation, and the U.S. National Park Service is also gratefully acknowledged. Thanks also to the various reviewers of a draft copy of this report. Any errors of fact, omission, or interpretation remain the responsibility of the authors.

Christian E. Downum

EXECUTIVE SUMMARY

Lisa M. Leap

The winter of 1982–83 was especially wet in the upper basin of the Colorado River, resulting in high snowpack levels that could potentially translate into greatly increased flows in the river. This potential was realized when late winter and early spring storms added to the snowpack and increased the volume and rate of runoff from the mountains into the river. Lake Powell began to fill at an alarming rate, and the U.S. Bureau of Reclamation was forced to release an unprecedented volume of water—up to 93,000 cubic feet per second (cfs)—from Glen Canyon Dam. This unanticipated event accelerated awareness of dam operations and their potential effects on downstream cultural resources.

As a result, a number of archaeological sites in Glen Canyon National Recreation Area and Grand Canyon National Park were either freshly exposed or eroded and damaged by this clear-water flow. GRCA personnel initially documented the effects of the 1983 flood that autumn (Balsom 1984). It was realized that cultural resources might be more abundant in the river corridor than previously assumed (including substantial habitation sites below the historic high-water marks of the river), and that dam operations might have substantial adverse effects on such resources. Scientific studies of cultural resources obviously were needed to document the nature and scope of such potential effects.

During the 1980s, other factors promoted an increased awareness of the presence of cultural resources in the river corridor, and the potential effects of Glen Canyon Dam on these resources. One of these factors was a growing concern among a number of constituencies regarding the practice of increasing the amount of water released from the dam to coincide with peak demands for electrical power. It is possible for the operators of a hydroelectric dam, such as the one in Glen Canyon, to time the water releases so that more water is released, and thus more electricity generated, during times of highest regional power demand. These water releases, however, created unpredictable surges and drops in the river that were of great concern to resource managers, environmental groups, commercial interests, Indian tribes, and others.

One outcome of these concerns was the creation by Reclamation of the Glen Canyon Environmental Studies (GCES) program, designed to study the effects of low and fluctuating river flows on a variety of natural resources downstream from the dam. These studies were also necessitated by a planned uprating and rewinding of the generators of Glen Canyon Dam, which would increase its power-generating capacity. Hence, in the early 1980s it was apparent that scientific studies were needed to assess the effects of the dam on downstream resources, especially regarding the issue of fluctuating flows. Cultural resources were not initially included in the list of affected resources, but a new paradigm of scientifically assessing the effects of the dam had been created. This was an essential step toward allowing studies of cultural resources to be incorporated at a later date.

One of the first of these investigations took place in the late 1980s as a collaborative pilot study involving NPS and the U.S. Geological Survey (USGS). This study focused on only one site along the Colorado River, but its results suggested that the operation of the dam might indeed be contributing to the deterioration of archaeological sites elsewhere along the river corridor (Balsom et al. 1989).

In July of 1989 Secretary of the Interior Manuel Lujan directed Reclamation to prepare an Environmental Impact Statement (EIS) regarding the operation of Glen Canyon Dam. Thus, after more than a quarter-century, the dam's environmental effects were to be judged scientifically. Under the National Environmental Policy Act of 1969, which authorizes the EIS process, cultural resources are an aspect of the environment worthy of study and consideration, just as are natural resources. The EIS for Glen Canyon Dam operations therefore mandated scientific studies of cultural resources within the area potentially affected by water releases. Further, Glen Canyon Dam operations are considered a federal undertaking that either directly, indirectly, or potentially affects cultural resources. Acknowledgment of this enacts the National Historic Preservation Act (NHPA) of 1992 (amended). Under Section 106 of this act, Reclamation is responsible for the impacts to cultural resources caused by dam operations, and NPS is dually responsible for these cultural resources under Section 110.

In a joint venture, Reclamation and NPS decided that the first step in the EIS process with respect to cultural resources was to conduct an intensive inventory of archaeological sites in the river corridor. The area surveyed encompassed a 255-mile stretch of the river corridor, extending from Glen Canyon Dam to Separation Canyon. The vertical extent of the survey area was the riverine environment that incorporated all terrestrial river-derived sediments below the estimated 300,000 cfs level, as well as a few areas of eolian sand dunes lying slightly above this level. The estimated 300,000 cfs level was considered an approximation of the pre-dam flood terraces and was not considered an absolute number representing an exact elevation.

The survey was conducted from 24 August 1990 to 30 April 1991. During this time some 1,968 person-days were spent surveying about 10,506 acres. The primary goal of site inventory was accomplished, with a total of 475 archaeological sites and 489 isolated occurrences of artifacts or features located and recorded. This total included 118 sites that were previously located and recorded, but it also included 357 newly discovered sites. Regarding the impacts of dam operations on archaeological sites, it was judged initially that 336 of the 475 recorded sites existed in locations that could potentially be adversely affected by changing water releases. Of the 336 sites potentially affected by dam operations, 322 were potentially eligible for the National Register of Historic Places. Since 1992, the cultural monitoring personnel have been able to refine the site impact categories initially identified by Fairley et al. (Fairley et al. 1994). As a result, 264 sites are currently considered affected by the operations of Glen Canyon Dam. Any site types with a roasting or thermal feature make up the majority (46%) of the properties monitored along the river corridor. The remaining property types, such as small structures, pueblos, and historic structures, each represent 20 percent or less.

It is sufficient to note that the cultural monitoring program has operated from its inception within a complicated framework of laws, regulations, and other directives that are not always in accord with one another. At times, there has been an inherent conflict between complying with the provisions of Section 106 of NHPA (mitigating the effects of a federally sponsored undertaking), and at the same time recognizing and adhering to long-standing NPS policies (i.e., Section 110 of NHPA) regarding the "preservation-in-place" of cultural resources.

Therefore, a crucial document created to guide Reclamation's Section 106 compliance in conjunction with other NPS legal mandates is the 1994 Programmatic Agreement (PA). This PA, regarding the operation of the dam, was signed by officials from Reclamation, the Advisory Council on Historic Preservation, the Arizona State Historic Preservation Officer, the U.S. National Park Service (NPS), and six Indian tribes and nations—the Hopi Tribe, the Hualapai Nation, the Kaibab Paiute Tribe, the Navajo Nation, the Paiute Indian Tribe of Utah for the Shivwits Paiute Tribe, and Zuni Pueblo—with an interest in the affected cultural resources listed on the National Register of Historic Places. Implementation of this agreement fulfills Reclamation's responsibilities under Section 106 of NHPA relative to Glen Canyon Dam operations and also satisfies the responsibilities of NPS.

The PA outlines the responsibilities of Reclamation for the mitigation of these adverse effects under Section 106 of NHPA, spelling out the responsibilities of the RCMP as follows:

> The purpose of the Monitoring and Remedial Action Plan shall be to generate data regarding the effects of Dam operations on historic properties, identify ongoing impacts to historic properties within the APE [Area of Potential Effect], and develop and implement remedial measures for treating historic properties subject to damage.

Currently, all work conducted by cultural monitors has been completed under stipulations in the Monitoring and Remedial Action Plan (MRAP). Until a final Historic Preservation Plan is completed, as outlined in the PA, the MRAP guides the ongoing process for the identification, monitoring, and remedial actions for cultural resources impacted, or potentially impacted, as a result of the operations of Glen Canyon Dam.

The PA identifies more than 300 National Register-eligible properties within the APE that are potentially subject to monitoring and remedial action. (This has since been reduced to 264 sites within GRCA.) The PA also recognizes that additional identification and evaluation of properties should take place within the APE, and it directs Reclamation and NPS to conduct appropriate studies to identify Traditional Cultural Properties within the APE.

The PA ratifies a number of important issues relevant to Section 106 compliance. Among these, it states that the legal authority for the PA derives not only from NHPA, but also from Interior Secretary

Lujan's directive to prepare an EIS for the operation of Glen Canyon Dam, and the language in the Grand Canyon Protection Act of 1992 ordering continued monitoring and management of resources within the area of the dam's effects. The PA also states that Reclamation is the lead agency for Section 106 compliance regarding the impacts of Glen Canyon Dam, and it notes that Reclamation has acknowledged potential adverse effects on cultural resources from dam operations. The PA declares further that "given their mutual responsibilities [Section 106 and Section 110 of NHPA, respectively], Reclamation and the NPS have determined to coordinate their respective roles in the management and consideration of historic properties which may be affected by the Program [i.e., operation of Glen Canyon Dam]." In 1992 GRCA contracted with NAU to conduct the joint Reclamation-NPS (GRCA) project referred to as the RCMP. The administrative structure for the RCMP is established by a cooperative agreement between GRCA and NAU. This agreement provides the framework by which the National Park Service at Grand Canyon contracts with NAU to conduct the RCMP as a collaborative venture.

It is clear that the RCMP is unusual and cannot be considered a routine Section 106 compliance project. This project is considerably more complex than most Section 106 actions because of the various legal requirements that guide the specifics of Section 106 compliance in this instance (e.g., the EIS, the ROD, and the GCPA), and because compliance is sought by one agency (Reclamation) within the jurisdiction of a second agency (NPS) bound by stringent preservation requirements. This theme—the tension between a traditional model of Section 106 compliance, and the obligation to preserve the unique, highly significant, and fragile cultural resources of Grand Canyon National Park (GRCA)—will surface repeatedly in subsequent chapters of this report.

All monitoring and remedial efforts pursued under the PA are subject to approval by the PA signatories. All proposed efforts must also comply with Wilderness Act requirements due to the proposed wilderness area designation of the Colorado River in the Grand Canyon. Remedial efforts are to be recommended by NPS and Reclamation on a site-specific basis in consultation with the Arizona State Historic Preservation Officer and the tribes that have signed the PA. Since its inception the RCMP has operated in a framework of intensive tribal consultation. Tribal concerns have been incorporated into the project in multiple ways, ranging from determination of monitoring schedules to proposed remedial actions.

The existence and significance of each tribe's traditional cultural properties (TCPs) have been documented through intensive ethnographic research (Ferguson 1998; Hart 1995; Havatone 1992; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). Tribes affiliated with or having an interest in river corridor sites have indicated that the entire Grand Canyon is crucial to maintaining the cultural identity of each tribe's community. The tribes have endorsed the long-term monitoring and preservation of archaeological sites in the River Corridor due to the accelerated erosion caused by dam operations (Ferguson 1998; Hart 1995; Roberts et al. 1995; Secakuku 1997; Havatone 1992; Hualapai 1992; Masayesva 1992; Stevens 1996; Stoffle et al. 1994).

The tribes have also stated their position when dealing with properties that have religious or cultural significance (Ferguson 1998; Hart 1995; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). The preferred actions are preservation measures and continued long-term monitoring of these resources. The consultation process has indicated that the tribes have certain TCPs that are off limits to any mitigation measures, but these are clearly identified in tribal reports and do not include most of the archaeological sites (Ferguson 1998; Hart 1995; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). Overall, the tribes maintain that mitigation should be performed due to the adverse effects of man-made disturbances caused by Glen Canyon Dam. If the physical erosion were entirely a natural process at these sites, then the tribes would feel much differently about mitigation options.

With the passage of the GCPA in 1992, the cultural resources staff at GRCA-NAU was presented with a considerable challenge. The law now mandated monitoring of cultural resources, yet there were virtually no precedents to be found anywhere in the world regarding reliable methods for monitoring the condition of archaeological sites through time, especially within a legal framework that involved multiple agencies, Indian tribes, and uncertainties regarding the potential effects of human-induced hydrological regimes. Historically, there has been very little attention to systematic, detailed monitoring of the condition of archaeological sites anywhere in the world (Downum et al. 1997).

The RCMP thus embarked on its monitoring program fully aware that its efforts would be experimental in many respects, and that much would be learned as the project progressed. According to Kunde (1999a), efforts at monitoring cultural resources are primarily limited to short-term programs, and previous monitoring programs for federal agency resource management have no guidelines for implementing monitoring protocols. Furthermore, several programs have gathered data for resource management in terms of human impact only (Des Jean 1991; Des Jean and Wilson 1991; Gale 1985; Goldsmith 1991). No programs have yet moved beyond the information stage to develop a trigger mechanism for implementing management actions. Additionally, their short-term nature did not lead to the identification of trends through time, or the formulation of predictive models (Kunde 1999a).

Although the general theoretical and methodological frameworks of natural resource monitoring are useful, they also have their limits when it comes to cultural resources. As with natural resources, monitoring the condition of cultural resources is an indispensable tool for their effective management. Cultural resource monitoring is difficult, however, because such resources are fragile and irreplaceable, and their information content is in a steady (though often exceedingly slow) state of decline. Unlike many biological or other natural resources, cultural resources cannot be replenished, cleansed, or regenerated. Because they are composed of human-made or altered objects and deposits, subject to decay, breakage, disarrangement, and loss, the information conveyed by cultural resources also inevitably degrades through time. At least with respect to information potential (and probably other areas of significance as well), all cultural resources are, in some measure, in worse condition today than when they were initially created.

From a scientific standpoint, understanding past human activities at archaeological sites relies on patterning, i.e., it relies on an ability to decipher the relationship between material objects (architecture, hearths, refuse, human burials) and the human behavior that produced and arranged those objects in three-dimensional space. Thus, at the time of site abandonment, the interpretable "structure" of a site—the patterned relationship between and among material objects and the human behavior that produced them—is at its peak. As time passes, various agents, some physical and some human, act to destroy the original patterns, breaking down the material remains and organized structure of the site and making it less interpretable (Schiffer 1987). This fact of decreasing quantity and structure of material remains through time applies to all archaeological sites, not just those within the Colorado River corridor where operation of Glen Canyon Dam has had some effect.

Since 1992, the RCMP staff has made 33 monitoring trips (approximately four rowboat trips each fiscal year) to assess the condition of cultural resources in the Grand Canyon. On average, RCMP staff members have monitored 130 sites per year. The individual trips lasted 16 to 18 days, for a total of 65 to 70 days spent each year on the river conducting the business of the RCMP. In a total of 1,042 monitoring visits, an estimated total of more than 80,000 observations have been made on site condition variables. Thus far, an estimated total of 9,000 photographs have been taken. The photo record, especially photos taken with a medium-format camera, have produced an immensely useful database for future environmental studies based on repeat photography.

To systematically assess site condition, a monitoring form was developed that made reference to the site condition variables recorded during the initial survey. This form has been revised and refined since 1992, but its core variables have remained. Generally, site impacts are divided into two categories: physical impacts and visitor-related impacts. Physical impacts include surface erosion, gullying, arroyo cutting, bank slump, eolian or alluvial deposition or erosion, and side-canyon erosion. A final category of physical impacts is an "other" category, intended to encompass impacts such as spalling of bedrock or boulders, and displacement of artifacts and features due to root growth.

The RCMP has been documenting physical impacts since the original archaeological survey. During the course of the survey, numerous observations were made on the geomorphic settings, site sediments, and other factors that might relate to site erosion. These observations laid the foundation for a later collaborative study between NPS and USGS (Hereford et al. 1993) that proposed a model for relating dam operations to site erosional processes.

Geomorphic studies conducted in the late 1980s (Balsom et al. 1989) and early to mid 1990s (Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996b) influenced RCMP staff and NPS survey personnel to pay particular attention to archaeological sites situated on the alluvial deposits (river terraces) of the Colorado River that contain gullies and arroyos, two of the main physical forces actively eroding sites.

The entrenched channels of small tributary streams, referred to as arroyos or gullies, that cross the terraces are erosional features that dissect the terraces as they extend headward. "The process of arroyo development destroys or damages surface and subsurface archaeologic sites" (Hereford 1993:9).

Geological mapping by Hereford and others (1993, 1995, 1996) has helped to determine how the ongoing erosion of terraces and archaeological deposits by arroyos and gullies is affected by regulated streamflow. The water and sediment discharge regimen of the Colorado River has been regulated since 1963 by the operation of Glen Canyon Dam. It has experienced substantially reduced sediment load, sediment concentration, duration of high flow, and peak-flow rates compared with the unregulated streamflow of the pre-dam era (Hereford 1993). In the present discharge regimen, sediment load has been reduced by a factor of six and the annual flood, which was the principal agent of natural geologic change, has been eliminated (Hereford 1993).

Hereford and others (1993) denoted two types of channels (gullies and arroyos): terrace based and river based. These channels are streams that begin with a catchment (collecting pool) and subsequent cutting into terraces that flow downward toward some effective base-level, or lowest point. Several factors determine this base-level, including the size of the catchment, the length of the channel, and the type of soil the stream flows over. For instance, a large collecting pool will hold more water, which will have the gravitational power to create a longer, deeper channel with a lower base-level. However, if the water flows over porous (e.g., sandy) soil or over a relatively large, flat terrace, the base-level will be higher (Hereford 1993; Hereford et al. 1993; Kieffer 1990; Thompson et al. 1998).

With increased rainfall or size of the collecting pool, the channel may deepen and widen, smoothing out the course of the stream. This permits more efficient water transportation, allowing the stream to finally reach the river. When the stream reaches the river, the channel continues to widen and deepen, becoming a permanent feature of the landscape (Hereford 1993; Hereford et al. 1993; Thompson et al. 1998).

The aforementioned factors determine whether a channel will remain terrace based or will become river based. This is an especially important consideration for cultural resource management because monitoring efforts can identify and mitigate terrace-based streams with tools such as checkdams. River-based streams represent a more or less permanent feature (Hereford 1993; Thompson et al. 1998). According to Hereford, sites with river-based drainages have a small chance of being preserved, whereas all other sites, including sites with terrace-based drainages, have a better chance of preservation in place.

The effects of Glen Canyon Dam, specifically the lowered base-level of the Colorado River and the lack of sediment-replenishing floods common during the pre-dam era, have exacerbated these natural processes, resulting in artificial acceleration of downcutting by channels seeking this new base-level. The downcutting of both terrace-based and river-based streams exposes archaeological remains, promoting the deterioration and loss of these nonrenewable resources.

Based on the work completed by Hereford, the RCMP staff grouped all 264 sites, monitored within the past 8 years and located within the APE, by drainage type. Four groups were defined: sites with river-based drainages, sites with terrace-based drainages, sites with side canyon-based drainages, and sites with undeveloped drainages. Hereford did not differentiate areas with side canyon-based drainages due to their small number. The RCMP staff recognizes this small group within this synthesis; however, during the various data analyses, sites with terrace- and side canyon-based drainages were consolidated.

Seventy sites have been identified as having river-based drainages. The RCMP staff considers these sites to be directly related to dam operations. Because these drainages reach the river, the river directly controls their depth and width. If river flows are high, the drainages retreat; if flows are low, drainages deepen to reach the river. It is a direct cause-and-effect relationship. Sites with river-based drainages have always been a high priority in the monitoring effort due to Hereford's hypothesis regarding base-level lowering (Hereford et al. 1993).

The catchment area of river-based drainages is about 12 times larger than that of terrace-based drainages, with a less variable channel length than terrace-based streams (Hereford 1993:17). When a channel becomes river based, the drainage adjusts to a lower base-level, erosion increases, and the drainage becomes a permanent feature of the landscape. A lowered base-level intensifies the exposure and deterioration of cultural resources that were once covered by the terrace alluvium. In pre-dam times, large sediment-laden floods plugged these river-based drainages. Currently, the Colorado River no longer regulates the drainages naturally.

The original cultural resource inventory and subsequent monitoring efforts have led to the identification of 70 sites containing terrace-based drainages. The RCMP staff considers these sites to be indirectly impacted by dam operations. Terrace-based drainages do not drain to the river, but instead die out on the older and higher base-level of the Colorado River, analogous to the river level prior to the construction of Glen Canyon Dam. These drainages are the most critical to preserve (Hereford 1996; Hereford et al. 1993, 1995, 1996b; Leap 1996f; Thompson et al. 1996).

Characteristics of terrace-based drainages include smaller catchment basins, averaging 1,300 m^2 but varying in size over three orders of magnitude (Hereford et al. 1993). This implies a high degree of variability among the size of terrace-based drainage systems. These drainages also have short channel lengths, averaging approximately 60 m (Hereford et al. 1993). All terrace-based drainages have the potential for increased arroyo cutting and breaching of the terrace level. Terrace-based drainages become river-based drainages when their catchment area is larger than 3,000 m^2 and the channel ends less than 100 m from the river (Hereford et al. 1993). "Any terrace-based stream can probably degrade to the lower effective base-level of the post-dam era through downcutting and subsequent expansion of the drainage network, increasing catchment area and channel length" (Hereford et al. 1993:18).

Approximately 2 years ago, geomorphologist Thompson began identifying streams that drained directly into side canyons as "side canyon-based drainages." These drainages probably follow a similar drainage development pattern as river-based drainages. Side canyon base-level is controlled by the Colorado River, as is the base-level of a side canyon-based drainage. Side canyons are extremely variable drainages that are shaped by high-energy, catastrophic changes. For example, when side canyons flood, cutbanks are often vertically truncated and the channel lowered. If the side canyon truncates a side canyon-based drainage, the drainage will respond by adjusting to its new lowered base-level. This response is often in the form of channel initiation and active headcuts. For this reason, sites with side canyon-based drainages are considered, for RCMP purposes, to be indirectly impacted by dam operations and directly impacted by side canyon floods.

Monitors have recorded the effects of large tributary floods on archaeological sites since 1992. Most tributary floods and debris flows occur during July to October, due to localized thunderstorms with rainfall intensities up to 40 mm/hr (Griffiths et al. 1997). Researchers have identified at least 600 tributaries in the Grand Canyon from Lees Ferry to Surprise Canyon where debris flows occur (Griffiths et al. 1997; Melis et al. 1997). Upon re-evaluation of the RCMP data, archaeologists identified six sites with side canyon-based drainages.

Sites with undeveloped drainages comprise 40 percent (118 sites) of the 264 archaeological sites. These sites do not have a drainage(s) deeper than 10 cm. Instead, water drains into dunes or shallow, ephemeral channels. Sites within this group do not currently exhibit gullying or arroyo cutting, but they have the potential to do so if their current drainage network transitions from surface runoff to a downcutting process. The RCMP staff considers these sites as potentially impacted by dam operations.

Using these four site groups, several frequency calculations were completed for this synthesis. For example, comparison of a site's condition identified during the 1991 survey (Fairley et al. 1994) with RCMP's current site evaluations shows that 49 sites (19%) have deteriorated over the past 8 years. The sites with river-based drainages show the most change. Since the survey there has been a 144 percent increase in the number of sites in poor condition. Sites indirectly and potentially impacted by dam operations demonstrate small variations in the numbers, but sites directly and indirectly impacted by dam operations show general deterioration over the years.

Overall, most sites with river-based drainages are in fair to poor condition, of which 67 percent are actively eroding. Sites with terrace- and side canyon-based drainages are commonly in good or fair condition, but 38 percent show active erosion. Most sites with undeveloped drainages are in excellent or good condition; only 17 percent are actively eroding.

Eighty-six percent of the sites with river-based drainages are in poor condition and are actively eroding. Sites with terrace- and side canyon-based drainages illustrate four sites in poor condition and all but one are actively eroding. Fourteen sites with undeveloped drainages are in poor condition, however, only one site is physically eroding. It is likely that visitor impacts account for the other 13 sites in poor condition.

Of the 264 sites currently thought to be affected by the dam, 87 have been placed on the RCMP's inactive monitoring list. This list represents sites that are located within the APE but for various reasons are not monitored by this program—for example, the site is under GRCA management, site integrity is questionable, the data potential is exhausted, or the site is in stable condition. Of the 87 sites on the inactive list, 78 do not show active erosion and are considered stable.

Members of the PA have expressed concern regarding visitor-related impacts at sites along the river. SWCA's data synthesis report points out that tribes see visitation as the "primary impact" to cultural resources (Neal et al. 1998:39); however, RCMP monitoring data demonstrate that only 25 percent of the monitored sites have active visitor-related impacts. Of course, any visitor disturbance is unacceptable.

Visitor-related disturbances recorded by RCMP personnel include collection piles (artifacts gathered by visitors and placed in piles), on-site camping, criminal vandalism, and trailing. Trailing is the most frequently recorded impact. Trail maintenance and obliteration remains a priority because RCMP staff have observed and documented that if trails are not maintained or obliterated, they can easily become entrenched river- or terrace-based gullies.

Researchers have been recording the loss of "suitable campsites" in the river corridor due to accelerated erosion for many years (Beus et al. 1985; Kearsley and Warren 1993; Schmidt et al. 1992; Schmidt 1989; Webb et al. 1987). The reduction of suitable campsites since the construction of Glen Canyon Dam was documented by Kearsley and Warren in 1993. Researchers inventoried existing river corridor campsites in 1991 and compared the results with previous inventories in 1973 and 1983 (Brian and Thomas 1984; Weeden 1975). The 1991 inventory showed 48 percent fewer campsites since 1983, and 51 percent fewer large campsites since 1973 (Kearsley and Warren 1993:12).

Dam operations reduce beach-building sediment in the river and prevent the annual floods that replenish beaches. For this reason, the reduction of campsites in the river corridor is directly linked to dam operations (Kearsley and Warren 1993). This reduction translates into higher concentrations of river-runners at a limited number of campsites, which means higher occurrences of visitor-related impacts at the archaeological sites located within the vicinity of these camps (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

Other evidence of a reduction in the number and quality of beaches is illustrated by historic photographs, such as those by Stone, Belknap, Kolb, and Hillers. Some pre-dam beaches still exist, but large annual floods no longer control the vegetation cover of the shoreline, making many beaches unsuitable for camping.

The research flood of 1996 illustrated the importance of sediment replenishment. The high flow redeveloped existing beaches and created new camping beaches, a process that happened annually before the dam. The experimental 45,000 cfs flood gave incontrovertible evidence that floods affect the existence of beaches, and it also highlighted which beaches river-runners prefer due to certain variables, such as beach size, location to attraction sites, flat areas for camping, and beach aesthetics.

The RCMP staff attributes most visitor-related impacts in the river corridor to river-runners. Archaeological sites with consistently high frequencies of impacts are often located directly above primary river camps (Kearsley and Warren 1993). Sixty-eight percent of the sites with active visitor-related impacts have a river-runners' camp within 1 km (Coder et al. 1994b). It should be noted that many of the sites in this group have camps less than 500 m away. Archaeological sites with no history of visitation are often located far from river camps. Some archaeological sites with consistently high visitor-related impacts have primary river camps below the sites as well as nearby backcountry trail systems. This combination results in the highest frequencies of impacts to archaeological sites (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

PA members have been discussing the responsibility for managing visitor-related impacts at sites along the river corridor for several years. While this debate continues, the RCMP staff will continue to record and mitigate visitor-related impacts during regularly scheduled monitoring visits; taking no action would simply be irresponsible. The RCMP staff has taken the lead in recording visitor-related impacts, and GRCA rehabilitation crews have mitigated visitor-related impacts by conducting trail and revegetation work. GRCA acknowledges its Section 110 responsibility to mitigate visitor-related impact in the National Park. However, RCMP staff members also believe that there is a connection between the dam's existence and operations, and the frequency of visitor-related impacts in the river corridor. Future visitor-related impact research should focus on clearly defining how the dam's operations affect the frequency of impacted sites in the river corridor. In the meantime, the NPS and Reclamation will continue working together to develop effective approaches to deter ongoing visitor-related impact.

The various impacts observed and recorded by the RCMP have precipitated several remedial actions, such as preservation and data recovery treatments, since this project officially began in 1995. The RCMP recognizes the preservation mandate of the NPS and the responsibilities of Reclamation under NHPA. The current goal of the existing PA (U.S. Department of the Interior et al. 1994), MRAP (U.S. Department of the Interior and Service 1997), and draft Historic Preservation Plan (U.S. Department of the Interior et al. 1997) is preservation-in-place in lieu of excavation.

Preservation actions have therefore been completed at 96 sites. Treatments include checkdam construction, planting vegetation, and trail work. Other forms of treatment that could be considered preservation-in-nature include medium-format photography (48 sites) and mapping of archaeological sites with a total station instrument (68 sites). Most preservation work has been completed on sites with river-based drainages and on sites in fair to poor condition.

Another method involving preservation is to educate the public about archaeological sites, factors that erode a site, and management actions implemented to preserve or retrieve archaeological data. Public education about archaeological sites along the river corridor has consisted of both formal and informal presentations, such as talks at professional archaeological conferences, Guides Training Seminars (annual seminars with approximately 200 commercial river guides attending), meetings with GRCA park employees and visitors, and talks given at education centers such as Northern Arizona University and various elementary and high schools in the Flagstaff area. Written updates and general comments have also been published in handbooks (Harmon 1997), as abstracts (*Archaeology* 1996), in the *Boatmen's Quarterly* (Bulletts 1995; Jackson and Leap 1996), *Nature Notes* (Kunde 1998b; others in press), *Arizona Highways* (Kuhn 1999), and science magazines (Balsom in press; Randall 1992).

To date, RCMP staff members have observed no whole-site improvement since the implementation of preservation treatments in 1995. As recognized by the NRC (Council 1999), when evaluating a long-term monitoring program, to discuss the success of preservation actions can be premature, and will not yield significant results. However, the RCMP staff has acknowledged and documented sediment collection in gullies and arroyos from checkdams, vegetation growth from transplanting and planting new seedlings, and successful trail projects.

The only real way to evaluate the short-term success of preservation actions is to conduct frequent visits to a site and to collect very detailed information (Council 1999). This type of monitoring has been completed in the past 2 years using a total station instrument, but due to the redistribution of funds and the disinterest of some PA members, this method of tracking success or failure by quantifying change has been discontinued. Other methods for tracking the success of preservation treatments are currently being investigated by project personnel and the Grand Canyon Monitoring and Research Center (GCMRC).

Currently, preservation treatments have not affected the frequency of monitoring. Yearly monitoring by the Zuni Conservation Project and GRCA revegetation crews has occurred in cases where checkdams are located and in some cases where trail work is completed. It is presumed that the success of these treatments should be evaluated intensely for several years. After these evaluations, a decline in the monitoring schedule is anticipated.

Data recovery has been completed at 42 sites in the form of feature-based excavations (excavation of a single feature that cannot be preserved, not excavation of the entire site), collection of radiocarbon dating samples, or testing specific features for intact subsurface cultural deposits. The majority of the work has been conducted at thermal and roasting sites. Carbon samples were taken at 20 sites in the late 1980s and early 1990s in conjunction with the research completed by Hereford.

The RCMP staff has prioritized preservation and data recovery treatments based on the findings of this report. Although each site is assessed individually for various treatments, certain descriptive generalizations can be made to assess priority. Based merely on descriptive analyses, it is clear that the stages of erosion are more advanced at sites with river-based drainages; most are actively eroding and in poor condition. This is demonstrated at C:13:099 and C:13:100 even after the implementation of checkdams. However, this observation is based solely on the preliminary results in this report, which show that maintenance was performed on checkdams at sites with river-based drainages more often than sites with terrace- or side canyon-based drainages. All checkdams installed in the various drainage types need to be researched much more closely to determine their effectiveness. This entails detailed mapping of the areas to measure volumetric change in sediment. It is possible that this work will be completed by GCMRC this fiscal year.

Until this work is completed, no conclusive evidence exists to suggest that river-based drainages cannot be stabilized. However, because of the advanced stages of erosion, RCMP staff members recommend that all sites with river-based drainages that are recommended for data recovery should be the PA's first responsibility for data recovery work. Of the 19 sites recommended for data recovery, 6 had already been slated for excavations prior to the release of this report (Leap 1999).

It has been difficult for Reclamation to obtain the necessary funds to complete data recovery. As a result, very few data recovery projects have been initiated, and very few have been completed. In the meantime, project staff are doing what they can to delay the destruction of these archaeological sites until funds are allotted for the proposed excavations. Sites recommended for data recovery will continue to be monitored and limited emergency data recovery will be conducted. It is better to retrieve what little information is left, than to let information about the history of the Canyon erode away.

The PA's first priority for preservation treatments should be sites with terrace- and side canyon-based drainages, and then sites with undeveloped drainages. The goal is to prevent any drainage system from becoming river based. Hereford speculated that after drainages are river based, erosion control is nearly impossible because the drainages are too advanced. They are connected to a much larger erosive force, the Colorado River. RCMP staff members recognize the need to focus on these sites for preservation treatment. The status of these sites is very fragile and if preservation in place is postponed, it is very likely that these sites will be listed for data recovery in the future.

There are several additional factors for PA members to consider prior to conducting any remedial tasks. For example, a research design should be in place prior to any recovery. This will aid in completing excavations on sites that will benefit the archaeological record within the corridor and within the area. Some corridor considerations include site type, site condition, site location, and cultural affiliation.

For preservation work, PA members should not only consider the archaeological potential of the site, but they also need to consider certain other factors. First, the geomorphological setting is extremely important. The work completed by Thompson et al. (1998) is a good starting point. Sediment type, catchment systems, slope, and general drainage cross-sections are all factors that should be considered prior to implementing a preservation treatment. Information about the vegetation in the area would supplement this data. The maturity of the plants and the root systems can also aid in the success or failure of a preservation project.

Much of this additional archaeological, geomorphological, and botanical information is supplied on the original survey forms. The task of incorporating this data into the current monitoring database would be substantial; however, the RCMP staff believes it will provide necessary and valuable information.

The history of the RCMP and the findings of this report reveal a steady refinement in our knowledge of how the operation of Glen Canyon Dam is impacting cultural resources in Grand Canyon National Park, and how best to mitigate those impacts. RCMP personnel continue to investigate and consider methods with the potential to improve and streamline documentation, monitoring, and treatment of cultural resources along the river corridor in the Grand Canyon.

Voluntarily, several specialists representing multiple professions have offered expertise to improve the monitoring program. Personnel from various tribes, NAU, the U.S. National Forest Service, the USGS, Reclamation, private contractors, GCES, and GCMRC have worked with the RCMP staff in the field and lab. Students from the university have also enhanced the ideas, methods, and concepts of this program. They have shared with RCMP their knowledge and personal experience in managing archaeological sites, preservation treatments, geological aspects, and research methods. These methods and concepts have all been interwoven to create an archaeological monitoring program that is grounded in the identification and observation of the processes that affect cultural resources and the appropriate treatments for preserving sites in place.

To date, two independent research projects have formally reviewed portions of the RCMP database to evaluate and assess the reliability of data collected thus far. SWCA, Inc., of Flagstaff is currently evaluating portions of the RCMP database for a research contract administered through the GCMRC (Neal et al. 1998). A Master's thesis by Jennifer Kunde at Northern Arizona University has recently been accepted that evaluates and analyzes monitoring methods in the natural resources realm and applies a model to cultural resource monitoring (Kunde, 1999b:1). Neither of these projects reviews the database in its entirety, although each has contributed valuable feedback to the RCMP program.

The RCMP staff has fulfilled virtually all of the assigned responsibilities outlined in the PA, MRAP, and draft Historic Preservation Plan, and has initiated a program of remediation at a limited number of sites. Under the current methods used to fulfill the requirements of the PA, minor changes are anticipated to further refine the project's methods and database. For example, remedial efforts need to be expanded to include more vigorous attempts to control erosion and recover scientific data from sites most severely impacted by Glen Canyon Dam. The RCMP can also expect changes upon completion of the Protocol Evaluation Panel review scheduled for the spring of 2000 and the completion of the Historic Preservation Plan scheduled for 2001.

However, it has recently been brought to the attention of the RCMP staff that a change in philosophy may be appropriate. Whole-site excavation, as opposed to feature-based excavation (excavating only eroding features, not the entire site), is the current issue. Reclamation has suggested that whole-site excavation is more suitable given the Secretary of the Interior's Standards for Archaeology and Historic Preservation and their Section 106 responsibilities. However, the current PA and MRAP both clearly state that preservation in place is the preferred method: If only portions of a site cannot be preserved, excavate only those portions eroding and leave the stable areas alone. This has been the philosophy of the RCMP since its inception.

If whole-site excavation is supported by the PA signatories, adjustments will be made to the current long-term monitoring program to address large-scale data recovery strategies. A shift to whole-site excavation would change the monitoring emphasis and add significantly to the proposed excavation priorities and costs. This would be initiated by implementing a comprehensive testing program for the sites suggested for excavation to define the lateral and vertical extent of the sites, and to identify whether there is a multicomponent aspect to the site. Testing for these attributes has not been done in the past because the PA program practiced an "as needed" data recovery program that was feature specific, not site specific. It will be very important for the project staff to identify site extent so that appropriate research designs can be developed.

At the request of Reclamation, RCMP personnel submitted a budget estimate and work plan for FY2000 at approximately 25 percent less than the FY99 level. The reductions are achieved by focusing on the most urgent monitoring aspects of the program.

The RCMP staff proposes three trips for the upcoming year, with a reduction in the number of sites evaluated and no site assessments or preservation treatment implementation. The only sites that will be evaluated are those regularly scheduled for FY00 (47 sites) and those where invasive preservation treatments have occurred (29 sites with checkdams). This altered program will allow for consistency in assessments of the most heavily impacted archaeological sites; however, no evaluations of sites on a 3 to 5 year schedule (21 sites) will be completed.

With the onset of FY00, project staff members have already been occupied with completing this extensive 8-year data synthesis report, compiling multiple budgets and proposals, preparing for the Protocol Evaluation Panel (PEP) review, and reviewing numerous GCMRC reports. It has been critical to focus on the PEP review and preparation of the Historic Preservation Plan. However, the reduction of funds will impact the ability to provide the same level of service for all of the affected entities. The PEP review will require considerable staff time in the preparation of materials and compilation of site records, photographs, and so forth.

The FY2000 scope of work precludes any new work such as completing preservation assessments, quantifying checkdam effectiveness, creating total station base maps, recording newly uncovered archaeological sites, conducting limited and repeat medium-format photography, completing limited data recovery, or collaborating with NPS base programs and the Hualapai and Navajo Nations.

Further, there is minimal to no participation in public outreach or professional and nonprofessional presentations. Thus, work completed in FY00 will be lacking in scope. Although it will be critical to refine the current MRAP and to complete an HPP, cultural resources fieldwork will be sacrificed because of a budget cut. Postponing the types of remedial actions mentioned above will only increase the backlog of the work identified in this report.

PART I

HISTORY OF THE PROJECT

CHAPTER 1. HISTORY OF THE PROJECT

Christian E. Downum, Jennifer L. Kunde,
Lisa M. Leap and Janet R. Balsom

A history of the Grand Canyon River Corridor Monitoring Project (RCMP) is presented here to document the historical progression of this project from the initial realization of the potential impacts of Glen Canyon Dam, to the archaeological inventory survey phase, to the initial monitoring efforts, and finally to present-day efforts to monitor and mitigate adverse impacts to Grand Canyon sites. This project has been a pioneering effort, with few precedents for its individual components and no precedent for its overall scope. Nowhere in the United States has there been a comparable cultural resource management effort involving such difficult physical terrain, so many Indian tribes and nations, and so many agencies and other stakeholders. Because monitoring archaeological sites and taking appropriate remedial action has generally not been part of the equation in cultural resource management until quite recently, the RCMP has contributed significantly to the theory and methods of monitoring cultural resources, while accomplishing the legally mandated objectives that have guided its operation.

LEGISLATIVE BACKGROUND

The ultimate origins of the RCMP can be traced to the extensive network of laws and regulations that require federal agencies to consider the effects of their actions on cultural resources, especially the National Environmental Policy Act (NEPA) of 1969 and the National Historic Preservation Act (NHPA) of 1966. More recently, the project has operated under the provisions of the Grand Canyon Protection Act (GCPA) of 1992 and the 1995 Environmental Impact Statement and its related Record of Decision (ROD) signed by Interior Secretary Bruce Babbitt. A crucial document that guides the compliance with all of these legal mandates is the 1994 Programmatic Agreement (PA) regarding the operation of Glen Canyon Dam, signed by officials of the U.S. Bureau of Reclamation (Reclamation), the Advisory Council on Historic Preservation (ACHP), the Arizona State Historic Preservation Officer (SHPO), the U.S. National Park Service (NPS), and six Indian tribes and nations with an interest in the affected cultural resources—the Hopi Tribe, the Hualapai Tribe, the Kaibab Paiute Tribe, the Navajo Nation, the Paiute Indian Tribe of Utah for the Shivwits Paiute Tribe, and Zuni Pueblo. Since it was officially ratified, the PA has determined the actions of the RCMP and has facilitated compliance by Reclamation and NPS with a variety of legal requirements, including the provisions of NHPA and GCPA. The RCMP has also been shaped by a variety of legal requirements, policies, and directives issued by the NPS regarding the preservation and management of cultural resources on National Park Service lands.

Chapter 2 of this report provides a more detailed discussion of the various laws and regulations that today guide the RCMP. In this chapter, it is sufficient to note that the RCMP has operated from its inception within a complicated framework of laws, regulations, and other directives that are not always in accord with one another. At times, there has been an inherent conflict between complying with the provisions of Section 106 of NHPA (mitigating the effects of a federally sponsored undertaking), while at the same time recognizing and adhering to long-standing NPS policies regarding the "preservation in place" of cultural resources. Stakeholders have identified preservation in place as a primary management goal of the adaptive management program. It is clear that the RCMP and its associated activities in many respects do not comprise a normal or routine Section 106 compliance action. This project is considerably more complex than most Section 106 actions, and in fact it is probably unique in the degree to which conflicting forces have molded its efforts. This theme—the tension between a traditional model of Section 106 compliance and the obligation to preserve the unique, highly significant, and fragile cultural resources of Grand Canyon National Park (GRCA)—surfaces repeatedly in the discussion to follow, and in subsequent chapters of this report.

THE GRCA-NAU COOPERATIVE AGREEMENT

The administrative structure for the RCMP is established by a cooperative agreement between GRCA and NAU. This agreement provides the framework by which the National Park Service at Grand Canyon contracts with NAU to conduct the RCMP as a collaborative venture, with NPS, GRCA and NAU personnel working side by side to achieve common objectives. From its inception, the agency responsible for managing cultural resources in the Grand Canyon—the NPS—has had the option of contracting the RCMP via a competitive bid process, or via a work order authorized under a comprehensive cooperative agreement between NPS and NAU. For a variety of reasons, NPS has chosen to work with NAU under the cooperative agreement. These reasons are elaborated below.

First, there is the issue of continuity in project personnel. Many of the individuals involved today in the RCMP have been associated with the project since its inception, and thus there is a great deal of valuable experience with Grand Canyon archaeology and the project's goals, methods, and field and laboratory procedures. Few people outside of the personnel involved with this project have had specific field and laboratory research experience with Grand Canyon archaeology, and an even more limited number have worked at sites along the river corridor. This is an important consideration given the unique nature of the river corridor environment and the cultural resources of the Grand Canyon. The issue of consistency in project goals, methods, and procedures is also vitally important. Reliable monitoring of cultural resources requires consistency in classification of site condition and impacts. Unpredictable changes in project personnel (as would be the case in a competitive bid arrangement) would work against the primary objectives of the project, namely, reliable understanding of impacts to sites through time. In addition to the consistency achieved in the field, integration of RCMP and GRCA databases is achievable with direct access available to project information for NPS and Reclamation cultural resources managers. As discussed in Part II, the RCMP has achieved a considerable degree of reliability in its observations, and much of this must be credited to the consistent training and cumulative field experience of its field crews. The issue is not whether the methods of the RCMP could be duplicated with different personnel, because they certainly could. Any monitoring program that purports to be reliable and valid in its methods should be able to convey those methods to new personnel. Methods used by the RCMP could indeed be replicated by new personnel, with sufficient training. However, by employing the same personnel year after year, the GRCA-NAU project allows for a maximum of continuity and efficiency that makes use of existing experience.

Second, the cooperative agreement allows for institutional stability and continuity from funding cycle to funding cycle. The offices, facilities, and records storage and management associated with the project have thus remained constant through time. This has maximized the project's reliability and efficiency from year to year, as there has been no start-up time involved between fiscal years. This would not be the case if different contractors were starting the project anew each fiscal year or contracting period. Given the highly diverse nature of Grand Canyon river corridor sites and the exacting standards required to make consistent and valid observations of site condition, it is certain that some efficiency and reliability would be lost to start-up costs associated with the competitive bid process.

Third, the agreement allows NPS to make use of the considerable human resources, equipment, and facilities provided by Northern Arizona University. These include the archaeology faculty of the Department of Anthropology, graduate and undergraduate student workers and research assistants, various Native American offices and organizations on campus, the administrative, accounting, and human resources staff of NAU, the facilities and equipment of the Anthropology Department and the Bilby Research Center, vehicles from the Transportation Services Department, security provided by the NAU Police Department, and a number of faculty and staff in other NAU departments or NAU-affiliated organizations involved with Grand Canyon environmental research.

Fourth, the agreement allows the project to be conveniently located with respect to many of the other agency personnel, contractors, offices, and facilities involved with management of the cultural resources in the river corridor. Location of the project headquarters on the NAU campus in Flagstaff has minimized travel time to and from the offices of organizations with which the RCMP has close ties. These entities include the U.S. Geological Survey, the NPS-NAU Cooperating Ecosystem Studies Unit, the Cline and Special Collections libraries at NAU, the Hopi Cultural Preservation Office, the Museum of Northern Arizona, and the Grand Canyon Monitoring and Research Center (GCMRC).

Finally, there is the issue of cost. Because NPS and NAU have entered into a cooperative agreement for the mutual benefit of both entities, the two have negotiated an agreement that waives much of the indirect costs normally associated with contracts. The indirect rate with NAU is 20 percent of total direct costs, a rate far below the indirect rate commonly charged by private consulting firms.

In addition to the discussion provided above related to the effectiveness of the cooperative agreement, federal agencies are encouraged to enter into cooperative agreements reflecting a relationship between the federal government and a state. In this case, the relationship between the National Park Service and Northern Arizona University represents a public purpose in support of public programs or law. Guidance is provided in 41 Stat. 505.

THE GRCA-NAU ARCHAEOLOGICAL SURVEY

The Grand Canyon Monitoring Project is an outgrowth of the 1990–1991 Grand Canyon river corridor archaeological inventory survey (Fairley et al. 1994), and much of its database, methods, and administrative structure has been derived from the initial survey. This original survey was conducted as a joint project between NPS and NAU, under the authority provided by the NPS-NAU cooperative agreement just described. The survey is notable for many reasons, not the least of which is that it represents the first intensive archaeological survey of the Grand Canyon river corridor. The survey also represented the first major cooperative venture between Grand Canyon National Park and the Department of Anthropology at Northern Arizona University. This collaboration provides a model of what can be accomplished by combining the resources of a federal agency with an academic institution. As noted by Balsom (1994:x), in spite of the pioneering nature of the survey and the tremendous logistical challenges associated with field work in the Grand Canyon river corridor, the project was completed one day ahead of schedule and a draft report on its results was completed within 7 months.

The genesis of the NPS-NAU survey can be traced to a growing awareness in the 1980s that an intensive inventory was needed within the Grand Canyon river corridor. Surprisingly, until this time it had not been widely recognized that cultural resources were abundant in the corridor, nor had it been realized that they might be adversely affected by the operation of Glen Canyon Dam. By the early 1980s, only about 100 archaeological sites had been documented in the river corridor. As discussed by Fairley et al. (1994:1; see also Balsom et al. 1989), it was traditionally assumed that dam operations had little or no effect on cultural resources within Grand Canyon National Park. This conclusion was not empirically derived, but seems to have been based on two faulty assumptions: (1) Prehistoric peoples would not have lived in or intensively used settings below the historic high-water levels of the river, and (2) even if they had, material traces of their activities would have long since washed away. As a series of events in the early to mid 1980s would make clear, and as the NPS-NAU survey would later amply document, both conclusions are spectacularly false. Not only did prehistoric peoples live in and intensively use the floodplain of the Colorado River within the Grand Canyon, but abundant remains of their activities could still be found and they were quite vulnerable to the potential effects of dam operations.

During the 1980s, several factors promoted an increased awareness of the presence of cultural resources in the river corridor, and the potential effects of Glen Canyon Dam on these resources. One of the factors was a growing concern among a number of constituencies regarding the practice of increasing the amount of water released from the dam to coincide with peak demands for electrical power. It is possible for operators of a hydroelectric dam such as this one to time water releases so that more water is released, and thus more electricity is generated, during times of highest regional power demand. These water releases, however, created unpredictable surges and drops in the river that were of great concern to a number of resource managers, environmental groups, commercial interests, Indian tribes, and others. One outcome of these expressed concerns was the creation by Reclamation of the Glen Canyon Environmental Studies (GCES) program, designed to study the effects of low and fluctuating river flows on a variety of natural resources downstream from the dam. These studies were also necessitated by a planned uprating and rewinding of its generators, which would have the effect of increasing the power-generating capacity of the dam. Hence, in the early 1980s it was apparent that scientific studies were needed to assess the effects of Glen Canyon Dam on downstream resources, especially regarding fluctuating flows. Cultural resources were not initially included in the list of affected resources, but a new paradigm of scientifically assessing the effects of the dam had been created. This was an essential step toward allowing studies of cultural resources to be incorporated at a later date.

In 1983, an unanticipated event accelerated awareness of dam operations and their potential effects on downstream cultural resources. The winter of 1982–83 was especially wet in the upper basin of the Colorado River, resulting in high snowpack levels that could contribute to greatly increased flows in the river. This potential was realized when late winter and early spring storms added to the snowpack and increased the volume and rate of runoff from the mountains into the river. The result was that Lake Powell began to fill at an alarming rate, and Glen Canyon Dam was forced to release an unprecedented volume of water, up to 93,000 cubic feet per second (cfs).

This water, of course, left the dam and surged into the Colorado River, flowing through Glen Canyon National Recreation Area and Grand Canyon National Park. A number of archaeological sites were either freshly exposed by the clear-water flow, or were eroded and damaged by the water. Initial documentation of the effects of the 1983 flood by GRCA personnel during the fall of 1983 (Balsom 1984) showed that cultural resources might be more abundant in the river corridor than previously assumed (including substantial habitation sites below the historic high-water marks of the river), and that dam operations might have substantial adverse effects on such resources. Scientific studies of cultural resources were therefore needed to document the nature and scope of such potential effects.

One of the first of these investigations took place in the late 1980s as a collaborative pilot study involving NPS and the U.S. Geological Survey (USGS). This study focused on only one site along the Colorado River, but its results suggested that the operation of the dam might indeed be contributing to the deterioration of archaeological sites elsewhere along the river corridor (Balsom et al. 1989).

At about this time, a directive was issued that provided the legal mandate for systematic and detailed studies of cultural resources and the potential adverse effects of Glen Canyon Dam. In July 1989 Interior Secretary Manuel Lujan directed Reclamation to prepare an Environmental Impact Statement (EIS) regarding the operation of Glen Canyon Dam. Under the National Environmental Policy Act of 1969, which authorizes the EIS process, cultural resources are considered worthy of study and consideration, just as are natural resources. The EIS for Glen Canyon Dam operations therefore mandated scientific studies of cultural resources within the area potentially affected by water releases.

Together Reclamation and NPS decided that the first step in the EIS process with respect to cultural resources would be to conduct an intensive inventory of archaeological sites in the river corridor. The area to be surveyed was to encompass a 255-mile stretch of the river corridor, extending from Glen Canyon Dam to Separation Canyon. The vertical extent of the survey area was the riverine environment that incorporated all terrestrial river-derived sediments below the estimated 300,000 cfs level, as well as a few areas of eolian sand dunes lying slightly above this level. Eolian deposits above the historic high-water mark were thought to ultimately derive from river sediments, and so were considered part of the riverine environment (see Fairley et al. 1994:2). The estimated 300,000 cfs level was considered an approximation of the pre-dam flood terraces and was not considered an absolute number representing an exact elevation. Surveyed areas would include present-day beaches, flood terraces, and eolian sand dunes. The survey would attempt to identify all cultural resources within these zones and make an accurate record of the location, extent, contents, significance, and condition of the resources. According to the research design (Balsom and Fairley 1989; Fairley et al. 1994:1), the survey had five major objectives:

- Provide an inventory of all sites located within the affected environment of the river corridor.
- Evaluate site condition and impacts as they relate to the environmental situation created by Glen Canyon Dam.
- Identify site settings that would provide information for further study as to the problems of site erosion and sedimentation.
- Evaluate site significance and eligibility for inclusion in the National Register of Historic Places.
- Provide management recommendations for river flow regimes for Glen Canyon Dam.

The survey was conducted from 24 August 1990 to 30 April 1991. During this time some 1,968 person days were spent surveying about 10,506 acres. This area was surveyed with a crew-spacing interval of 10–50 m, depending on terrain. Sites were recorded by filling out site forms, mapping each site's boundaries and features to scale, plotting the site's location on USGS 7.5-minute topographic maps and aerial photographs, and filling out a specialized form detailing the condition of the site with respect to physical and visitor-related impacts. Consistent with NPS policies regarding preservation in place, detailed analysis of artifacts and features was undertaken mostly in the field. This resulted in the accumulation of a large amount of information useful for assessing site function and temporal and cultural affiliation. At the end of the survey, it was possible to claim that "virtually every area that was physically possible to access below the 300,000 cfs level was included in the survey" (Fairley et al. 1994:8).

The GRCA-NAU archaeological survey of 1990–91 contributed significant new information on the archaeology of the Grand Canyon, and it provided the baseline data against which the ongoing effects of Glen Canyon Dam operations could be gauged. The 1990–91 survey built upon archaeological inventory and excavation information collected by Schwartz and Euler beginning in the 1950s (Euler 1966a, 1966b, 1967a, 1967b, 1971, 1972, 1974, 1978, 1979a, 1979b, 1984a, 1984b; Euler and Chandler 1978; Euler and Dobyns 1971; Euler and Gumerman 1974, 1978; Euler and Olson 1965; Euler and Taylor 1966; Schwartz 1957, 1958, 1960, 1963, 1966; Schwartz et al. 1979, 1980, 1981) and GRCA project information from the mid 1980s (Jones 1986b). All of the objectives identified in the research design were met (Fairley et al. 1994:151). The primary goal of site inventory was accomplished, with a total of 475 archaeological sites and 489 isolated occurrences of artifacts or features located and recorded. This total included 118 sites that previously had been located and recorded, but it also included 357 sites that had not been documented prior to the survey. Regarding the impacts of dam operations on archaeological sites, it was judged initially that 336 of the 475 recorded sites existed in locations that could potentially be adversely affected by changing water releases. During the course of the survey, numerous observations were also made on the geomorphic settings, site sediments, and other factors that might relate to site erosion. These observations laid the foundation for a later collaborative study between NPS and USGS (Hereford et al. 1993) that proposed a model for relating dam operations to site erosional processes. The survey also made preliminary National Register eligibility determinations for river corridor sites. Of the 336 sites potentially affected by dam operations, 322 were potentially eligible for the National Register, and the Arizona SHPO concurred with this assessment (Lerner 1991a, 1991b). Chapters 2 and 3 provide more details on the 322 sites potentially eligible for the National Register. Finally, the project made a number of management recommendations regarding how the operation of Glen Canyon Dam might be altered to minimize adverse impacts to cultural resources. These recommendations were subsequently incorporated into the EIS process.

From the perspective of the RCMP, the lasting contribution of the 1990–91 NPS-NAU survey has been documentation of the baseline condition of cultural resources so that ongoing changes in site condition can be assessed.

THE GRCA-NAU RIVER CORRIDOR MONITORING PROJECT (RCMP)

Following the archaeological inventory survey, a logical next step was to begin monitoring the condition of cultural resources in the river corridor. The survey had been designed with this in mind, and indeed shortly after the survey was completed, cultural resource monitoring was required by law. In 1992, the Grand Canyon Protection Act was passed, which ordered the Secretary of the Interior to operate Glen Canyon Dam "in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established." The language of this act is clear and explicit regarding its intent to prevent operation of Glen Canyon Dam from harming the natural and cultural resources of Glen Canyon and Grand Canyon, so long as those protection measures do not violate a variety of existing laws concerning the waters of the Colorado River Basin (Section 1802[b]). The law specifically states (Section 1802[c]) that its protection measures are not in any way to conflict with the laws and policies that guide NPS in its administration of Glen Canyon and Grand Canyon:

> Nothing in this title alters the purposes for which the Grand Canyon National Park or the Glen Canyon National Recreation Area were established or affects the authority or responsibility of the Secretary with respect to the management and administration of the Grand Canyon National Park and Glen Canyon National Recreation Area, including natural and cultural resources and visitor use, under laws applicable to those areas, including, but not limited to, the Act of August 25 1916 (39 Stat. 535) as amended and supplemented.

The Grand Canyon Protection Act therefore in no way supersedes or is intended to vitiate the mission of NPS with respect to its management of resources within its jurisdiction in Glen Canyon National Recreation Area or Grand Canyon National Park.

To achieve its goals with respect to protection of cultural resources, the GCPA, Section 1805[b], requires long-term monitoring of the effects of Glen Canyon Dam operations on cultural resources in Glen Canyon National Recreation Area and Grand Canyon National Park. According to this section of the law,

> Long-term monitoring of Glen Canyon Dam shall include any necessary research and studies to determine the effect of the Secretary's actions under section 1804(c) [i.e., operation of Glen Canyon Dam] on the natural, recreational, and cultural resources of Grand Canyon National Park and Glen Canyon National Recreation Area.

This mandate was later strengthened by the Record of Decision (ROD) signed in 1995 by Secretary of the Interior Bruce Babbitt. The ROD (Section VI) notes that "cultural sites in Glen and Grand Canyons include prehistoric and historic sites and Native American traditional use and sacred sites," and requires that "Reclamation and the National Park Service, in consultation with Native American Tribes, will develop and implement a long-term monitoring program for these sites." This requirement is fulfilled via the Programmatic Agreement of 1994, which states specific objectives related to the monitoring program. These objectives include generating data regarding the effects of dam operations on cultural resources, identifying ongoing impacts to those resources, and developing and implementing remedial measures to repair or halt the damage done.

With the passage of the GCPA in 1992, the cultural resources staff at GRCA was presented with a considerable challenge. Monitoring of cultural resources was now mandated by law, but there were few precedents for how this should be accomplished. Historically, there has been very little attention to systematic, detailed monitoring of the condition of archaeological sites anywhere in the world (Downum et al. 1997), and in Grand Canyon National Park (GRCA) there had been only a few previous attempts to assess the condition of its cultural resources. A limited program of monitoring cultural resources in the river corridor of GRCA was initiated in 1978, with the assessment of visitor and physical impacts (Euler 1979b). Annual site monitoring began in 1982 when NPS archaeologists accompanied other environmental specialists on resource-assessment trips down the river at the end of the summer tourist season (Balsom 1984, 1985, 1989; Downum et al. 1996). The agents of change recorded on these trips included physical and visitor-related impacts from camping, hiking, and site visitation. Management recommendations from the monitoring data led to subsequent site-rehabilitation trips, conducted during fall or winter months. None of these monitoring programs, however, were specifically linked with operation of the dam, and none had been conducted on the scale that the GCPA was now mandating.

With this historical and legal background, in 1992 the GRCA contracted with NAU to conduct the joint GRCA-NAU project referred to as the RCMP. The project at that time had both advantages and disadvantages. On the plus side was completion of an intensive inventory survey of the river corridor, which had resulted in the recording of detailed information on the location, contents, and condition of each site. NPS had in hand detailed site records, site plots, photographs, and assessments of each site's condition as of 1991. On the negative side, there were no precedents to be found anywhere in the world regarding reliable methods for monitoring the condition of archaeological sites through time, especially within a legal framework that involved multiple agencies, Indian tribes, and uncertainties regarding the potential effects of human-induced hydrological regimes. The RCMP thus embarked on its monitoring program fully aware that its efforts would be experimental in many respects, and that much would be learned as the project progressed. The following discussion outlines the fundamental concepts of resource monitoring, and details how the RCMP translated these concepts into action.

CULTURAL RESOURCE MONITORING

Cultural resource monitoring is considered by the RCMP to be a special subset of the general topic of resource monitoring. In resource management, monitoring is a methodological tool for answering specific questions designed to aid in management decisions and problem solving. Monitoring is a process, repeated at regular intervals, designed to provide a baseline for recording potential change in the future

(Goldsmith 1991:x). Some forms of monitoring detect the occurrence of change, the direction of change, and the extent and intensity of identified changes (Hellawell 1991). Monitoring is more than the gathering of data. It is instead "intermittent (regular or irregular) surveillance carried out in order to ascertain the extent of compliance with a predetermined standard or the degree of deviation from an expected norm" (Hellawell 1991).

One of the principal goals of monitoring is to recognize the causes of change to a system so that negative changes can be ameliorated. Changes to any resource will likely fall into two distinct categories: physical change related to natural processes and change related directly to human interaction with the resource (Hellawell 1991:5). Changes can also be categorized according to whether they are successional, cyclical, or stochastic. Successional changes may be extremely slow, with the resource appearing to be stable but gradually changing through time in significant ways. Cyclical changes involve a recurring sequence of changes resulting in the indefinite persistence of a phenomenon. Stochastic changes are random and unpredictable, and often are associated with severe environmental events such as flooding or fire. Each of these types of changes must be understood to effectively control them and manage the resource in question. As noted by Hellawell (1991:6), monitoring programs are designed to provide early warning of the detrimental effects of excessive human or management pressure, and provide the information necessary for taking appropriate action to ameliorate these effects.

Although the general theoretical and methodological frameworks of natural resource monitoring are useful, they also have limits when it comes to cultural resources. As with natural resources, monitoring the condition of cultural resources is an indispensable tool for their effective management. Cultural resource monitoring is difficult, however, because such resources are fragile and irreplaceable, and their information content is in a steady (though often exceedingly slow) state of decline (but see also U.S. Department of the Interior [USDI] 1995:265–267). Unlike many biological or other natural resources, cultural resources cannot be replenished, cleansed, or regenerated to repair damage or degradation of their information potential. Because they are composed of human-made or altered objects and deposits, subject to decay, breakage, disarrangement, and loss, information conveyed by cultural resources also inevitably degrades through time. At least with respect to information potential (and probably other areas of significance as well), all cultural resources are, in some measure, in worse condition today than when they were initially created. From a scientific standpoint, understanding past human activities at archaeological sites relies on patterning, i.e., it relies on an ability to decipher the relationship between material objects (architecture, hearths, refuse, human burials) and the human behavior that produced and arranged those objects in three-dimensional space. Thus, at the time of site abandonment, the interpretable "structure" of a site—the patterned relationship between and among material objects and the human behavior that produced them—is at its peak. As time passes, various agents, some physical and some human (Schiffer 1987), act to destroy the original patterns, breaking down the material remains and organized structure of the site and making it less interpretable.

The fundamental reality that cultural resources degrade through time, no matter what, raises a difficult dilemma with respect to monitoring changes in their condition through time. With respect to assessing the impacts of Glen Canyon Dam, a central question at the outset of the RCMP was to what extent the existence and operation of the dam has acted to destroy or disorganize the archaeological remains at sites in the Colorado River corridor. Surely, even without the dam there would have been some loss and disorganization of material remains. A major issue for the RCMP therefore was to determine what damage would have occurred and was occurring at cultural resource sites even if Glen Canyon Dam had never been built (background or natural damage) vs. what damage has occurred, and is occurring, because of the dam. The fundamental problem was to fairly and accurately characterize whether dam operations had served to accelerate harm to cultural resources in the river corridor, and if so, how this had occurred. This is a difficult question; any attempt to answer it relies on a time series of relevant observations at individual sites in a variety of geomorphological settings.

THE RCMP: A GENERAL OUTLINE

As noted, prior to the RCMP there were few attempts to monitor the condition of cultural resources in the Grand Canyon river corridor. All of these efforts took place after construction of the dam. Sites that had been recorded prior to dam construction were recorded in a minimal fashion, and there were no detailed data available on their condition. Thus, the baseline was the condition of the site at the time of detailed recording by the 1990–91 inventory survey. Since the initial survey, the RCMP has refined its understanding of which sites are potentially being affected by the dam, and how best to identify and remedy negative impacts to the sites.

Objectives and Legal Authority

From the outset, the principal objective of the RCMP has been preservation of the in situ cultural resources of Grand Canyon National Park. (Monitoring of cultural resources within Glen Canyon National Recreation Area is the responsibility of resources staff within the NPS unit, so subsequent discussions in this report pertain only to Grand Canyon National Park.) Preservation is to be accomplished through a variety of means, including erosion control structures in active drainages, planting vegetation to stabilize active dune areas, and trail obliteration and re-trailing. Monitoring data are collected so that management actions can be implemented to curtail the loss of archaeological features, artifacts, and sediments. Recognizing that in situ preservation sometimes is impossible, monitoring data are also collected to assist in preparation for mitigation of adverse impacts through data recovery. The RCMP has assisted the goal of data recovery by testing archaeological sites to determine their subsurface contents and extent, by conducting surface artifact collections, and by limited data recovery at damaged features.

As noted previously, the objectives outlined above are not only guided by long-standing NPS policies for preservation of cultural resources in GRCA, but are also mandated by the Grand Canyon Protection Act, the Record of Decision pertaining to the EIS for the operation of Glen Canyon Dam, and the legally binding Programmatic Agreement (PA) of 1994 (USDI et al. 1994). The PA was reviewed by the Arizona State Historic Preservation Office (SHPO) following the conclusion of the archaeological inventory survey. The Arizona SHPO evaluated and made recommendations for the 336 sites identified on the survey as being impacted or potentially impacted by dam operations. The SHPO determined that these sites were potentially eligible for inclusion in the National Register of Historic Places, and concurred with the initial identification of impacts. The operation of the dam was considered by the SHPO to constitute an "adverse effect" under the regulations for the National Historic Preservation Act (NHPA).

The PA outlines the responsibilities of Reclamation for the mitigation of these adverse effects under Section 106 of NHPA, spelling out the responsibilities of the RCMP as follows:

> The purpose of the Monitoring and Remedial Action Plan shall be to generate data regarding the effects of Dam operations on historic properties, identify ongoing impacts to historic properties within the APE [Area of Potential Effect], and develop and implement remedial measures for treating historic properties subject to damage.

All monitoring and remedial efforts pursued under the PA are subject to approval by the PA signatories. All proposed efforts must also comply with Wilderness Act requirements due to the proposed wilderness area designation of the Colorado River in the Grand Canyon. Remedial efforts are to be recommended by NPS and Reclamation on a site-specific basis in consultation with the SHPO and the tribes that have signed the PA.

The Sample

The sample of monitored sites has changed through time as our understanding of site condition and the monitoring process has been refined. The initial archaeological inventory survey identified 336 out of 475 recorded sites as being potentially affected by the operation of Glen Canyon Dam. Subsequently, three additional sites were identified and recorded, and some sites were either added to or deleted from the initial list of sites eligible for monitoring.

By focusing on the sites most in need of monitoring for the potential effects of Glen Canyon Dam, the list has been pared to a total of 318 sites considered to be located within the area of potential effect (APE) of Glen Canyon Dam (Glen Canyon National Recreation Area and Grand Canyon National Park) and that are directly, indirectly, or potentially impacted by the dam. Of these, 53 are located within Glen Canyon National Recreation Area and their monitoring is the responsibility of the Glen Canyon NRA resources staff. The other 264 sites are within Grand Canyon National Park. For the remainder of this report, we concentrate exclusively on the 264 located within Grand Canyon National Park.

The sites to be monitored have been selected based on their location within the APE, documented vulnerability to erosion, and other considerations. Based on evident changes, however, other sites were also determined to need frequent monitoring. Annual or semi-annual monitoring takes place at all actively eroding sites. Annual monitoring also occurs at all sites with checkdams built to stem erosion, to assess the effectiveness of these remedial efforts. Sites identified by tribal members based on specific tribal concerns are monitored at frequencies determined through consultation with individual tribes. Such decisions regarding the frequency of monitoring are made by the RCMP staff in consultation with PA signatories and on the basis of comments made during their review of the RCMP annual reports.

Assessing Impacts

The potential impacts of dam operations (Fairley et al. 1994:148) have been divided into several broad categories: direct impact, indirect impact, potential impact, and no impact. (These categories of impact reflect the terminology of the National Environmental Policy Act [NEPA; see 40 CFR 1508.81], which provided the guidance under which EIS studies, including the GRCA-NAU survey, were conducted. See also USDI 1995:261–267.) These categories were further divided into specific subcategories relating to geographic setting, erosional forces, visitation patterns, and other factors that could be identified at specific sites.

- Direct Impact: There has been inundation or bank cutting within the site area in recent years.
- Indirect Impact 1: There is bank slumpage or slope steepening adjacent to the site.
- Indirect Impact 2: There is evidence of arroyo cutting or other erosion exacerbated by base-level lowering or proximity to river-eroded sediments within the site.
- Indirect Impact 3: There is evidence that changes in recreational use patterns have affected visitor impacts at the site (e.g., walking passengers around sites to avoid dangerous rapids, or the creation of new camps to replace camps that eroded away).
- Potential Impact 1: The site is buried in or is located on old river alluvium and is below the 300,000 cfs river flow zone.
- Potential Impact 2: The site is located below the 300,000 cfs river flow zone and is not situated in or on river alluvium.
- No Impact: There is no apparent impact occurring at the site.

Variables

To systematically assess site condition, a monitoring form was developed that made reference to the site condition variables recorded during the initial survey. This form has been revised and refined since 1992, but its core variables have remained. Generally, site impacts are divided into two categories: physical impacts and visitor-related impacts. Physical impacts include surface erosion, gullying, arroyo cutting, bank slump, eolian or alluvial deposition or erosion, and side-canyon erosion. A final category of physical impacts is "other," intended to encompass things such as spalling of bedrock or boulders, and displacement of artifacts and features due to the growth of roots. Visitor-related impacts include collection piles (artifacts gathered by visitors and placed in piles), trails, on-site camping, and criminal vandalism.

Two of the more important physical variables are gullies and arroyos. As a result of geomorphic studies conducted in the late 1980s (Balsom et al. 1989) and early to mid 1990s (Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996b), RCMP staff and NPS survey personnel have paid particular attention to archaeological sites on river terraces that contain gullies and arroyos. Alluvial deposits of the Colorado River form these terraces. According to Hereford et al. (Hereford 1993), most archaeological sites are associated with prehistoric terraces, although archaeological remains also occur within the pre-dam terraces and terrace-like features. The terraces are crossed by entrenched channels of small tributary streams referred to as arroyos or gullies. The arroyos are erosional features that dissect terraces as they extend headward, destroying or damaging surface and subsurface archeologic sites.

Further, geological mapping has been completed by Hereford and others (1993, 1995, 1996) to determine how the ongoing erosion of terraces and archaeological deposits by arroyos and gullies is affected by regulated streamflow, which began in 1963 with Glen Canyon Dam. Regulated streamflow is defined by Hereford and others (Hereford 1993) as the water and sediment discharge regimen of the Colorado River since 1963. It has substantially reduced sediment load, sediment concentration, duration of high flow, and peak-flow rates compared with the unregulated streamflow of the pre-dam era (Hereford et al. 1993). In the present discharge regimen, sediment load has been reduced by a factor of six and the annual flood, which was the principal agent of natural geologic change, has been eliminated (Hereford 1993). Due to the research conducted by Hereford and others (1993, 1995, 1996), monitoring of archaeological sites within the APE is focused on the presence of arroyos and gullies on the site, or in the vicinity. In Chapter 4, more detail is presented on the research conducted by Hereford et al. and how their results have structured the RCMP data synthesis.

Appendix A presents the version of the monitoring form currently in use (as well as previous versions), showing how the variables are coded for each of the potential impacts. Generally, impacts are recognized and categorized based on repeat visits to the sites that include photographic documentation. Field crews have accumulated considerable experience in categorizing the variables on the monitoring form, leading to a high degree of reliability in classification. Photographic documentation has also been refined as an aid to making time-series comparisons.

Analysis of change at individual sites is grounded in the concept of National Register eligibility and the desired condition of sites (integrity) that qualifies them for the Register. Because absolute quantification of the loss of integrity is either impossible or unfeasible in terms of time and effort, the judgment of an individual crew member about site integrity is to some degree a qualitative and subjective assessment. However, the RCMP has devoted considerable time, thought, and effort to ensuring the validity and reliability of site condition assessments. Each crew member has been trained to consistently recognize and assess physical and visitor-related impacts, and crew members check their observations against each other. Repeat photography at each site (now aided by highly detailed, medium-format photography) is used to provide an objective visual standard for comparing site condition through time, and to allow individual crew members to calibrate their assessments of erosion and other impacts. All of these measures contribute to an objective assessment of the National Register concept of integrity. As a result, observations made at individual sites are keyed to an understanding of how ongoing changes at the site either do or do not affect the site's integrity, as defined according to National Register criteria.

The Site Monitoring Process

Monitoring is a process repeated at regular intervals to determine the condition of a resource relative to the condition during the previous monitoring episode (Goldsmith 1991; Hellawell 1991; Kunde 1999a). Monitoring methods are not standardized in cultural and natural resource fields, although common elements link these realms methodologically (Kunde 1999a). Detailed discussions on long-term monitoring can be found in Goldsmith (1991), Hellawell (1991), Kunde (1999a), and Spellerman (1980).

The purpose of all monitoring is to detect changes in resource conditions through time. Without systematic monitoring, there is no mechanism for understanding the relative condition of cultural resources or observing changes to them through time (Kunde 1999a). The interval between monitoring episodes is therefore based on how long it takes for change to be detected. Active sites are monitored more frequently than inactive sites.

The river corridor survey of 1990–91 (Fairley et al. 1994) docments a baseline condition for all archaeological sites located within the area of potential effect along the river corridor (Downum et al. 1996; Kunde 1999a). This baseline is the beginning point from which all future information is generated. Figure 1 depicts the monitoring process as it pertains to the River Corridor Monitoring Project.

Monitoring Terminology

Archaeological sites include both physical evidences of past human activity and the effects of that activity on the surrounding environment (USDI 1997a) and can be prehistoric or historic in age. Cultural remains are defined as "one or more human-made features or a cluster of artifacts representing a former locus of human activity" (Fairley et al. 1994). During the course of the intensive cultural resource inventory, no limits were placed on the actual number of artifacts located at a site (Fairley et al. 1994).

Archaeological Site Monitoring

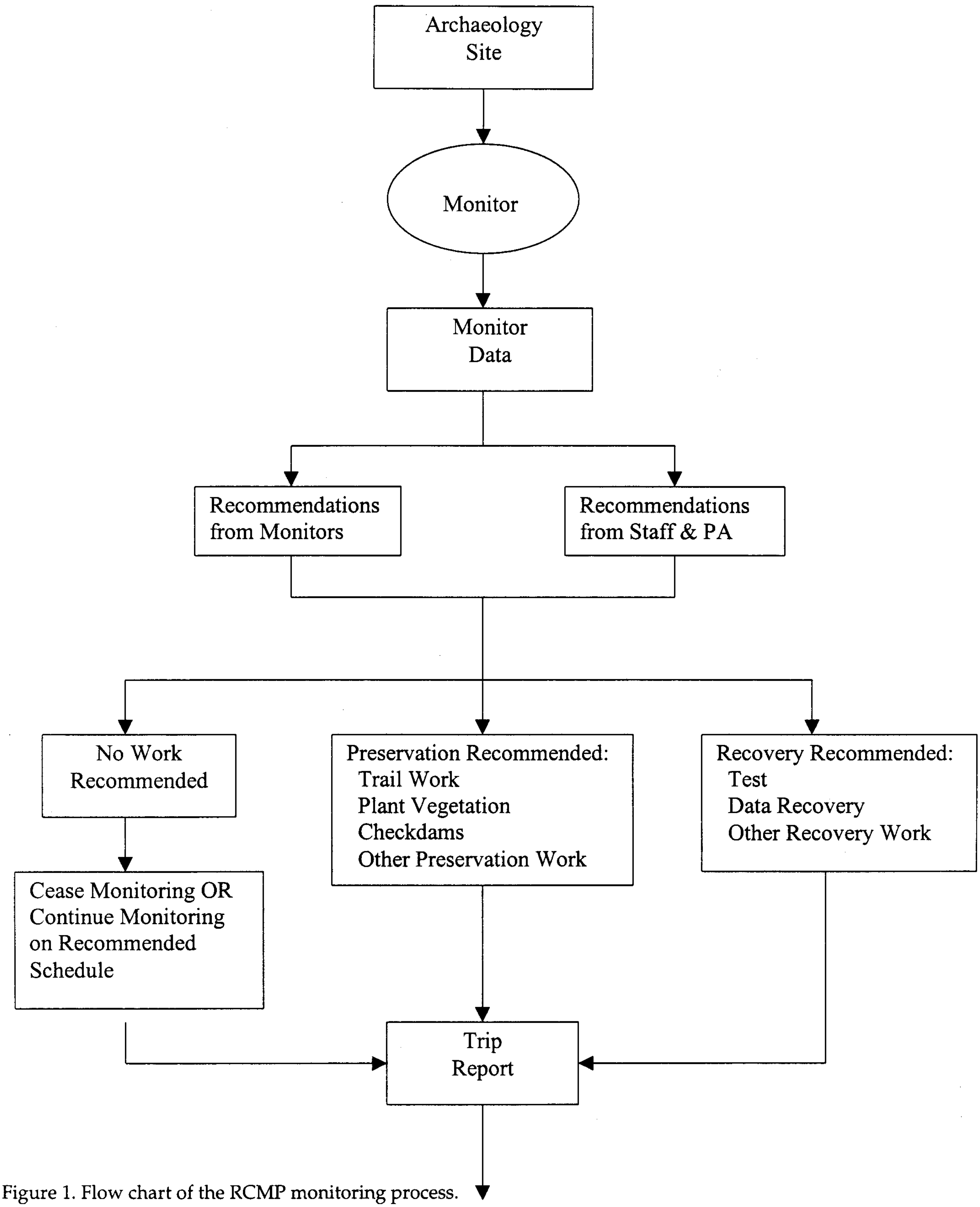
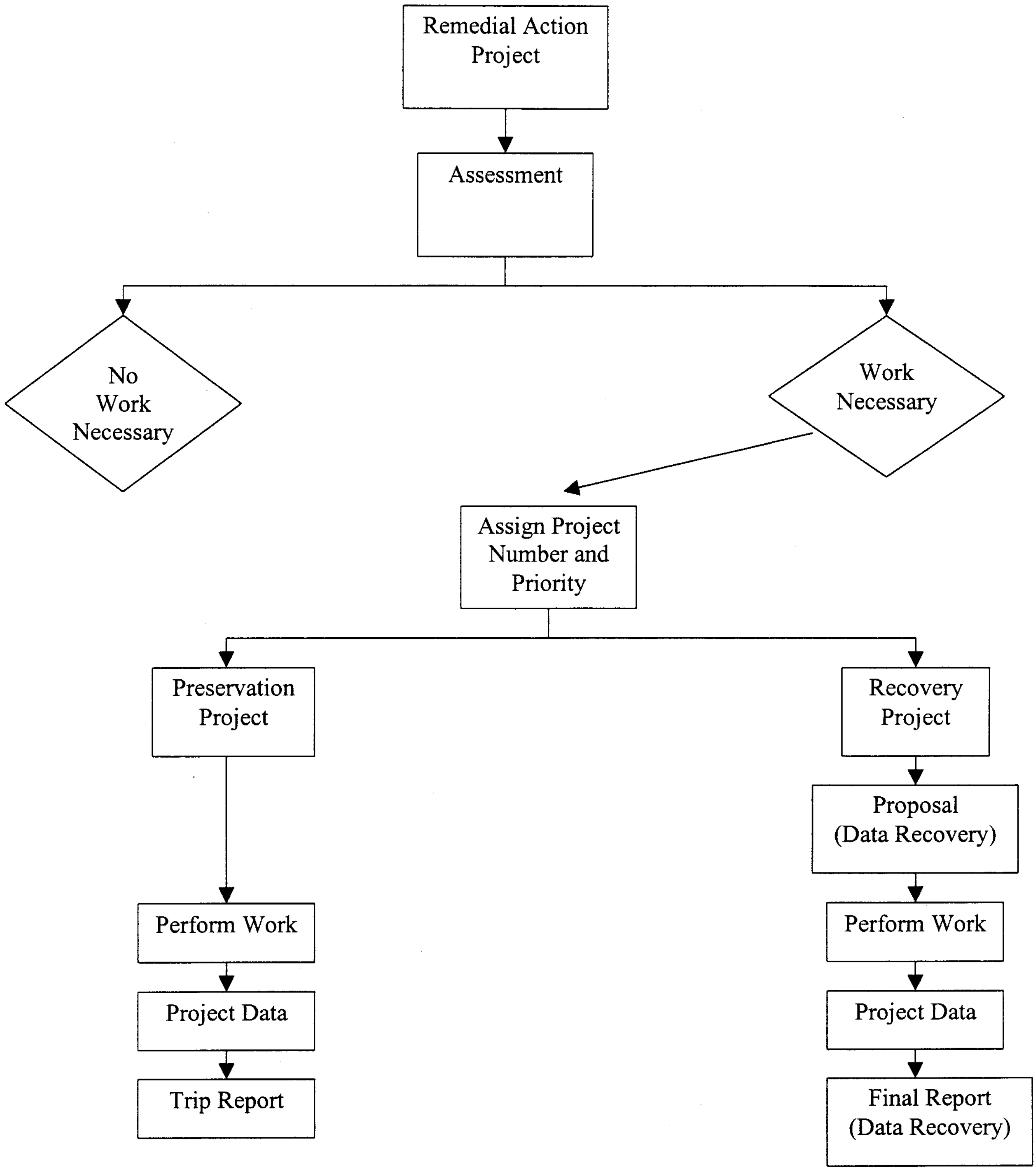
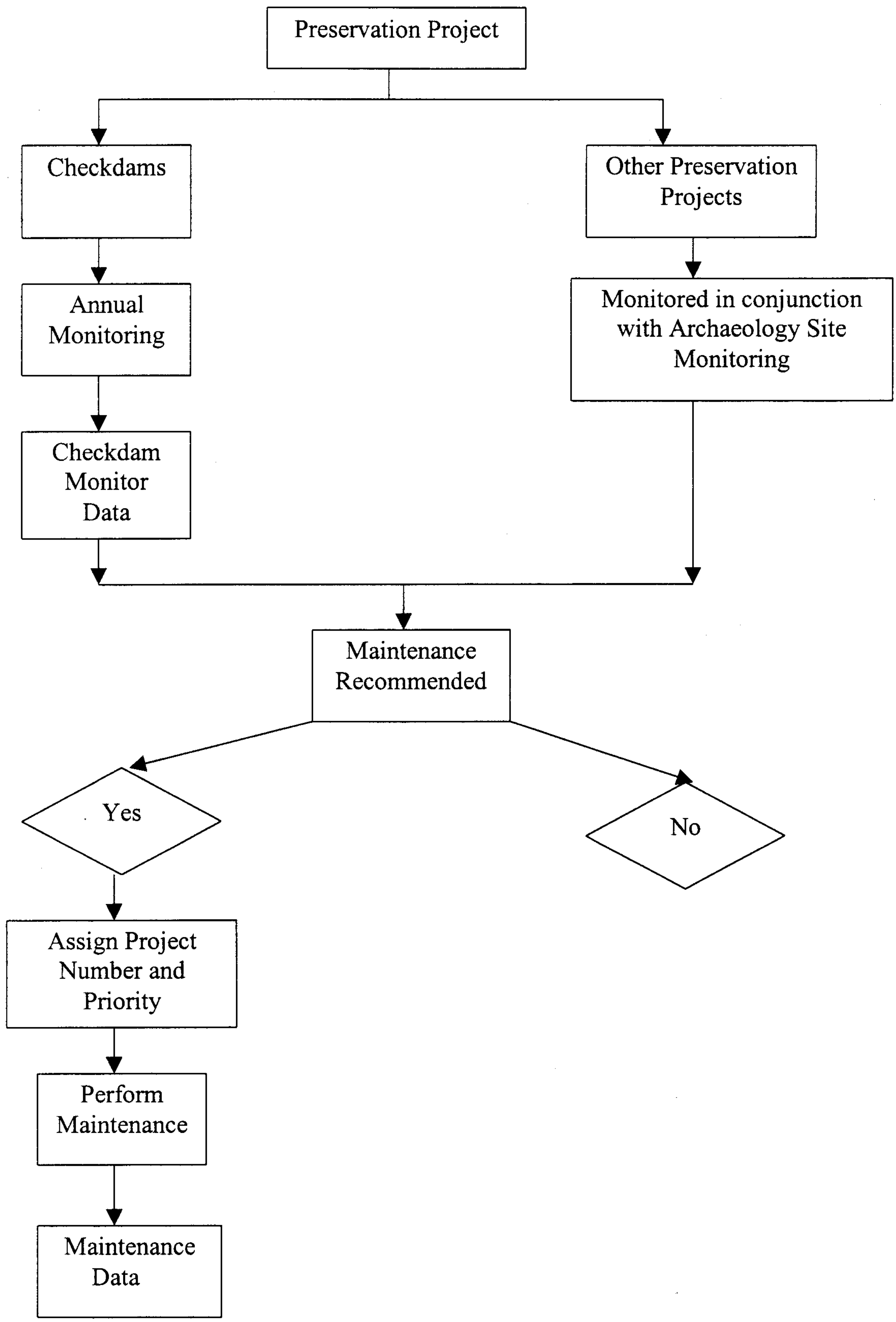


Figure 1. Flow chart of the RCMP monitoring process.

Remedial Action Project



Preservation Treatment Monitoring



To *monitor* site condition is to determine the extent of any deviation from the recorded baseline. Field notes and photographs aid in observing and comparing change. Staff members review previous monitoring forms, IMACs site description forms, photographs, and baseline information, and then observe current conditions to determine the degree of change, thus generating new site condition data.

Generation of *monitoring data* occurs when staff members fill out a River Corridor Archaeological Site Monitoring Form (see Appendix A), and take additional or repeat photographs of a site, feature, or overview. The current monitoring form consists of 30 questions that record who is monitoring, what impacts are being observed, whether drainages at the site flow directly to the Colorado River, side canyons, or percolate into alluvial terraces, whether visitor-related impacts are present, and site management recommendations. Three comment fields are also provided for narrative descriptions of impacts observed and management issues. This information is recorded in the field and then entered into a relational database in the laboratory for data management. In addition to generating data related to overall site condition based on the presence or absence of certain impacts, recommendations for treatment are also made in both the field and laboratory to curtail further losses of cultural remains at the site.

Recommendations from monitors are based on the conditions observed at the time an archaeological site is monitored. Preservation and data recovery recommendations may be made for future work at the site. These recommendations are a result of the identification of new impacts, or the recognition that existing impacts are increasing

Recommendations from staff are made upon completion of field trips. Formal and informal discussions occur regarding the changing conditions observed at sites monitored. On occasion, treatment recommendations are made by staff members in the office, or requests are generated from PA representatives to initiate treatment in certain locations. All tribal requests are honored to the best of the abilities of the RCMP.

A *No Work Recommendation* occurs if no new or active impacts are observed during a monitoring episode. A site then either continues to be monitored on the recommended schedule or is placed on inactive status (monitoring ceases unless there is a major flood event). If impacts are observed, one of two recommendations are made: preservation options and recovery options.

Preservation options include work initiated prior to the destruction of a site with the goal of in situ preservation. Options for preserving sites consist of trail work, planting vegetation, construction of checkdams, and other supplementing preservation methods not specified, such as the stabilization of a structure.

Recovery options include work initiated when all efforts to preserve cultural information have failed or are considered impractical. Options include data recovery and an "other" category for recommendations such as bulk sampling. Recovery options are considered only in the event that cultural remains can no longer be preserved in situ.

A *trip report* occurs upon completion of a monitoring trip, after the input of monitoring data into the computerized database, and after discussions related to site condition have occurred amongst staff members. The trip report is compiled and distributed to all PA representatives. A trip report is intended to be a formal examination of the specific information gathered at each site monitored; it is a requirement under the Programmatic Agreement. Trip reports also serve as a means for PA representatives to identify locations of interest and concern. Trip reports constitute partial fulfillment of the BOR consultation responsibility for the Programmatic Agreement.

Recommendations for treating impacts observed during archaeological site monitoring episodes result in the development of *remedial action projects*, which encompass a variety of preservation treatments and data recovery techniques (see Figure 1). Specific recommendations are based on an accumulation of data collected during archaeological site monitoring episodes and preservation treatment monitoring. These sources provide a body of knowledge based on site-specific information, geomorphic processes, and references to previous treatments that may or may not have succeeded in similar contexts.

Remedial action projects constitute either preservation treatments or actions designed specifically for data recovery projects. Prior to the implementation of any formal excavation project, a proposal is submitted to PA representatives for review and comments. Upon acceptance of the data recovery proposal, or the acceptance of all other remedial action options, the recommended treatment is performed.

Field assessments are conducted prior to the initiation of specific remedial actions; field assessments are conducted to confirm the utility of the recommended action. In certain cases, an assessment is conducted at the initiation of the remedial action project. Assessments allow project staff an additional opportunity to review and concur with the monitoring recommendations, or to consider other options. A written assessment includes the type of work recommended, comments from previous monitoring forms related to the potential remedial action, and discussions of drainage systems including soil contexts, the presence of nickpoints, headward migration, archaeological features in the immediate vicinity, vegetation coverage, and potential agents of change. An estimation of the time and materials needed to complete the remedial action project is also part of the assessment process. The result of an assessment is to either proceed with the recommended work or not. If work is recommended upon completion of an assessment, a series of actions follow.

A *project number* tracks the project from the recommendation stage through the assessment, field work, reporting, and completion stages. Upon completion of the assessment and the concurrence to proceed, a remedial action project becomes formalized by assigning a project number.

Each project is also *prioritized* using categorical values (high, medium, low) based on the relative degree of erosion observed and its vicinity to cultural remains. Prioritizing keeps the most important items at the forefront of the RCMP's efforts. For example, all checkdam recommendations are automatically assigned a priority rank of 1.

The *type of data generated* from remedial actions is dependent on the type of work completed. Remedial action documentation forms include the type of remedial action recommended and a copy of the assessment. Documentation also includes a description of the work completed, time spent working, and the number of participants. Checkdam data include material type, measurements, and checkdam types for each checkdam constructed. Data recovery projects include excavation forms and forms specific to the types of samples obtained.

Data recovery reports include an archaeological overview of the region, previous work completed, the methods of data recovery employed, samples recovered, and the dissemination of data recovery results. Data recovery reports are distributed separately from the trip reports and annual reports generated by the RCMP.

Preservation Treatment Monitoring

Completed remedial action projects are monitored to assess preservation treatment methods. Assessments and monitoring information provide feedback to the RCMP staff and PA signatories on the success of management actions implemented (Hellawell 1991; Kunde 1999a). Preservation treatment monitoring, as shown in Figure 1, has been divided into two distinct categories: checkdam monitoring and all other preservation treatment work.

With the exception of checkdams, all other preservation treatments implemented are monitored according to the assigned site monitoring schedule, and observed conditions from previous remedial actions are recorded in the management comment field of the monitoring form. Recommendations are forwarded to the rehabilitation trail crew or the revegetation crew at GRCA if maintenance work is deemed necessary.

All checkdam locations are monitored annually because checkdams are often constructed in active drainages and the preservation treatment can be quite invasive. Annual monitoring enables RCMP staff to determine the effectiveness of the checkdams. Checkdam monitoring would not be possible without the continued assistance of personnel from the Zuni Conservation Project. RCMP staff members document changes in checkdam construction styles and are familiar with determining locations where checkdams may be effective; the Zuni Conservation Project members guide the number and types of checkdams necessary. This synergy between RCMP staff and Zuni Conservation Project members results in the most effective means of implementing and maintaining checkdam building projects. Zuni Conservation Project members accompany RCMP staff during checkdam monitoring episodes on no more than two trips per fiscal year. During the course of checkdam monitoring, maintenance is performed if necessary and if time allows.

In the event that maintenance work is required, Zuni Conservation Project members direct any construction necessary. At times, maintenance work requires little more than removing excess rock built up along the center of the checkdams and placing it along the sides of the structures. Maintenance work is also required when checkdams are completely blown out due to erosional events or the development of new nickpoints in drainages requires immediate treatment.

Maintenance data collected includes the number previously assigned to the checkdam, the checkdam type, materials used, and measurement of the checkdam itself. This information is compared to previous information for the same checkdam to produce a history of construction and maintenance work for every checkdam constructed along the river corridor.

All other preservation treatment work is monitored according to the assigned site monitoring schedule. Preservation treatment maintenance recommendations are often made during regular monitoring activities. Maintenance recommendations are forwarded along to the NPS and tribal agencies as needed for treatment work. For example, all trail work and vegetation projects are completed by GRCA.

Documentation of maintenance work includes photographs, written descriptions, and measurements of overall preservation treatment areas. The preferred method of documentation is total station mapping of the treated areas overlain onto existing maps.

Maintenance data are entered into the computer and used to track activity, types of preservation treatments, and success of preservation treatments. This information is used as a reference for assessing future work and continued use of select preservation treatments.

Personnel, Logistics, Field Work, and Reporting

For any given monitoring trip, field work associated with the RCMP is performed by GRCA archaeologists and other qualified crew members drawn from the NAU staff, GRCA staff, PA signatories, or other public or private sector representatives. The GRCA provides project leadership and management direction, field personnel, and logistical support. The Department of Anthropology provides research guidance, field and laboratory personnel, office and laboratory space, and opportunities for student research. A core field crew has remained with the project since 1993, which ensures continuity and consistency in field methods and procedures. This core RCMP staff consists of two GRCA and two NAU archaeologists. These four crew members have primary responsibility for collecting the monitoring data, analyzing and interpreting it in the field and laboratory, making management recommendations, implementing any proposed remedial actions, and generating all reports. RCMP staff meet and exceed the minimum professional qualifications in archaeology as outlined in 36 CFR Part 61. All staff members have completed or will complete a graduate degree in Anthropology, with an emphasis in archaeology.

All permits and other arrangements necessary to allow the monitoring trips to take place are handled by the NPS resources staff at GRCA. Logistical considerations such as boat rental or outfitting, hiring boat pilots or other staff, food preparation, and arranging transportation to the launch and take-out sites are handled by RCMP staff. Food purchases are made cooperatively by NPS and NAU staff. Field equipment is stored in NAU and NPS facilities.

RCMP activities generally take place during four river trips per monitoring season. These trips usually consist of two expeditions devoted to the collection of monitoring data and two devoted to both data collection and remedial actions. On the latter two trips, remedial work may consist of maintaining previous work or implementing new remedial measures to help curtail the loss of archaeological sediments, features, and artifacts. Additional river trips may take place in any given monitoring season because of the need for emergency remedial actions, tribal requests, and other unanticipated factors.

Monitoring trips are best scheduled to take into account seasonal factors such as vegetation growth and the ebb and flow of tourism along the river corridor. Experience has shown that the period from mid-September through April is the optimal monitoring field season. During this time, field work is less visible to the commercial and recreational river trips, minimizing the chance that tourists will be attracted to archaeological sites by noticing the activities of archaeological field crews. This season also represents an environmental optimum for field work, as daytime temperatures are cooler and sun angles are lower, making field work and photography more effective and efficient. The timing of the monitoring trips also allows observation toward the end of the summer vegetation season (October), at the vegetation low-point of mid-winter, and throughout the spring vegetation season (February, March, and April). Monitoring during these seasons allows the field crews to observe sites with different amounts and types of vegetation, which can have a dramatic effect on the perception of site condition over just a few months' time. Site condition is best assessed in multiple seasons, so that the effects of a single season's vegetation growth do not inordinately skew perceptions about erosional processes and the density of surface artifacts or features.

Impacts to sites include rills, gullies, and arroyos, evidence of sheetwashing, the slump or collapse of site sediments, stripping or rearranging of sand dunes or other sediments by wind, burrowing or other bioturbation, and growth of vegetation. Assessment of such impacts is based on previous experience and knowledge of the erosional forces of the Grand Canyon environment. In the field, change is assessed by re-locating cultural features, topographic features, and surface artifacts at each site, and comparing their current condition with previous characterizations. Previous photograph sites are also re-located, using a field copy of the photograph. Crew members stand at the photograph view location and systematically compare the site's current appearance with its appearance at the time the photograph was made. In the past, when funds were available, another aid to assessing changes was a program of detailed topographic mapping of selected sites with a total station mapping instrument, which allowed an objective assessment of volumetric changes of sediments in drainages so that a predictive model could be developed for identifying likely areas of erosion on pre-dam alluvial terraces. Site mapping was to occur repeatedly at sites experiencing active erosion suspected to be caused by dam operations, and these sites were compared with a control group judged not to be affected by the dam. This mapping also measured the effectiveness of preservation treatments such as checkdams.

After each river trip, the RCMP staff produces and distributes a trip report. These reports are sent to all signatories of the PA for review of the just-completed work and any proposed work to be conducted during upcoming trips. Near the completion of each fiscal year, the RCMP staff compiles the monitoring data from the preceding monitoring season, analyzes it, and produces an annual report that provides recommendations for preservation or data recovery at each individual site that was monitored, and presents recommended remedial actions for the next fiscal year. This proposed work for the next year was heavily relied upon by PA tribes in creating their scope of work for the following year. For example, if the RCMP staff recommended mitigative work at site C:13:273, the tribes would visit that site on their river trip, thus providing a response to RCMP on whether or not the work should be carried out.

Program Assessment

Assessments of the contributions of the RCMP take place on many levels. Internal evaluations of data collection and analysis are ongoing, and can occur at the conclusion of each monitoring trip. As an example, RCMP staff have revised the monitoring form based on in-field evaluations by the staff and PA participants (Coder et al. 1995; Leap et al. 1997).

External review is provided through a number of means. RCMP staff members participate in preservation workshops and archaeological conferences, presenting their methods and results to the community of historic preservation specialists and archaeologists for review. The program is reviewed annually by PA signatories and other peers in the scientific community who participate in the larger effort of Grand Canyon resource research, monitoring, and remediation. Because the work performed by the RCMP is complementary to part of the larger resource monitoring efforts coordinated by the Grand Canyon Monitoring and Research Center (GCMRC), the project may also participate in a protocol review sponsored by GCMRC that is scheduled to take place in FY2000. Evaluation of the project also occurs as contractors affiliated with the GCMRC use and analyze the database generated by the RCMP (Neal et al. 1998; Thompson et al. 1998). A measure of the success of the RCMP is provided by emulation of its methods by other NPS units. In the past 2 years, cultural resource managers associated with Wupatki National Monument, Walnut Canyon National Monument, Dinosaur National Monument, the Washington State Parks and Recreation Commission, and the Western Archaeological and Conservation Center have contacted the RCMP office to request information and assistance in developing their own cultural resource monitoring programs.

Annual reports generated by the RCMP staff (Coder et al. 1994a, 1994b, 1995a, 1995b; Leap et al. 1996, 1997, 1998) are available through the project office, Grand Canyon National Park, Upper Colorado River, Bureau of Reclamation, and the GCMRC. These reports fulfill consultation requirements as set forth in the draft Historic Preservation Plan (USDI 1997a).

CONTRIBUTIONS OF THE RCMP

Site Condition Assessments

Since 1992, the RCMP has made 33 monitoring trips to assess the condition of cultural resources in GRCA. On average, RCMP staff have monitored 130 sites per year. The individual trips have lasted from 16 to 18 days, for a total of 65 to 70 days spent each year on the river conducting the business of the RCMP. A total of 1,042 monitoring visits has been made, during which more than 80,000 observations have been made on site condition variables. See Table 1 for the total number of monitoring episodes per year since FY92. The frequencies of monitoring visits for the individual sites are shown in Appendices E–I. Thus far, an estimated 9,000 photographs have been taken. The photo record, especially the medium-format photographs, have produced an immensely useful database for future environmental studies based on repeat photography. These activities have resulted in an impressive site condition database for Grand Canyon river corridor sites. Currently, records from this database occupy some 26 linear feet of file cabinet space, and photo records occupy another 26 linear feet.

Remedial Actions

The monitoring program recognizes the preservation mandate of the NPS and agency responsibilities of Reclamation under the National Historic Preservation Act. The goal of the existing PA (USDI et al. 1994), MRAP (USDI 1997a), and draft Historic Preservation Plan (USDI et al. 1997) is in-place preservation. Existing efforts therefore focus on retaining the integrity of as much of a site as possible.

Site preservation actions have been completed at 96 sites, including checkdam construction, medium-format photography, trail work, and vegetation management (planting new grass seedlings and transplanting bunch grasses, cacti, and small shrubs).

The maintenance required at 29 sites with checkdams will be completed by RCMP staff. Maintenance or monitoring of completed remedial work enables the RCMP staff to determine the effectiveness of its methods. All trail work and vegetation projects were supervised by GRCA crew and will therefore be maintained by them. The Interior Department's Standards for Archaeology and Historic Preservation and the National Park Service's guidelines both instruct agencies to actively maintain historic properties, especially if preservation treatments have been implemented. Intervention into the historic fabric constitutes a disturbance to the property and must be monitored and maintained.

Educating the public about archaeological sites, factors that erode a site, and management actions taken to preserve or retrieve archaeological data is also an important part of preservation. Public education concerning archaeological sites along the river corridor has consisted of formal and informal presentations such as talks given at archaeological conferences, at river guide training seminars (annual seminars with approximately 200 commercial river guides attending), to GRCA park employees and visitors, and at educating centers such as NAU and various elementary and high schools in the Flagstaff area. Written updates and general comments have also been published in handbooks, as abstracts, and in the *Boatmen's Quarterly, Nature Notes, Arizona Highways,* and science magazines.

Probably the most valuable form of education occurs on the river. Many times there are spaces available on our river trips for volunteers and GRCA interpretive staff. The commercial boatmen we use are also very willing to learn about archaeological concerns within the Canyon. When these people go down the river with us they see first hand the erosive problems to archaeological sites and the preservation and mitigative treatments implemented. They take this knowledge and tell their friends and the public. Although this method of education reaches only a small number of people, it is very personal and influential.

To date 48 sites, mainly rock art sites, have medium-format photos. Ten sites are located outside the APE and 12 sites have been placed on the inactive monitoring list because the photographs of these sites are viewed as final mitigative treatment. For example, site C:06:004 is a pecked USGS rock hammer from 1923 and C:06:005 is a single pecked anthropomorph. An IMACS form was completed for each of the sites, scaled drawings were completed, and medium-format photographs were taken; no more information can be collected. Table 2 lists the 12 sites that are no longer monitored due to medium-format photo documentation.

Total station mapping of archaeological sites was completed at 68 sites. These maps are commonly completed prior to data recovery and before and after preservation treatments. However, 16 of these

Table 1. Number of Monitoring Episodes Completed Each Year Since FY92

Fiscal Year	Monitoring Episodes
92	83
93	163
94	160
95	165
96	150
97	104
98	105
99	112
Total Monitoring Episodes	1,042

Table 2. Sites No Longer Monitored by RCMP Staff

Sites with medium-format photo-documentation as final measure			
A:15:018	C:05:007	C:09:034	
A:16:172	C:06:002	C:13:003	
B:11:284	C:06:004	C:13:322	
B:15:124	C:06:005	G:03:077	
Sites with total station maps as final measure			
A:15:017	B:10:230	B:15:132	C:13:367
A:15:030	B:10:236	B:15:143	C:13:384
A:16:156	B:15:121	C:09:080	G:03:019
B:10:121	B:15:126	C:13:356	G:03:027

sites are not monitored, and mapping is seen as a final mitigative measure. Most of these sites were originally mapped as a control group. However, after further discussion with PA members, these sites have been omitted from the monitoring program (see Table 2 for the list of sites with total station maps that are no longer monitored by RCMP staff).

The more common form of mitigation by our staff involves data recovery of damaged features on archaeological sites. Sixty-one sites have received limited data recovery. Excavation has been conducted in the past to collect information prior to losing the entire feature to erosion, when preservation is not an option. Such data recovery has included testing for site significance, testing for feature significance, compliance work, and research. For example, carbon samples were taken for Richard Hereford's (USGS) geomorphological studies (1993, 1996; Hereford et al. 1993, 1995, 1996) at 20 sites located within the APE prior to this monitoring program (see Appendix B for a summary of the mitigative efforts completed).

Information Sharing and Consultation

The RCMP has on numerous occasions contributed important information to Indian tribes, nature scientists, and others interested in cultural resources and management issues pertaining to the Grand Canyon river corridor. The RCMP staff has distributed information about the PA and the monitoring and remedial action program to various audiences, including speaking at formal and informal archaeological conferences, presenting slide shows to various groups, and writing reports and disseminating them to the public. RCMP personnel have also participated in information-sharing river trips designed to contribute to a greater understanding of resource management in the Canyon. Detailed information on all public outreach programs by RCMP staff for the past 8 years is given below.

Publications and Presentations

In 1999, Janet Balsom wrote an article titled "Staying Upright: Reflections on the Section 106 Process and Glen Canyon Dam Cultural Program" (Balsom 1999). A second article by Balsom, "Cultural Resources and Glen Canyon Dam–Colorado River Experimental Flow of 1996," will be published in the Fifth Biennial Conference of Research on the Colorado Plateau. A third article by Balsom will appear in *Ecological Applications* (Balsom, in press). The title of this article is "Cultural Resources and the Experimental Habitat Building Flow in Glen and Grand Canyons, Spring 1996."

GRCA RCMP personnel (Andrews, Hubbard, Kunde, and Leap) have submitted six articles regarding the PA and the archaeological monitoring program to *Nature Notes*, a quarterly Park magazine.

In 1998, a poster session was presented at the 63rd annual Society for American Archaeology meetings in Seattle, WA.

In 1997, the George Wright Society published "Below the Dam: Partnerships in Cultural Resources Management on the Colorado River," in *Making Protection Work* (Harmon 1997). In March of 1997, the George Wright Society also held its 9th Conference on Research and Resource Management in Parks and on Public Lands in Albuquerque, New Mexico. The session was titled "Below the Dam: An Experiment in Partnerships for Management of Cultural Resources along the Colorado River Below Glen Canyon." RCMP personnel were among the presenters at this session, along with representatives from GRCA, Reclamation, USGS, NAU, the Hopi Tribe, Pueblo of Zuni, Navajo Nation, Hualapai Nation, and the Southern Paiute Consortium (Begay 1996; Balsom and Larralde 1997; Bulletts 1996; Crumbo 1996; Dishta 1996; Downum et al. 1996; Ferguson et al. 1996; Hereford 1996; Honga and Jackson 1996; Leap and Hubbard 1996a).

In 1996, a symposium on the PA program titled "Below the Dam: Cultural Resources and the Colorado River Below Glen Canyon Dam" was presented at the 61st annual Society for American Archaeology meetings in New Orleans, LA. RCMP personnel were among the presenters at this session, along with representatives from GRCA, Reclamation, U.S. Geological Survey, NAU, the Hopi Tribe, Pueblo of Zuni, Navajo Nation, Hualapai Nation, the Southern Paiute Consortium, Arizona State Historic Preservation Office and the Advisory Council on Historic Preservation (Balsom and Larralde 1997; Dishta 1996; Downum et al. 1996; Ferguson et al. 1996; Leap and Hubbard 1996a). Additional public outreach in 1996 included presentations on the RCMP at the Pecos Conference in Flagstaff, Arizona. The resulting paper is titled "Preservation along the Grand Canyon River Corridor" (Leap 1996).

In 1995, a paper titled "An Update on Archaeology Monitoring in Grand Canyon National Park" was presented at the Pecos Conference, Mimbres, New Mexico (Andrews 1995b). RCMP staff also presented a paper at the 3rd Biennial Conference of Research on the Colorado Plateau, Northern Arizona University, Flagstaff, titled "Physical and Visitor-Related Impacts to Cultural Resources along the Colorado River Within Grand Canyon National Park." (Andrews 1995a).

In 1994, a paper titled "Monitoring River Corridor Sites in Grand Canyon National Park" was presented at the Pecos Conference by RCMP staff at Mesa Verde National Park (Andrews et al. 1994).

In 1993, a paper titled "Cultural Resource Inventory and Monitoring in Grand Canyon National Park" was presented at the 2nd Biennial Conference of Research on the Colorado Plateau, Northern Arizona University, Flagstaff, by RCMP staff (Andrews 1993).

Every year, the RCMP staff participates in the land-based and river-based Guides Training Seminar. We supply updated information on the monitoring program at the land-based sessions and give informal archaeology talks during the river-based sessions. Since 1994, RCMP staff have also participated in the annual Arizona Archaeology Expo in Phoenix. Members of the public have an opportunity to learn about natural and cultural resources within Grand Canyon National Park and along the Colorado River at this outdoor exhibit.

River Trip Participation

The Guides Training Seminars have incorporated project consultation and expertise during both land-based sessions and river trips since 1992. From 1992 to 1995, RCMP organized one PA monitoring trip per year, taking two snout rigs down the river and showing sites to several PA representatives. Project staff have also accompanied all but one of the annual Zuni river trips since 1992.

The Hopi Tribe had one of our staff members on at least five of their river trips (see Figure 2). The Navajo Nation has also had one of our staff members on at least three river trips, and staff members

Figure 2. Trip participants on the upper half of an RCMP monitoring trip in April of 1994. First row (left to right): D. Peterson (NPS), C. Coder (NPS), L. Whisnant (NPS), B. Tyma (Hopi). Back row: N. Rivers (NPS), R. Hoyestewa (Hopi), G. Naseyowma (Hopi), M. Clark (NPS), R. Talayumptewa (Hopi), J. Balsom (NPS), O. Siewumptewa (Hopi), S. Larralde (Reclamation), T. J. Ferguson (Hopi).

have attended at least three Paiute Consortium trips. Additionally, Hualapai cultural preservation staff members have attended at least 10 of the regularly scheduled RCMP archaeological monitoring trips.

Other trips that RCMP personnel have accompanied include one geomorphology trip with Hereford in 1994 and 12 total station mapping trips sponsored by Reclamation. Specialists accompany most of our monitoring trips, visiting specific sites to facilitate assessments and management recommendations. Some specialists who have participated in the regularly scheduled monitoring trips are Allen Gellis (USGS New Mexico, geomorphologist), Kate Thompson (SWCA geomorphologist), Andres Cheama and Gabriel Yuseluw (Zuni Conservation Project), Frank Hays (GRCA vegetation supervisor), Ruth Lambert (GCMRC archaeologist), Kim Crumbo (GRCA wilderness advisor), Mark Manone (Northern Arizona University geologist, specialist in Colorado River sediment storage), Linda Jalbert (GRCA recreational advisor), Mike Quinn (GRCA photographer), Bruce Lindsey (National Resources Conservation Services), John Rihs (GRCA hydrologist), Jim Garrison (Arizona State Historic Preservation Officer), Bob Gasser, Ann Howard, Kathy Johnson, Teresa Hoffman, and Carol Heathington (Arizona State Historic Preservation Office), Loretta Jackson, Monza Honga and numerous Hualapai archaeologists, Jennifer Burns (Coconino National Forest), Mary Barger (Western Area Power archaeologist), Lynn Neal (SWCA archaeology director, Flagstaff), Chris Brod (Reclamation surveyor), Wayne Prokopits and Signa Larralde (previous Reclamation regional archaeologists), Warren Hurley (Reclamation archaeologist), Tim Begay and Roger Henderson (Navajo Nation), Chris Downum (Northern Arizona University archaeologist and PI for this project), and Kurt Dongoski and Mike Yeatts (Hopi cultural representatives). All have contributed useful knowledge for the refinement of this monitoring and remedial action program. See Figure 3 for the trip participants at Palisades Delta in September 1995.

When space is available on a river trip we make an effort to include GRCA employees from the division of interpretation to discuss the archaeology along the corridor and the various aspects of preservation and data recovery associated with the various legal requirements related to the operations of Glen Canyon Dam. This information increases their knowledge for interpretive talks to people visiting the Canyon and promotes pubic awareness and participation regarding cultural resource management.

Miscellaneous Public Outreach

In August of 1999, RCMP personnel educated high school students at Coconino High School in Flagstaff about the RCMP and gave general information regarding the discipline of archaeology. In May, RCMP personnel talked with elementary children at the West Side Montessori School in Flagstaff about archaeological etiquette and the general study of archaeology. Also, a slide presentation about the monitoring program was given in March in Grand Canyon Village to GRCA employees and visitors.

In June of 1988 an informal presentation of our project was given to high school students at Coconino High School in Flagstaff.

NAU forestry students were educated in November of 1997 on identification and impact avoidance to cultural resources on the Colorado Plateau.

In 1996, the Paiute Consortium and Hualapai and RCMP personnel wrote two letters in the *Boatmen's Quarterly* concerning specific locations on the river and the preservation of these areas (Bulletts 1995; Jackson and Leap 1996).

RCMP staff housed a stabilization workshop in 1995 at Lees Ferry involving participants from the following organizations: Reclamation, GRCA, GLCA, Pacific Northwest Laboratory, Department of Agriculture National Sediment Lab, Havasupai Tribe, Hopi Tribe, Hualapai Nation, Navajo Nation, San Juan Southern Paiute Tribe, Southern Paiute Consortium, Pueblo of Zuni, USGS, AZSHPO, and GCES.

As a result of the workshop and the field work completed at Palisades, a videotape was created by GRCA and RCMP staff and disseminated to PA members and various federal agencies. The video is titled "Erosion Control Project at Palisades Delta, Grand Canyon National Park" (Quinn and Hubbard 1995). RCMP staff also trained the Hualapai Cultural Department on survey and monitoring techniques in Peach Springs, AZ.

Figure 3. Participants on the September, 1995 erosion control project at Palisades Delta. First row (left to right): G. Yuselew (Zuni), A. Chopito (Zuni), D. Hubbard (NAU), D. Sharlow (NPS), L. Jackson (Hualapai), J. Balsom (NPS). Second row: K. Crumbo (NPS), K. Burke (USGS), M. McCaslin (NPS), R. Nabahe (NN), L. Leap (NPS), N. Brian (NPS), C. Johnson (AZSHPO), C. Coder (NPS). Third row: R. Henderson (NN), K. Thompson (USGS), C. Downum (NAU), M. Yeatts (Hopi), L. Jalbert (NPS), S. Imus (Hualapai), R. Talayumptewa (Hopi), B. Jacobson (NPS), C. Mortley (NPS), J. Garrison (AZSHPO), T. Begay (NN), D. Seoutewa (Zuni).

Information Requests

Various tribes, private firms, and state and federal agencies have requested data from the RCMP office located in Flagstaff: Sandi LeFevre (NPS, Honolulu, HI), Dawn Frost (Western Archeological and Conservation Center), Deborah Petersen (Washington State Parks and Recreation Commission), personnel from Wupatki National Monument, Walnut Canyon and Dinosaur National Monument, Chalis National Forest, Hualapai (Haulapai Tribe Department of Cultural Resources), Lynn Neal, Lil Jonas, Gary O'Brian, Kate Thompson (SWCA, Flagstaff), Peter Bungart (Navajo Nation), and Andres Cheama (Pueblo of Zuni). These formal requests commonly evolve around the monitoring database. However, more recent requests are for the monitoring form, the photo log, and the Palisades Delta video (Quinn and Hubbard 1995).

Training

Another contribution of the RCMP has been training of students, tribal members, and others in cultural resource management. Since 1992, numerous graduate and undergraduate students at NAU have received field and laboratory training while working for NAU in the RCMP office. From the beginning, the project has employed a graduate assistant in the Department of Anthropology to assist with database management, photo curation and cataloguing, and other tasks directly associated with the project. On some occasions, this graduate assistant has also accompanied the RCMP staff into the Grand Canyon to assist with field data collection. The project has also employed a number of NAU undergraduate students, providing training in database management and photo curation.

Two of the graduate assistants employed on the project have used their project experiences as the basis for a Master's thesis or internship in archaeology. In 1995, Dana Kline drew on her project experiences to craft a summer internship with the Advisory Council on Historic Preservation and the Utah State Historic Preservation Office. This internship was the basis for her Master's internship paper in the Department of Anthropology (Kline 1995). In 1999, Jennifer Kunde wrote and successfully defended her Anthropology Master's thesis. This work (Kunde 1999b) details a protocol for resource monitoring and applies this protocol to cultual resources and the RCMP specifically. Kunde has since been employed by NPS as a member of the RCMP staff.

A third Master's thesis dealing with the RCMP is in progress. Duane Hubbard, a former undergraduate employee of the project and now a graduate student in Anthropology at NAU, has designed and researched a thesis on the roasting pits at sites monitored by the RCMP. Using data from the original NPS-NAU survey, as well as observations made at the sites during the monitoring program, Hubbard is proposing to classify and analyze the thermal features of sites in the Grand Canyon river corridor. Results of his research should assist in understanding the cultural affiliations, functions, and chronological positions of these sites. This should in turn contribute to an enhanced understanding of the significance of these sites with respect to current research issues.

The RCMP has also provided an opportunity for students to present the results of their research and cultural resource management efforts in a variety of regional and national meetings. In 1996, Duane Hubbard co-authored a paper on the photographic methods used by the project. This paper was presented at the 1996 Society for American Archaeology Meeting symposium (Hubbard 1996). Jennifer Kunde also co-authored a paper in the same symposium (Downum et al. 1996). Revised versions of these papers were later presented at the George Wright Society Meeting in Albuquerque, NM (Harmon 1997).

METHODOLOGICAL ADVANCES

Development of the Monitoring Form

The monitoring form has undergone changes over the last 8 years, and its refinement is not yet complete. Since the beginning of the monitoring project in 1992, the monitoring form, which is completed in the field, has undergone copious modifications. Rather than identifying the changes within this text, Appendix A contains all site forms from 1992 to 1999. (See individual annual reports for detail in the changes that occurred; Coder et al. 1995a; Leap et al. 1996, 1997, 1998.)

Some generalizations can be made when discussing the RCMP monitoring forms of the past 8 years. The trend has always been to create a form that lessens subjectivity; however, with so many different monitors, it has been important to reduce bias. The main subjectivity reduction attempt occurred from

FY93 to FY94. The form completed in FY92 and FY93 was not answering the questions asked by PA members. RCMP staff members from Glen Canyon National Recreation Area (GLCA) and GRCA restructured the entire form based on their field knowledge and experiences, and on the variables listed on the FY92–93 form. As a result, RCMP settled on a matrix containing all the physical and visitor-related impacts observed combined with all the feature types found within the APE.

This form was also fashioned to simplify the choice of site management methods. Maintaining existing NPS policies of preservation in place is a priority, but PA members pointed out that if only one or two features on a site are in poor condition, why disturb the other stable features? The ability to identify where the disturbances occur has allowed RCMP staff to promptly inform PA members where the impacts are present in a timely and accurate manner. It also allows for more appropriate and concentrated management decisions made in the field. With this alteration, the program subsequently changed from site-based management to feature-based management.

Since 1994 the monitoring forms have been fundamentally the same. However, as addressed in the SWCA synthesis draft report (Neal et al. 1998), the actual physical changes to the form were made inappropriately and this is reflected in the database. Minor changes are anticipated on the monitoring form in the future. With these additional amendments, RCMP will consult the suitable personnel to apply these changes, as suggested by SWCA in their draft synthesis report (Neal et al. 1998).

Refinement of Photography

Photographic documentation is very essential for this program. We use photographs—35 mm black and white, 8 mm videotape, color slides, and 5 x 7 medium-format color or black and white—to visually document observations on or near archaeological features. Photographs reduce subjectivity and are relied upon heavily in the office to supplement monitoring forms. Additionally, photo images are useful for people who are unable to go on a river trip. Clear and distinct photos are essential to illustrate the property types (and features) along the corridor, the impacts observed, and the preservation measures implemented—showing success or nonsuccess of the implementation. This visual information generally allows for a common understanding of what is occurring along the corridor between people who have personally visited the sites and people who have not.

All site images along the river corridor, some beginning as early as 1962, are entered into the computer. To date, there are more than 9,000 photo images on file; therefore, with this many fields, it is imperative to have a proficient and well thought out database. Last year all photo image information was updated into Microsoft Access for more effective and efficient data input. The previously used photo log was also expanded to supplement the new and improved database (see Appendix C) for the photographic log used by RCMP personnel in the field.

Beginning with the survey in 1990, a general decrease is evident in the number of photographs taken on each monitoring trip, except from FY95 to FY97. Prior to FY95 photo documentation was incomplete and many photos were insufficiently clear and detailed for use in the field. Therefore, from FY95 to FY97 the complete baseline photographic documentation for every site monitored was accomplished.

One obvious factor for the overall reduction in photographs taken on each trip is that the number of sites visited has declined. A second reason is that RCMP personnel only take photographs when change is observed in a feature's appearance, for whatever reason.

The photos generated by this project since 1992 meet or exceed the Interior Department's Standards for Architectural and Engineering Documentation. All black-and-white negatives, medium-format photographs, slides, and videotapes are housed in a fireproof cabinet and stored in archivally stable polypropylene sleeves. The RCMP staff continually discusses various photographic approaches with NAU special collections employees and personnel at the Museum of Northern Arizona. This interaction helps improve current archival and database practices and generally offers added knowledge on identifying what a good photo is after examining so many inadequate ones (due to poor lighting, angle, distance, the camera operator, etc.).

Stationary Cameras and Analysis Units

Beginning in FY92, the RCMP staff experimented with two methods of data collection thought to aid in understanding the mechanisms of change and quantifying change: surface analysis units and stationary cameras. FY92 marked the placement of five stationary cameras at sites C:13:371, C:13:003, C:13:359, B:10:229, and A:16:180 along the river corridor. These five cameras remained in use through FY93. In FY94, one camera was moved to a new location at C:13:006 and two cameras were removed. Three sites continued to be documented daily with color photographs through FY96. After FY96, the RCMP staff recommended termination of the stationary camera program. In the 5 years when the cameras were in use, only stochastic change was identified in one location as a result of a side canyon flood depositing large amounts of sand at C:13:003 (Coder et al. 1995b). No changes were noted to cultural features; only changes in beaches and sandbars were documented through the use of stationary cameras. The film is stored in the Geography Department at Northern Arizona University.

In September 1993, several PA representatives who were accompanying RCMP monitors on a river trip suggested tracking artifact movement in locations where impacts were high. In FY94, ten 1 x 1 m units were placed at nine sites: C:09:051, C:09:052, C:13:070, C:13:006, C:13:100, C:13:101, C:13:272, C:13:321, and C:13:385 (Coder et al. 1995a). The surface analysis units were visited two times by RCMP staff, and in FY95 more precise methods were recommended (Coder et al. 1995b). The analysis units did not enable monitors to identify processes working to transform the modern ground surface and did not give further insight beyond what was already recorded on monitoring forms. The surface analysis units were terminated in FY96 (Leap et al. 1996).

Global Positioning System

The Global Positioning System (GPS) uses satellite observations for very accurate locational information. GPS is funded by and controlled by the U.S. Department of Defense. Although there are many thousands of civilian users of GPS worldwide, the system was designed for and is operated by the U.S. military. GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity, and time. Archaeologists can use GPS units to plot accurate site dimensions and feature locations. Archaeologists also use GPS for outlining survey transects and plotting UTM coordinates on topographic maps or orthophotographs.

Surveyors and GIS specialists have used GPS minimally in conjunction with RCMP projects over the last 5 years. Researchers used GPS to test the accuracy of UTM coordinates recorded by archaeologists on the 1990–91 river corridor survey (Fairley et al. 1994). Comparisons between GRCA (50 sites) and Hopi Tribe GPS data, GCMRC total station mapping data, and 1990–91 manually calculated UTM coordinates displayed varying results (Neal et al. 1998:101). The estimated error for GPS UTM data in the Canyon was calculated as ± 2 m; the estimated error for manually recorded UTM data was calculated as ± 15 m. Appendix D is a list of RCMP sites with GPS data.

Various researchers using the GPS system in the river corridor have had difficulty obtaining sufficient satellite time to receive accurate locational data; civilian access to satellites is limited to certain times of day. However, with future advancements in technology, such problems will probably be mitigated in the future.

Total Station Mapping

Site mapping using a total station instrument provides a high-resolution record of the condition of a historic property before and after mitigation, and it tracks the success of remedial work. It can also quantify change. A total station instrument map is generated when excavation occurs or when remedial work alters the appearance of a site (i.e., building checkdams). On average, 10 to 15 sites were mapped annually starting in 1996. To date, 68 archaeological sites have been mapped with a total station (Leap et al. 1996, 1997, 1998). Total station mapping and remapping was recommended by NPS and Reclamation program managers and is included in the Monitoring and Remedial Action Plan (USDI 1997a).

A total station instrument generates topographic maps with archaeological features. Land surveyors, not archaeologists, create them because they are commonly used by RCMP staff as topographic maps. Terrain is displayed at .25 m contour intervals with a 12.5 cm margin of error, and a design jet plotter prints them.

To quantify volumetric change on a site, repeat mapping of drainage areas is conducted to make a time 1 vs. time 2 comparison. Only the drainage areas are remapped and measurements are taken of the amount of fill or cut that occurred since time 1. Repeat mapping quantifies sediment movement, erosion, and deposition within the drainage systems. These maps also demonstrate the effectiveness of erosion control projects.

Preliminary results of repeat mapping are seen in Figure 4. Overall, two sites lost sediment and nine sites gained sediment. This outcome is somewhat surprising because the monitoring forms for several of these sites rarely depict net deposition, only some type of geomorphic activity. These results offer a suggestion that repeat mapping can generate important quantitative information to supplement the regular monitoring efforts. Furthermore, this type of mapping can assist in the geomorphic work completed.

RCMP personnel think that the total station mapping has been a very valuable technique that can demonstrate volumetric change in sediments at a site over time. The Hopi Tribe strongly supports the continuation of this aspect of the monitoring program Neal (Neal et al. 1998) and Thompson (Thompson et al. 1998) both recommend detailed mapping. However, despite continued recommendations for this technique, this program has been terminated because total station mapping is costly. There are other methods, however, for quantifying change that RCMP is considering, such as aerial photogrammetry and advanced repeat photography. Less technical methods are repeat photography using a tripod and gathering detailed comparative measurements (cross-sections) on various drainage systems. Chapter 11 discusses these applications in more detail.

Control Sites

The August 1994 revised final version of the Monitoring and Remedial Action Plan (USDI 1997a) recommended that a 10 percent sample of the sites outside the APE be monitored annually as a control group to compare with impacted sites. After the FY96 field season, because control group sites are not receiving active impacts, annual monitoring was found to be redundant. Beginning in FY97, control group sites were placed on a 3-year monitoring schedule, with all control group sites scheduled to be monitored in FY2000. PA representatives on the April 1999 river trip discussed the utility of the river corridor control group sample. It was determined at that time that sites out of the APE were not close enough in physical characteristics (namely not located on pre-dam alluvium) to provide any valuable information on impacts to river corridor sites. The control group sites originally chosen for monitoring were C:09:080, C:13:367, C:13:274, B:15:132, B:15:121, B:15:126, B:15:143, B:10:236, B:10:121, B:10:230, A:16:156, A:15:017, and G:03:019. Monitoring these control group sites has ceased, although the Hopi Tribe "strongly supports the continuation of this aspect of the monitoring program and feels that the Bureau of Reclamation is remiss in their unwillingness to support this monitoring activity" (letter of 14 October 1999 from Leigh J. Kuwanwisiwma, director of the Hopi Cultural Preservation Office, to Jan Balsom, Grand Canyon National Park).

Ground Penetrating Radar

Most recently, RCMP staff members have intensely investigated the use of ground-penetrating radar (GPR). Since the late 1960s this nonintrusive technique has been applied to civil engineering, geophysical, geological, and archaeological problems involving subsurface phenomena. The unit uses low frequencies to penetrate the ground, achieves high resolution in both depth and cross-range to discriminate an objective, and efficiently couples radar signals into the ground. Clay soils and moisture-laden soils, however, continue to be problematic except when work efforts are concentrated in very shallow depths.

The benefits of using a GPR unit in the Canyon are many. Several of the alluvial terraces where historic remains exist are fragile dune areas. It has been proven that numerous archaeological deposits are positioned at least a meter below the surface. Instead of placing a shovel through the soil, increasing the possibility of destabilizing cultural remains, it is more efficient and environmentally correct to use a GPR unit to minimize surface and subsurface disturbance. Additionally, this instrument can cover much more ground in less time. The data gathered generates a map providing information on buried remains, and it facilitates a more detailed and relevant preservation or excavation proposal.

Jim Doolittle, research soil scientist from the Natural Resources Conservation Service, will probably facilitate GPR on one of the monitoring trips in FY2000. A list of sites selected for data recovery and preservation will be prepared, and the GPR unit will be used at these sites to identify site magnitude and to facilitate more accurate cost and time projections for site management implementations. This will be sponsored by GRCA.

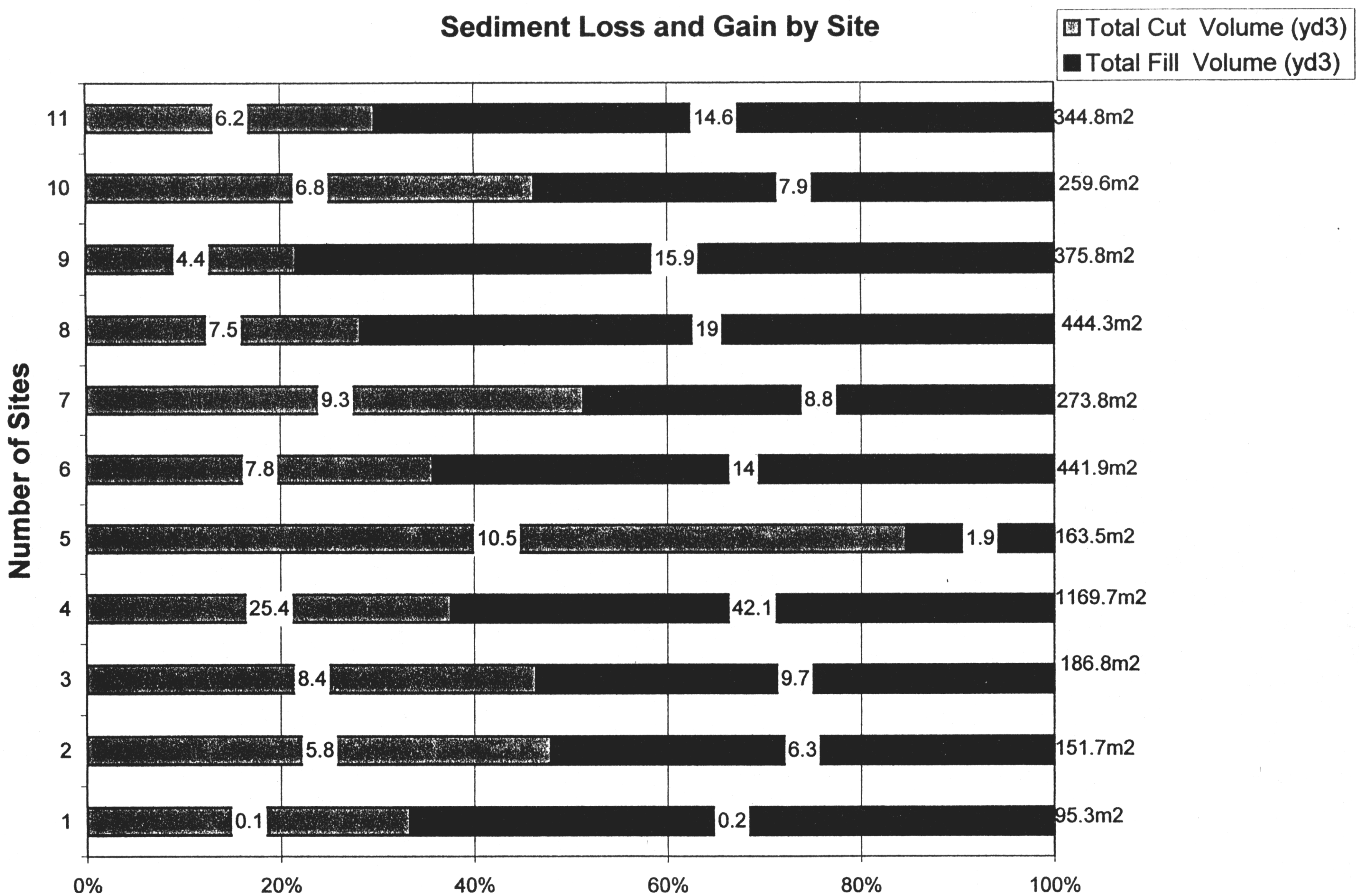


Figure 4. Preliminary results of the repeat-mapping efforts illustrating the amount of sediment either deposited or eroded away since the initial mapping of the site.

REMEDIATION

Checkdams

The mitigation efforts of checkdam construction began in 1995 (Leap and Coder 1995). Prior to the actual field work, PA members were involved in 3 years of discussion, several visits to active sites along the river (Palisades Delta in particular), and a stabilization workshop held at Marble Canyon Lodge, Arizona. This 4-day workshop was sponsored by Reclamation and involved participation from experts such as Paul Nickens (Pacific Northwest Laboratory), Richard Hereford (USGS, Flagstaff), Allen Gellis (USGS, New Mexico), Andres Cheama (Zuni Conservation Project), and Doug Shields (Department of Agriculture National Sediment Lab). Following the workshop, a trip was taken for checkdam installation at Palisades Delta, the most active area identified by monitors and containing abundant cultural deposits. If this area could be maintained by checkdams, then most of the sites within the APE with active drainages could probably be preserved. Additionally, if successful, checkdam building is much less costly than excavation.

Seventy checkdams were therefore built at Palisades. Twenty-eight people were involved in this project, representing NPS, NAU, USFS, USGS, Pueblo of Zuni, Hopi Tribe, Hualapai Nation, Navajo Nation, and the Arizona SHPO (Leap and Coder 1995). Zuni members Gabriel Yuseluw, Albert Chopito and Danny Seoutewa supervised the field work at Palisades.

Since 1995, 29 sites contain a total of 282 individual checkdams. Zuni representatives and the RCMP staff monitor all checkdams annually. Monitoring increases our knowledge of which construction styles work and which do not. Fifty percent (142) of the installed checkdams have received some form of maintenance. Figure 5 is a bar graph depicting the percentage of checkdams with maintenance based on the type of drainages the checkdams were placed into.

Several of the repairs entail removing rocks and logs from the center of the checkdams and placing them up on the side walls of the drainage. Other repairs include adding more gravel to the checkdams and lining the drainage rather than building a high check as initially constructed. (Currently, most checkdams have a depth of 10 cm or less.) A final change in checkdam construction is filling in channel nick points with gravel. All these minor, yet necessary changes have proven to be advantageous in collecting sediment, thus slowing erosion of archaeological sites and features. Figures 6 and 7 show changes in checkdam construction.

RCMP staff and Zuni tribal representatives continue to increase their understanding of the drainage systems within the corridor by consulting, or doing river trips with people knowledgeable on this topic, such as Kate Thompson, Richard Hereford (USGS), Tom Moody (NAU Forestry Department), and Stephanie Yard (National Resources Conservation Services). All are familiar with the drainage systems in the Canyon and have experience in building checkdams. They offer more detailed data on attributes that need to be considered prior to constructing checkdams. These attributes consist of gradient, vegetation, and catchment system, to name just a few. This information is crucial when deciding what checkdam types to build, where checkdam construction would be most successful, or whether to build them at all. Mapping these areas with a total station instrument before and after checkdam installation quantifies changes in sediment load. Thus, mapping also identifies the success of checkdams. To date, six sites with checkdams have been mapped to distinguish sediment change.

Planting Vegetation and Trail Work

Since the beginning of the monitoring project, all vegetation and trail work projects conducted within the APE have been a shared duty between RCMP staff and GRCA revegetation and trail crews. With the addition of a permanent GRCA staff, this program has become more formal in recent years. RCMP staff members are working directly with Frank Hays (GRCA vegetation supervisor) and his crew. Recently, Hays or another vegetation person has accompanied RCMP monitoring trips to offer vegetation assessments on sites and to collect native plants and grasses from the river corridor. It is very important that river vegetation is used for the corridor. Using vegetation from the rim or even side canyons may encourage nonnative species growth along the corridor. When the river seeds are thoroughly propagated at the Park they are dispersed on the sites recommended for planting vegetation to promote stabilization. Hays and Cheama (Zuni Conservation Project) have completed river trips together and have discussed joint projects, involving fewer checkdams and planting more vegetation to increase site stability.

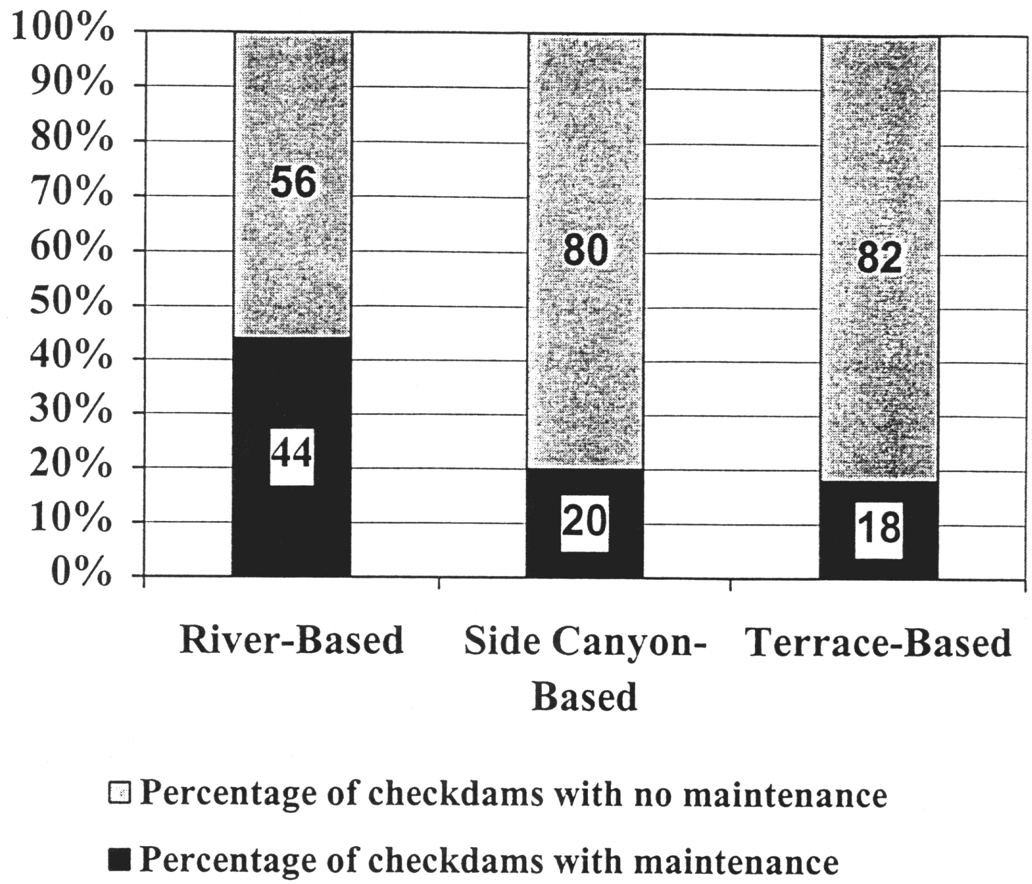


Figure 5. Percentage of checkdam maintenance on sites categorized by drainage type.

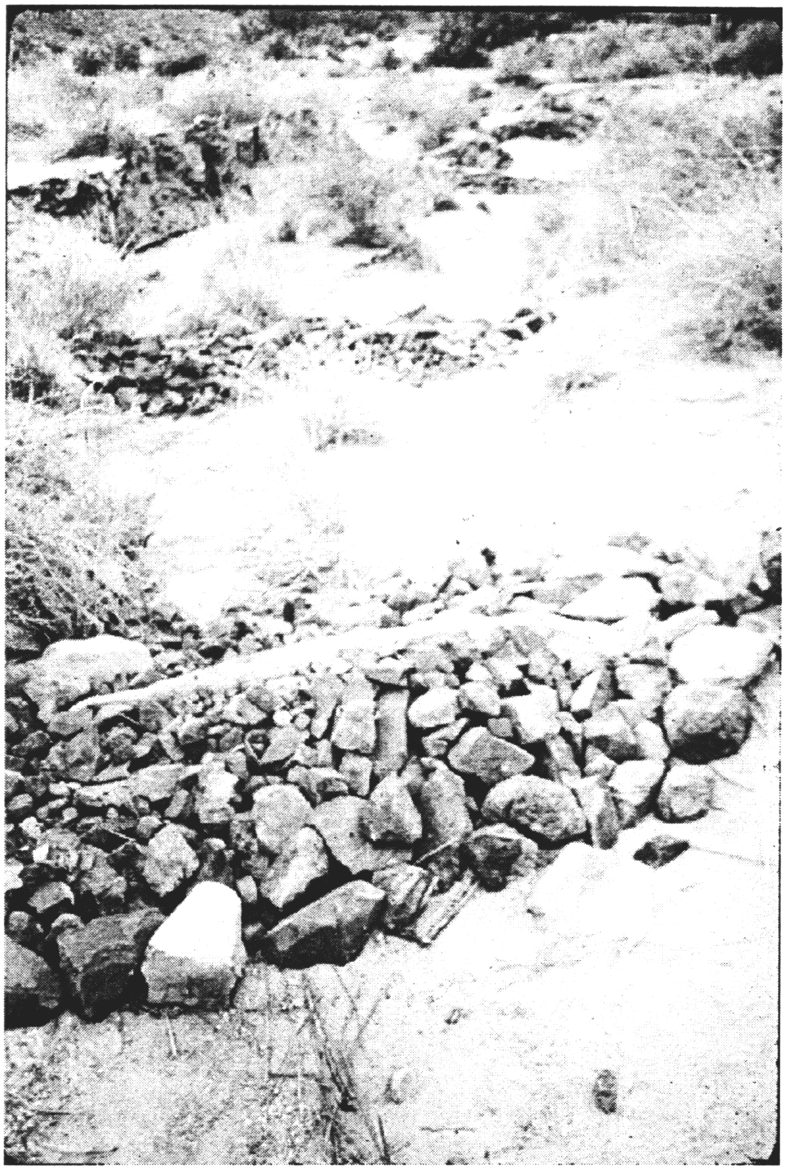


Figure 6. A very common style of checkdam constructed at Palisades Delta in September 1995.

Figure 7. Photograph illustrating the type of checkdam used most commonly since FY96. The Zuni have gone from the traditional "rock check" to rock and gravel linings as seen here at 60 Mile Canyon.

Trail work has been conducted at 43 archaeological sites along the river corridor. In earlier years Kim Crumbo (GRCA wilderness coordinator) supervised several of these projects with a crew of boatmen and volunteers. Trail work involved placing large boulders along the trails to better define them and using deadfall and rocks to block unwanted trails. Hays has adopted this project also. However, he wants to promote the technique of planting vegetation rather than using deadfall and large rocks to deter visitors. He believes that planting vegetation will provide a more permanent solution to deter people from walking over archaeological sites (personal communication, Hays 1999). Through monitoring efforts the RCMP staff has learned that placing large rocks and deadfall on trails to disguise them can cause more harm than good, because water runs around the large obstacles and causes gullies.

SUMMARY AND CONCLUSIONS

The history of the RCMP reveals a steady refinement in our knowledge of how the operation of Glen Canyon Dam may be impacting cultural resources in Grand Canyon National Park, and how best to mitigate those impacts. In providing this knowledge, the RCMP has been central to fulfilling numerous legal responsibilities of GRCA and Reclamation regarding dam operations and preservation of cultural resources in Grand Canyon National Park. The project has been unique in its scope and complexity, and there can be little doubt that it has been a pioneering effort with little precedent to assist in its development.

Nearly a decade after it was first conceived, the RCMP has fulfilled virtually all of its assigned responsibilities outlined in the PA, MRAP, and draft HPP, and has initiated a program of remediation at a limited number of sites. Much work remains to be done to further refine the project's methods and database, and its program of remedial efforts needs to be expanded to include more vigorous attempts to control erosion and recover scientific data from the sites most severely impacted by Glen Canyon Dam. Overall, the RCMP has done what it was designed to do, to develop the methods and collect the information necessary for evaluating and mitigating the effects of Glen Canyon Dam on cultural resources in Grand Canyon National Park.

With preservation in place being the main goal of both the Adaptive Management Plan and the PA, excavation of archaeological sites is at a minimum. This program has not promoted the typical, traditional archaeology; rather, it supports conservation archaeology (Kunde 1999a; Lipe 1974, 1977, 1984; McGimsey and Davis 1977; Moore 1994; Schiffer and Gummerman 1977; see also the revised NHPA 106 regulations 1999). This has been the intent of the entire monitoring program thus far.

Several specialists representing multiple profession have volunteered their expertise to improve the monitoring program. Personnel from various tribes, NAU, the U.S. National Forest Service, the USGS, the Bureau of Reclamation, private contractors, GCES, and GCMRC have worked with RCMP in the field and lab. Students from the university have also enhanced the ideas, methods, and concepts of this program. They shared their knowledge and personal experience in managing archaeological sites, preservation treatments, geological aspects, and research methods. These methods and concepts have all been interwoven to create an archaeological monitoring program grounded in identifying and observing processes affecting cultural resources and appropriate treatment methods for preservation in place.

RCMP monitoring data, including the survey information, have been collected for more than 10 years. The data set has even more time depth for other sites that were included in the regular Park-based monitoring program prior to 1990. Since the beginning of the RCMP, this has been an evolving program because there was (is) no other program like it. According to Kunde (1999a), efforts at monitoring cultural resources are primarily limited to short-term programs, and previous monitoring programs for federal agency resource management have no guidelines for implementing monitoring protocols. Examples of these types of monitoring projects have been published by Des Jean (1991), Des Jean and Wilson (1991), Gale (1985), and Goldsmith (1991). No programs have yet moved beyond the information stage to develop a trigger mechanism for implementing management actions. Several programs have also gathered data for resource management in terms of human impact only. Additionally, their short-term nature did not lead to the identification of trends through time, or the formulation of predictive models (Kunde 1999a).

Part II of this report gives the results of the RCMP for the past 8 years. It provides an analysis of the data collected and summarizes monitoring trends and observations, the effectiveness of site management treatments, and individual site histories. It is anticipated that the data summaries will direct the current RCMP toward continued efficient and effective monitoring and remedial actions of archaeological sites along the Colorado River corridor.

CHAPTER 2. LEGAL BACKGROUND FOR THE RCMP

Christian E. Downum, Jennifer L. Kunde,
Lisa M. Leap, and Janet R. Balsom

The RCMP operates within a complex network of legal requirements and guidelines. It assists NPS and Reclamation in achieving their responsibilities under federal law regarding the operation of Glen Canyon Dam. To summarize the project's legal frameworks and constraints, we review some of the most important laws, regulations, executive orders, and policies that guide the RCMP.

NATIONAL ENVIRONMENTAL POLICY ACT

One of the most comprehensive federal laws concerning the protection of the environment is the National Environmental Policy Act of 1969, as amended (NEPA; P.L. 91-190, 42 U.S.C. 4321-4347). This legislation and its implementing regulations (40 CFR 1500-1508) are the foundation of federal protection of the environment. NEPA is sweeping in its intent. The law is designed to "encourage productive and enjoyable harmony between man and his environment," and "to promote efforts which will prevent or eliminate damage to the environment and biosphere" (Sec. 2; 42 U.S.C. § 4321). To achieve these objectives, NEPA created the Council on Environmental Quality, which is responsible for enacting the federal government's environmental policies (Sec. 201-209; 42 U.S.C. § 4341-4347). It mandated a process for reviewing the environmental impacts of "proposals for legislation and other major federal actions significantly affecting the quality of the human environment" (Sec. 102; 42 U.S.C. 4332). Under NEPA, the environment is broadly defined as including "important historic, cultural, and natural aspects of our national heritage" (Sec. 101[b][4]; 42 U.S.C. 4331). Therefore, under NEPA, cultural resources such as those found in the Grand Canyon river corridor are considered part of the environment, worthy of consideration and protection through the NEPA process.

NEPA mandates that when the federal government plans an action that might harm the environment, "a detailed statement by the responsible official on the environmental impact of the proposed action" must be prepared (Sec. 102; 42 U.S.C. 4332). Such a detailed statement is referred to as an Environmental Impact Statement (EIS), which is required of federal agencies before they may proceed with major actions that might result in environmental damage or degradation. An EIS is considered to be "an action-forcing device" that insures compliance with the provisions of NEPA (40 CFR 1502.1). Among other things, an EIS describes the affected environment, reviews significant environmental consequences of the proposed federal action, documents and addresses public concerns, presents a set of alternative actions, and documents the potential consequences of each alternative (40 CRF 1502.10). Penalties for noncompliance with NEPA can be stiff, and court actions brought under NEPA can (and have) delayed, curtailed, or resulted in the cancellation of many federal projects.

As discussed briefly in Chapter 1, although the Glen Canyon Dam was constructed well prior to the passage of NEPA, the environmental impacts of the dam have been reviewed in a post-hoc application of the NEPA process. The process was initiated on July 27, 1989, when Interior Secretary Manuel Lujan directed Reclamation to prepare an EIS on the impacts of the operation of Glen Canyon Dam. The purpose of this EIS was to consider, in the context of a proposed increase in power generation from the dam, the environmental consequences of the cumulative and ongoing operation of the dam on the natural and environmental resources of Glen Canyon National Recreation Area and Grand Canyon National Park. Lujan's order was given statutory authority in 1992, when the Grand Canyon Protection Act (P.L. 102-575, Sec. 1804a) mandated that "not later than 2 years after the date of enactment of this Act, the Secretary [of the Interior] shall complete a final Glen Canyon Dam environmental impact statement, in accordance with the National Environmental Policy Act of 1969."

FINAL EIS AND RECORD OF DECISION

The EIS for the operation of Glen Canyon Dam was prepared after a lengthy process involving "an unprecedented amount of scientific research, public involvement, and stakeholder cooperation" (USDI

1995). These studies included the original NPS-NAU archaeological survey and subsequent monitoring of cultural resources. The final EIS for the operation of Glen Canyon Dam (USDI 1995) was completed and filed with the Environmental Protection Agency on March 25, 1995. This EIS presented nine alternatives for the operation of Glen Canyon Dam, including a "no action" alternative that would have maintained operation of the dam under its historical operating regime. The nine alternatives were grouped into three major options: (1) unrestricted fluctuating flows (the no action alternative); (2) restricted fluctuating flows, subdivided into high, moderate, modified low, and interim low; and (3) steady flows, subdivided into existing monthly volume, seasonally adjusted, and year-round. These alternatives were based on variables such as the minimum and maximum amount of water released (in cubic feet per second [cfs]), allowable daily flow fluctuations (rate of change in cfs per 24-hour period), and "ramp" rates (rate of change in cfs per hour).

As called for in the regulations for NEPA (40 CFR 1505.2), in 1996, Interior Secretary Bruce Babbitt signed a Record of Decision (ROD) declaring the course of action that would be taken as a result of the studies and comments presented in the EIS (USDI 1995). A Record of Decision is a public document that (1) states which alternative has been chosen by the agency, (2) identifies all alternatives considered by the agency and discusses the considerations used in making a final choice among them, and (3) states "whether all practicable means to avoid or minimize environmental harm from the alternative have been adopted, and if not, why they were not" (40 CFR 1505.2[c]). A final aspect of the ROD regulations, highly relevant to the RCMP, is that "a monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation" (40 CFR 1505.2[c]).

In the 1996 ROD, the chosen alternative was that of modified low-fluctuating flow, with a minor change made in the timing of water releases designed to build beaches and habitat areas. This alternative was chosen "because it will reduce daily flow fluctuations ... and will provide high steady releases of short duration which will protect or enhance downstream resources while allowing limited flexibility for power operations" (USDI 1996). This flow regime was considered the optimum course of action to achieve "recovery and long-term sustainability of downstream resources while limiting hydropower capability and flexibility only to the extent necessary to achieve recovery and long-term sustainability."

The EIS (USDI 1995) and the ROD (USDI 1996) acknowledge that Glen Canyon Dam has had and continues to have a variety of environmental impacts that include both direct and indirect impacts, and daily and cumulative effects. Existence of the dam is taken as a given, in that none of the alternatives included dismantling the dam and restoring the Colorado River to its pre-dam conditions. The cumulative impacts of the dam are primarily related to a reduction in the amount of downstream sediment transported and redeposited by the Colorado River. NEPA regulations (40 CFR 1508.7) define cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." As the ROD states, "nearly all downstream resources are dependent to some extent on the sediment resource," and the chosen alternative "meets the critical requirements of the sediment resource by restoring some of the pre-dam variability through floods" (USDI 1996). Negative impacts from ongoing operation of the dam are widely acknowledged throughout the EIS and the ROD. These impacts include habitat changes brought by a lowered base level of the river, curtailment of seasonal floods, erosion of beaches and sandbars, lowered water temperature of the river, and a host of other effects.

The 1996 ROD specifically calls for protection and monitoring of cultural resources in Glen Canyon and Grand Canyon. The Adaptive Management Program (AMP) is one of the programs resulting from the ROD. (Preservation is an AMP management goal that is reinforced through the current PA and MRAP.) Cultural resources are highlighted in the Secretary's "Basis for Decision," where it is stated that the decision process followed in choosing the preferred alternative included rejection of alternatives with "unacceptable adverse effects on resources," such as "long-term loss of sandbars leading to the destruction of cultural resource sites." The environmental commitments to be adopted under the chosen alternative include a program designed specifically for cultural resources. Section VI, Part 2 states that cultural sites in Glen and Grand Canyons include prehistoric and historic sites and Native American traditional use and sacred sites. Some of these sites may erode in the future under any EIS alternative, including the no action alternative. Reclamation and the National Park Service, in consultation with Native American Tribes, will develop and implement a long-term monitoring program for these sites. Any necessary mitigation will be carried out according to a programmatic agreement written in compliance with the National Historic Preservation Act.

GRAND CANYON PROTECTION ACT

As noted, the EIS and its associated ROD were an outcome of an initial order in 1989 by Interior Secretary Lujan, which later was given statutory authority by the passage of the Grand Canyon Protection Act of 1992 (GCPA). The GCPA represents an important turning point in the history of Glen Canyon Dam. Prior to the GCPA, operation of the dam was designed to fulfill various laws, judicial decisions, treaties, and compacts associated with water allocation and power generation—the "Law of the River." The GCPA ordered that dam operations be conducted to achieve a balance between fulfilling legal obligations and protecting downstream resources. The GCPA did not necessarily provide a new legal framework for accomplishing this objective. Instead, it mandated that this balance be sought within existing legal frameworks, including federal laws such as NEPA and the National Historic Preservation Act.

The GCPA accomplished a number of objectives regarding cultural resources. As noted, it authorized the GCDEIS and its ROD, which ordered a long-term monitoring program and the development of a Programmatic Agreement concerning dam operation and its effects on cultural resources. The Programmatic Agreement, which was completed prior to issuance of the ROD, was included as an attachment to the GCDEIS. With respect to long-term monitoring, the GCPA states that

> long-term monitoring of Glen Canyon Dam shall include any necessary research and studies to determine the effect of the Secretary's actions under section 1804(c) on the natural, recreational, and cultural resources of Grand Canyon National Park and Glen Canyon National Recreation Area.

The GCPA goes on to note that these monitoring programs shall be conducted as a cooperative process, not unilaterally by a single agency or authority. Specifically, the Act calls for its monitoring programs to be

> established and implemented in consultation with (1) the Secretary of Energy; (2) the governors of the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming; (3) Indian tribes; and (4) the general public, including representatives of academic and scientific communities, environmental organizations, the recreation industry, and contractors for the purchase of federal power produced at Glen Canyon Dam.

Clearly, this provision of the GCPA establishes that its implementation with respect to cultural resource monitoring is intended as a collaborative venture, with representation of multiple stakeholders.

An additional and especially important provision of the GCPA is a subsection (Sec. 1802[c], the Rule of Construction) indicating that the GCPA does not alter "the purposes for which the Grand Canyon National Park or the Glen Canyon National Recreation Area were established," nor does it change "the authority and responsibility of the Secretary with respect to the management and administration" of these two NPS units. Thus, fulfilling the GCPA is to be undertaken in accordance with NPS responsibilities and policies related to maintaining the values for which the units were created. As noted in Chapter 1, this language seems plainly to indicate that monitoring, mitigation, and other programs dealing with cultural resources are to be conducted according to NPS policies designed to protect and preserve the resources of Grand Canyon National Park.

NATIONAL HISTORIC PRESERVATION ACT

A vitally important piece of federal law that crosscuts and in many ways structures the RCMP is the National Historic Preservation Act (NHPA), originally passed in 1966 (P.L. 89-665), and subsequently amended, most recently in 1992 (P.L. 102-575). NHPA is probably the most important single piece of legislation that guides national goals, policies, and procedures for the protection of cultural resources. NHPA was passed in response to growing concerns in the mid-1960s that America's cultural heritage was being destroyed or degraded at an alarming rate. Among its many provisions, NHPA created a system of State Historic Preservation Offices (Sec. 101[b]), greatly expanded the National Register of Historic Places (Sec. 101[a]), and set up procedures for reviewing how the actions of federal agencies might adversely affect historic properties (Sec. 106). NHPA also spells out the obligations of federal agencies to inventory and preserve their historic properties (Sec. 110), and it creates incentives for historic preservation in the form of grants, loans, and tax breaks (Sec. 101[e], 102-104, 112). Over the years, various amendments to NHPA (e.g., P.L. 102-575) have added a greater role for Native Americans and Native Hawaiians in its preservation efforts. Of particular importance are a set of 1992 amendments that, among other things, authorized tribal organizations to assume the functions of a State Historic Preservation Office (Sec. 101[d][2-6], authorized National Register eligibility for "properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization" (Sec. 101[d][6][A]), mandated that federal agencies consult with Indian tribes or Native Hawaiian organizations when the agency's undertaking might affect properties having "religious or cultural significance" (Sec. 101[d][6][B], and dedicated one seat of the Advisory Council on Historic Preservation to a member of an Indian tribe or Native Hawaiian organization (Sec. 201[a]).

A crucial provision of NHPA is Section 106, which requires that all federal agencies consider the impacts of their actions on cultural resources. In its entirety, Section 106 states that

> the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, 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. The head of any such federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking.

Section 106 thus establishes a consultation process by which federal agencies shall make an inventory of the historic properties potentially affected by their actions, determine whether these properties are listed in or eligible for the National Register, assess potential adverse effects, and consult with the appropriate authorities regarding the best course of action for preserving the properties. Under Section 106, no particular outcome is mandated as a result of this consultation process. Instead, Section 106 requires a collaborative process of consultation, so that federal agencies have a responsibility to subject their actions, and any proposed mitigation measures, to review by the State Historic Preservation Office, Tribal Historic Preservation Offices, and the Advisory Council on Historic Preservation.

The relationship between Section 106 and NEPA is, in principle, a simple one. According to current Section 106 regulations (36 CFR 800.8), "Federal agencies are encouraged to coordinate compliance with Section 106 and the procedures in this part with any steps taken to meet the requirements of the National Environmental Policy Act." The regulations go on to state that fulfillment of Section 106 responsibilities should be done as early as possible in the NEPA process, and that sufficient time should be allotted to allow for public participation, analysis, and review so that the requirements of both NEPA and Section 106 can be met. An agency official can use the EIS process of documentation and public involvement in lieu of Section 106, provided that the official has notified the SHPO and the Advisory Council in advance that this is intended (36 CFR 800.8[3][c]).

Although Section 106 is by far the most important single mandate in NHPA, with respect to the RCMP, other sections are important as well. Section 110, for example, requires that "the heads of all federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency." In the context of the RCMP, this section thus directs agency officials of GRCA to comply with the specific provisions of Section 110, which detail agency responsibilities to identify, evaluate, and nominate historic properties to the National Register; conduct preservation activities in consultation with other government agencies and Indian tribes; and conduct compliance activities under Section 106 according to Section 106 implementing regulations as well as provisions of the Native American Grave Protection and Repatriation Act (25 USC 3002[c]). The mandates of Section 110 clearly have implications for NPS management of archaeological sites and other cultural sites in

Grand Canyon National Park, as well as compliance by Reclamation with Section 106 within GRCA. The potential complications presented by this situation should be obvious, given that the RCMP is assisting compliance by one agency (Reclamation) with Section 106, while attempting to fulfill the responsibilities of a second agency (NPS) with respect to Section 110.

Section 101 of NHPA is also vitally important to the RCMP, as it details the requirements for federal agencies to take into account the concerns of Native American tribes regarding historic properties. Section 101 legitimizes the concept of a special category of historic property, the "Traditional Cultural Property" (TCP), originally defined in National Register Bulletin 38, by asserting that such properties may indeed be included on the National Register. Section 101 also mandates consultation with Indian tribes regarding properties that have been accorded "religious and cultural significance." The Grand Canyon and its archaeological sites are places of deep religious and cultural importance to a number of Indian tribes and nations in the region, so the provisions of Section 101 unquestionably apply to the activities of the RCMP.

The RCMP and Compliance with Section 106

As noted above, Section 106 is a process used by a federal agency to review the potential adverse effects that its actions ("undertakings") may have on historic properties. This process includes the identification of historic properties, an evaluation of their potential eligibility for the National Register, an assessment of possible effects of the proposed action, and consultation with appropriate parties regarding proposed efforts to avoid or mitigate adverse effects. In the case of the RCMP, the federal agency seeking compliance is Reclamation, and the undertaking is the operation of Glen Canyon Dam. For the RCMP, much of the Section 106 process occurred during the initial GRCA-NAU archaeological survey of the river corridor, when an attempt was made to identify historic properties, evaluate their potential eligibility for the Register, assess the potential effects of the operation of Glen Canyon Dam, consult with the Arizona SHPO, propose a variety of mitigation measures, and develop a PA with consulting parties.

An important element in compliance with Section 106 is the creation of various forms of agreement documents to provide evidence of a federal agency's fulfillment of its Section 106 responsibilities (ACHP 1989:7). Agreement documents may take a variety of forms, but they generally fall into three categories: a finding of No Adverse Effect, a Memorandum of Agreement, and (3) a Programmatic Agreement. Procedures for completing agreement documents are spelled out in the regulations for Section 106 found at 36 CFR Part 800. For a variety of reasons, including a directive included in the ROD (Section VI[2]), Reclamation compliance with Section 106 is recorded in the form of a Programmatic Agreement (PA) completed in 1994 (USDI et al. 1994).

There are many issues involved in Section 106 compliance and the contribution of the RCMP to that effort. The discussion below focuses on some of the key issues involved in most Section 106 compliance actions, as detailed in the regulations for Section 106 (36 CFR 800.3-7). This discussion evaluates the contribution of the RCMP to Reclamation compliance.

Identification of Historic Properties

Most of the identification phase of compliance was completed during the GRCA-NAU archaeological survey of 1990–91. This survey and its associated report (Fairley et al. 1994), conducted according to the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (USDI 1983), recorded the location, contents, extent, and condition of 475 archaeological sites in the river corridor, as well as 489 isolated occurrences of artifacts and features. This survey was intense and thorough, recording a large volume of high-quality information. The methods and results of the survey, the scope of its identification efforts, its level of effort, and other aspects were reviewed and approved by the AZSHPO, officials of NPS, Reclamation archaeologists, participating tribes, and professional peers. Survey results were published in 1994 (Fairley et al. 1994), and the data it produced formed the nucleus of consideration of cultural resources in the EIS (USDI 1995). Two additional sites have been located in the river corridor since the initial survey, and these have been incorporated into the RCMP and its Section 106 compliance activities.

Evaluation of Significance

As part of the initial survey, individual sites were evaluated for potential eligibility for inclusion in the National Register of Historic Places. During the survey, 336 sites were considered to be within the area of direct, indirect, or potential impacts from operation of the dam. The Arizona SHPO evaluated these sites for National Register eligibility, concluding on the basis of survey information that 313 were eligible, 14 were not, and 9 could not be evaluated without testing (Lerner 1991a). Later, the nine sites were evaluated, with four of them determined to be potentially eligible for the Register after testing (Leap 1994c). Seven additional Register-eligible sites were later added to the list of sites potentially affected by dam operations. These eligibility determinations, along with evaluation of significance of sites subsequently discovered, form the basis for compliance actions to date. (Note that RCMP staff members are concerned only with 264 of these sites.) As discussed in Chapter 3, National Register eligibility determinations can be upgraded and refined based on current data from the RCMP. These same sites can also be declassified as Register eligible based on new data acquired through the monitoring program (testing). An example of this is site C:13:356. It was tested in 1999 for site significance and was determined non-eligible for National Register listing. However, a reconsideration of eligibility does not alter the basic conclusions derived from the original survey regarding the density of significant cultural resources within the river corridor that are potentially affected by dam operations.

Undertakings and the Area of Potential Effect

To assess the potential effects of a federal agency undertaking on historic properties, it is necessary to define the undertaking and the overall area within which impacts might occur. For Section 106, under current regulations, an undertaking means

> any project, activity, or program that can result in changes in the character or use of historic properties, if any such historic properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a federal agency or licensed or assisted by a federal agency. Undertakings include new and continuing projects, activities, or programs and any of their elements not previously considered under section 106 (36 CFR 800.2[o]).

The Area of Potential Effect (APE) represents the physical location where impacts may occur. Current regulations (36 CFR 800.16) for Section 106 define this area as

> the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

According to current regulations, decisions regarding the APE are arrived at through a process of consultation involving the agency official and the SHPO or THPO (36 CFR 800.4[a]). Generally, the APE is defined broadly, so that it may encompass not only areas of direct impact, but areas of indirect, cumulative, or potential impact as well.

During the original survey, an area reaching from the Colorado River to the estimated pre-dam maximum river flood level at 300,000 cfs was adopted as the working definition of the APE. Subsequently, the RCMP and the PA program as a whole has refined its understanding of the APE based on the maximum flow that could be released by Glen Canyon Dam. According to the Department of the Interior's Office of the Solicitor and the GCDEIS, "dam operational works are capable of releasing approximately 256,000 cfs in flows"(Loveless 1999:5). The RCMP therefore has adopted the level represented by a potential 256,000 cfs flow as the maximum level for the area of potential effect by dam operations on downstream cultural resources. This has not resulted in any significant change in the number of sites considered within the sample to be monitored, nor has it changed monitoring procedures. The initial survey and subsequent monitoring were based on the identified flood plain of the Colorado River, not an absolute cfs number or elevation. Reclamation models have not provided the accuracy to define the specific cfs or elevation for flows above approximately 45,000 cfs. Because of this, the absolute numbers are less important than the geomorphic setting identified in the field.

For the RCMP, the APE has been defined previously with definitions of direct, indirect, and potential impacts as they were carefully identified on the original survey (Fairley et al. 1994) and as they have been subsequently refined using data from the ongoing monitoring project and associated geomorphological studies (Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996a, 1996b; Thompson et al. 1998). A universal definition of potential areas of impact for all resources potentially affected by operation of Glen Canyon Dam probably cannot be defended either empirically or according to the legally mandated consultation guidelines established by either the GCPA or Section 106 regulations.

Given that geomorphological studies have documented significant erosional processes unrelated to maximum river levels, the potential high-water mark of dam releases is probably less important for defining the APE than empirically documented direct and indirect impacts under dam operations. That is, the APE should be defined based on field studies documenting direct, indirect, or potential impacts from both the daily and cumulative effects of dam operation, rather than an arbitrary potential high-water mark. Monitoring is called for in the GCPA and ROD based on daily and cumulative effects of dam operations. In many ways, any disputes over the correct high-water mark misses the major point established by the RCMP and geomorphological studies, namely that effects of dam operations on cultural resources are recognizable, highly variable, and dependent on geographical location, geomorphic setting, existing environmental conditions, site contents, and other factors.

Any attempt to redefine the existing APE will need to acknowledge that regulations for Section 106 require that the APE be defined through consultation between the agency official and the SHPO. It should also be noted that nowhere in NHPA or the Section 106 regulations is there a mandate to make the APE for cultural resources correspond with impact areas defined for natural resources (see Council 1999:32 for further acknowledgment of this by the Committee on Grand Canyon Monitoring and Research). In fact, there is no logical reason why Section 106 compliance should operate within the same boundaries identified for monitoring or mitigating impacts to natural resources. Management principles, methods, and objectives for cultural and natural resources are often quite different and are not necessarily pursued in concert. Many reasons can be cited for considering the APE for cultural resources separately from the zones of impacts for natural resources. Among these are that the locations and contents of cultural resources are structured by systems of human behavior that ignore or defeat environmental factors that constrain elements of natural biological systems, and the processes that adversely affect cultural resources are often highly dependent on the nature of the resource itself and its specific geographic, geomorphological, and cultural landscape setting. Impacts to cultural resources are therefore often unrelated to many of the habitat issues relevant to natural resource integrity, and impacts to cultural resources—e.g., changed patterns of visitor behavior, side-canyon erosion induced by a lowered river base level, or depletion of sediments that once protected archaeological features—may be unique to this type of resource. In this regard, RCMP data on physical and visitor-related site impacts, and geomorphological studies relevant to site erosion, provide a fruitful empirical basis for clarifying and justifying the APE, should this become necessary.

Adverse Effects

A central concept in the Section 106 process is that of "adverse effect" to historic properties potentially eligible for the National Register. Several potential types of adverse effect are defined in current Section 106 regulations, including but not limited to the following:

- Physical destruction of or damage to all or part of the property.
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines.
- Removal of the property from its historic location.
- Change of the character of the property's use or physical features within the property's setting that contribute to its historic significance.
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's setting that contribute to its historic significance.
- Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization.

- Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance (36 CFR Part 800.5).

When considering the operation of Glen Canyon Dam, by far the most common and destructive form of adverse effect is the first one cited above, "physical destruction of or damage to all or part of the property." Other adverse effects must also be considered, especially with respect to remedial actions that might be taken to mitigate effects of dam operations. Since the original survey of 1990–91, the RCMP has documented on each monitoring trip the physical condition of sites monitored. This database can be used to summarize the potential effects of dam operations and integrate them with both Section 106 and NEPA legal requirements.

For *daily effects*, the APE has been defined as reaching up to the 256,000 cfs level. According to the final EIS on the operation of Glen Canyon Dam (USDI 1995:70), "The amount of water and its pattern of release directly or indirectly affect physical, biological, cultural, and recreation resources within the river corridor." A number of archaeological sites located within or adjacent to the area of regulated river flows have been recently damaged or destroyed by erosion (Fairley et al. 1994; Hereford 1993; Jones 1986a). This apparent acceleration of erosion suggests a relationship between daily flows and cultural resource condition within the direct impact zone along the river corridor.

At the time of the GRCA-NAU archaeological survey, it was proposed that 33 sites were adversely affected by direct impacts from dam operations (Fairley et al. 1994). However, as flow regimes change between seasons, as the river channel and its sediments change, or in the event of beach habitat building flows, the number of sites experiencing direct impacts can change. For example, during the 1990–91 survey, direct impacts to site C:13:291 were not acknowledged. However, during the beach habitat building flows of 1996, water releases of up to 45,000 cfs resulted in direct adverse impacts to this site (Balsom and Larralde 1996). A similar case was represented by site C:06:005 (Balsom and Larralde 1996). Conversely, some sites that were initially identified on the survey as subject to direct effects of dam operations (e.g., site C:02:094) may not now be experiencing direct impacts. In any event, the monitoring program pursued by the RCMP is designed to regularly assess the potential adverse effects of daily dam operations.

Cumulative effects of dam operations result in successional changes to cultural resources. The RCMP focuses on three long-term or cumulative effects from dam operations: a lowered base level of the river, a reduced supply of sediment, and a lack of sediment-laden seasonal floods. These three cumulative effects have all altered the pre-dam alluvial terraces containing cultural resources. The GCDEIS notes that "sediment is critical for stabilizing archaeological sites" (USDI 1995:72). Geomorphological research (e.g., Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996a, 1996b; Lucchitta 1990, 1991; Lucchitta et al. 1995a, 1995b; Thompson et al. 1998) has provided credible evidence that the existence of the dam has lowered the base level of the river and accelerated erosional processes at archaeological sites. According to Hereford (Hereford et al. 1993), "sediment depletion has altered the erosional balance of the river corridor. One possible effect of this depletion is increased erosion by the streams that drain the terraces along the river."

Prior to construction of Glen Canyon Dam, the base level of streams along the river corridor was maintained at a higher topographic level by deposition during floods. The depositional level of the post-dam river is substantially lower (Hereford et al. 1993). Pre-dam annual flooding provided a depositional barrier of sediment, which prevented some gullies and arroyos from draining to the river. These lower terraces can no longer be maintained because of dam operations. Erosion of the higher pre-dam terraces by gully formation and arroyo cutting will continue unless preservation measures are implemented on a site-specific basis.

In the absence of seasonal floods, runoff is no longer contained on the alluvial terraces; runoff is now free to drain onto the next lower terrace. As gullies and arroyos reach the river at its new lowered base level, the gullies themselves are downcutting within the drainage channels to reach the new base level. As stated in the EIS, "arroyo cutting of even the lowest terraces indirectly causes erosion of higher terraces, exposing and eroding archaeological remains" (USDI 1995).

The absence of sediment deposition comparable to pre-dam times has adversely affected river corridor cultural resources by slowly eroding away protective barriers between these resources and the river channel. Riverbed sand, sandbars, high terraces, debris fans, rapids, and lake deltas have all been affected in some way by the existence and operation of the dam (Hazel et al. 1999; Kaplinski et al. 1997; USDI 1995). Alluvial terraces once buffered from erosion by the existence of channel-margin sandbars have become susceptible to artificially accelerated erosion. And, as noted by Thompson et al. (1998:6), "the size and characteristics of channel-margin sand bars along the river are of critical importance in determining rate and extent of erosion of cultural sites."

Most of the cumulative adverse effects related to geomorphic processes cannot be perceived over a 6-month interval of monitoring. Only three sites on the RCMP monitoring schedule are believed to show short-term changes detectable within a 6-month time frame. The majority of sites monitored by the RCMP are thus on a proposed 3- to 5-year visitation schedule, reflecting the conclusion that cumulative change is best observed within a 3- to 5-year time span. However, due to the experimental nature of this program and the necessity of checking these recommendations against the actual field conditions of sites, to accept a rigid 3- to 5-year visitation schedule without further documentation of the actual rates of potential adverse effects might not be appropriate.

Another category of potential cumulative adverse effect from dam operations is visitor-related impacts. Due to the issuance of permits by GRCA for backcountry hiking and commercial and private boating, GRCA does acknowledge that not all visitor-related impacts are caused by dam operations; however, some are. To interpret when, where, and to what degree visitor-related impacts occur, the RCMP has recorded these impacts when applicable. This accumulated data also fulfills a provision of the MRAP stating that "sites which have high potential for adverse impacts due to non-geomorphological factors such as changing river camp or visitor access locations will be monitored as needed" (USDI 1997a, Part II B). Data collected through the RCMP have also been used to supplement other visitor-related studies conducted within the river corridor. GCMRC and others are conducting research on visitor-related impacts related to dam operations.

Preliminary information from two studies (Stewart 1998; Kearsley and Warren 1993) and personal observations by several experienced Colorado River boat operators suggest that commercial trips now camp repeatedly at the same beaches because access to these beaches is made predictable by the relatively narrow range of water levels released by the dam. As a result, not only do these trips camp at the same beaches, they repeatedly take the same hikes and visit the same attraction sites, both natural and cultural. Because there are no dramatic changes anticipated in river levels, trip operators evidently have come to rely on particular beaches, depending on the number of passengers on the trip. Prior to construction of the dam, it appears that seasonal fluctuations in river levels distributed visitor impacts across a wider variety of camping locations, resulting in less regular concentration of visitors and their associated impacts, such as foot traffic (see Chapter 10).

Cumulative impacts from visitors take several forms. The creation of visitor trails is probably the most common impact observed by the RCMP. These trails can be highly destructive because they result in compaction of sediments, which in turn concentrates runoff and leads to the formation of gullies and, ultimately, arroyos. At a certain point in their development, entrenched trails become extremely difficult to treat, and they may serve as conduits for surface runoff into side canyons or directly into the river. Fortunately, through cooperative efforts between GRCA and the RCMP staff, most trails at river corridor cultural sites are either regularly maintained or have been successfully obliterated.

Collection piles are another form of adverse effect from the actions of visitors. Collection piles consist of artifacts removed from their original context and placed in concentrations at various locations around a site. Collection piles threaten the integrity and information potential of archaeological sites by removing artifacts from their original spatial locations and re-combining them at locations far removed from their original contexts. This destroys the ability of archaeological researchers to make valid inferences about the spatial structure of site activities based on the distributions and associations of surface artifacts. Furthermore, by drawing attention to the artifacts, collection piles may encourage some visitors to remove artifacts from the site.

Certainly, the topic of visitor impacts and the role of dam operations in causing or concentrating these impacts deserves additional study. It would appear, based on information gathered so far, that many visitor impacts are indeed related to river levels associated with dam operations, and thus are a cumulative impact that falls within the provisions of Section 106. Until these issues are clarified, the

RCMP continues to make relevant observations on visitor impacts during its monitoring activities, and trail work will continue cooperatively between GRCA and RCMP personnel.

Tribal Consultation

NHPA contains several sections that require federal agencies to solicit and consider the opinions of Native Americans and Native Hawaiians when conducting an undertaking that may affect historic properties of interest to them, especially those having religious and cultural importance. According to current regulations, a federal agency is required "to consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by an undertaking" (36 CFR 800.2[c][3]). The timing and nature of this consultation is specified as follows:

> The agency official shall ensure that consultation in the Section 106 process provides the Indian tribe or Native Hawaiian organization a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects. It is the responsibility of the agency official to make a reasonable and good faith effort to identify Indian tribes and Native Hawaiian organizations that shall be consulted in the Section 106 process. Consultation should commence early in the planning process, in order to identify and discuss relevant preservation issues and resolve concerns about the confidentiality of information on historic properties.

The regulations further stipulate that "consultation with Indian tribes should be conducted in a sensitive manner respectful of tribal sovereignty," should be pursued in a "government-to-government" fashion, and "should be conducted in a manner sensitive to the concerns and needs of the Indian tribe or Native Hawaiian organization" (36 CFR 800.2[c][3][ii-iii]). It is further recognized (36 CFR 800.2[c][3][iv]) that "frequently historic properties of religious and cultural significance are located on ancestral, aboriginal, or ceded lands" that are not currently within the boundaries of tribal lands. This is certainly true for Grand Canyon National Park and the cultural resources monitored by the RCMP. Perhaps no other place on earth is as important as the Grand Canyon to such a diverse group of native cultures, and the just-cited part of the Section 106 regulations indicates a special responsibility on the part of Reclamation and the NPS (Section 110) to consult with tribes having an interest in the significant cultural properties potentially affected by the operation of Glen Canyon Dam. To carry out consultation in a respectful and meaningful manner, current regulations (36 CFR 800.2[c][3][v]) indicate that "an Indian tribe or Native Hawaiian organization may enter into an agreement with an agency official that specifies how they will carry out responsibilities under this part, including concerns over the confidentiality of information." An existing agreement that has served aspects of this function for the RCMP is the "Programmatic Agreement on Cultural Resources ... Regarding the Operations of the Glen Canyon Dam." This agreement is discussed below.

The Programmatic Agreement

A fundamental document that provides evidence of Reclamation's compliance with Section 106, including aspects of tribal consultation, is the Programmatic Agreement (PA) of 1994 (USDI et al. 1994), signed by officials from Reclamation, the Arizona SHPO, the executive director of the Advisory Council on Historic Preservation, the National Park Service (regional directors for both the former Western and Rocky Mountain regions) and representatives of the Hopi Tribe, the Hualapai Tribe, the Kaibab Paiute Tribe, the Navajo Nation, the Paiute Indian Tribe of Utah (for the Shivwits Band), and the Pueblo of Zuni. Implementation of this agreement fulfills federal agency responsibilities for Section 106 of NHPA relative to Glen Canyon Dam operations.

The PA ratifies a number of important issues relevant to Section 106 compliance. Among these, it states that the legal authority for the PA derives not only from NHPA, but also from the Secretary of the Interior's directive to prepare an EIS for the operation of Glen Canyon Dam and the GCPA's language ordering continued monitoring and management of resources within the area of the dam's effects. The PA also states that Reclamation is the lead agency for Section 106 compliance regarding the impacts of Glen Canyon Dam, and it notes that Reclamation has acknowledged potential adverse effects on cultural resources from dam operations. The PA declares further that "given their mutual responsibilities [Section 106 and Section 110 of NHPA, respectively], Reclamation and the NPS have determined to coordinate their respective roles in the management and consideration of historic properties which may be affected by the Program [i.e., operation of Glen Canyon Dam]."

It is in the PA that specific responsibilities of Reclamation are spelled out with respect to Section 106 compliance regarding dam operations, and it is from the PA that much of the program pursued by the RCMP derives. The PA identifies more than 300 National Register-eligible properties within the APE that are potentially subject to monitoring and remedial action. (This has since been refined to 264 sites within GRCA and 53 sites in GRCA.) The PA also recognizes that additional identification and evaluation of properties should take place within the APE, and it directs Reclamation and the NPS to conduct appropriate studies to identify Traditional Cultural Properties within the APE.

Section 2 of the PA is devoted to specifics of monitoring and remedial action. According to the PA,

> Within three months of the execution of this Programmatic Agreement, Reclamation and the NPS, in consultation with the SHPO and Tribes, shall develop a Plan for monitoring the effects of the Glen Canyon Dam operations on historic properties within the APE and for carrying out remedial actions to address the effects of ongoing damage to historic properties. The purpose of the Monitoring and Remedial Action Plan shall be to generate data regarding the effects of dam operations on historic properties, identify ongoing impacts to historic properties within the APE, and develop and implement remedial measures for treating historic properties subject to damage (Section 1[a]).

Further efforts to identify and evaluate previously undiscovered properties are also called for in a formal plan, and specific measures for remedying adverse effects are identified:

> The Monitoring and Remedial Action Plan (Plan) shall provide for the identification and evaluation of previously unrecorded properties overlooked by previous surveys or exposed subsequent to the surveys, and include measures by which any adverse effects identified during the monitoring effort shall be avoided or minimized. Remedial measures shall be implemented to mitigate ongoing adverse effects and may include, but not be limited necessarily to, bank stabilization, checkdam construction and data recovery, as appropriate. The Plan shall specify an expedited consultation process among the parties to this agreement to accommodate situations requiring remedial actions.

A third section of the PA, "Management," directs the NPS and Reclamation to combine forces so that the two agencies may fulfill their mutual responsibilities under NHPA. A key element of this collaboration was specified in a Historic Preservation Plan (USDI et al. 1997):

> Reclamation and the NPS shall incorporate the results of the identification, evaluation, and monitoring and remedial action efforts into a Historic Preservation Plan (HPP) for the long-term management of the Grand Canyon River Corridor District and any other historic properties within the APE. The HPP shall be developed in consultation with the parties to this Programmatic Agreement.[1]

Although the PA states that "the development, and review of the HPP shall be completed prior to the issuance of a Record of Decision for the GCD-EIS, or December 1994, whichever comes first," an HPP has not yet been finalized. A final draft HPP was prepared jointly by Reclamation and the NPS in June, 1997, but this collaborative effort has recently been rejected by Reclamation and a new, noncollaborative document has been proposed in its place (Coulam 1998). An HPP therefore still has not been completed, and prospects and timelines for completion are currently unclear.

Another stipulation of the PA acknowledges the special nature of this project by highlighting the need for collaboration in pursuing compliance with both Section 106 and Section 110 of NHPA. As noted previously, the RCMP is unusual and cannot be considered a routine Section 106 compliance project because of the various legal requirements that guide the specifics of compliance in this instance (e.g., the EIS, the ROD, and the GCPA), and because compliance is sought by one agency (Reclamation) within the jurisdiction of a second agency (NPS) bound by stringent preservation requirements. The PA acknowledges as much by stating that

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> the HPP shall integrate Reclamation's lead agency role pursuant to Section 106 of the Act and the NPS's stewardship role pursuant to Section 110 of the Act. Specifically, the HPP shall provide management direction responsive to the NPS's responsibilities under Sections 110(a)(1) and 110(a)(2); and NPS's and Reclamation's responsibilities under Sections 110(b) and 110(d).

To date, implementation of the PA has largely taken place smoothly and in collaborative fashion, despite the potential for conflicts inherent in the overlapping jurisdictions and compliance responsibilities of Reclamation and NPS.

OTHER RELEVANT LEGAL REQUIREMENTS AND POLICIES

Many other national laws, regulations, and executive orders also constrain and guide the RCMP. Because GRCA-NAU archaeological crews are operating within the boundaries of a national park, all relevant legislation, regulations, and orders that guide NPS treatment of cultural resources must be followed. As the federal agency charged with setting policies and standards for other agencies, NPS has an especially rigorous set of standards regarding their stewardship of cultural resources. Thus, the RCMP and its associated actions cannot be viewed as philosophically or procedurally equivalent to Section 106 actions on other federal lands. The project is indeed special in the sense that Section 106 compliance takes place within a jurisdiction where special rules and policies are in force that seek protection of resources so that the values leading to creation of Grand Canyon National Park can be preserved.

A listing of many of the laws, policies, and other legal considerations guiding the RCMP has been provided in the GCDEIS, under the heading "Authorities and Institutional Constraints" (USDI 1995:8–10). Among the most important pieces of general legislation guiding the cultural resource management philosophy of the RCMP is the National Park Service Act of 1916 (P.L. 64-235; also referred to as the Organic Act), which established the NPS and required this agency to manage its properties so as to "conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The general spirit of the Organic Act is reflected in the proclamations and laws that initially created and later expanded Grand Canyon National Park. Among the most important of these were the initial proclamation that designated the Grand Canyon as a National Monument in 1908, and acts passed by Congress in 1919 (40 Stat. 1175) and 1975 (16 USC 228a), which enlarged its boundaries and stated or expanded its purpose. These proclamations and laws recognized the unique nature of the Grand Canyon and strongly emphasize the significance of the park and the need for its preservation.

Within the jurisdiction of GRCA, the RCMP is guided by numerous laws and statements of policy that pertain to the study, management, preservation, and treatment of cultural resources within a unit of the NPS. The most comprehensive guidance is provided by the NPS "Cultural Resource Management Guidelines" (USDI 1997b), which contains detailed information on NPS policies, standards, and procedures with respect to cultural resources, including general philosophy. It also provides guidance for research methods and standards, the planning process, approaches to stewardship, Section 106 compliance, and management of archaeological resources, cultural landscapes, structures, and ethnographic resources. The tone of NPS-28 is set in the following statement:

> As custodian of the national park system, the National Park Service is steward of many of America's most important natural and cultural resources. It is charged to preserve them unimpaired for the enjoyment of present and future generations. If they are degraded or lost, so is the park's reason for being (USDI 1997b:1).

Regarding management of archaeological resources, NPS-28 strongly advocates a policy of in situ preservation in its definition of management standards:

> Park archaeological resources are left in situ and undisturbed, unless removal of artifacts or intervention into cultural material is justified in the planning process by preservation, treatment, protection, research, interpretation, or development requirements. They are preserved in a stable condition to prevent degradation and loss of research values or in situ exhibit potential (USDI 1997b:1).

Another statement of the NPS policy of in situ preservation can be found in NPS Management Policies, which declares that "all cultural resources will be protected and preserved in their existing condition."

More specific guidance regarding the treatment of archaeological resources, objects, structures, and other cultural resources within the care of NPS is provided by the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation, authorized by Section 110 of NHPA and published in the Federal Register (Vol. 48, No. 190; see also 36 CFR Part 61). These standards pertain to preservation planning, development of historic contexts, identification of historic properties, research designs, archival studies, field surveys, evaluating site significance, documentation of historic properties, photography, preparation of reports, and a host of other issues involved in archaeological and preservation-related activities. The standards included in this document are not regulatory nor do they set or interpret agency policy (USDI 1997b:197). Instead, they are "intended to provide technical advice about archaeological and historic preservation activities and methods" so that there can be a more systematic approach to preserving the nation's cultural heritage (USDI 1997b:197). Staff members of the RCMP are familiar with the Secretary's Standards and Guidelines, and apply them to all project activities.

Many other laws, regulations, orders, and directives also guide the activities of the RCMP. The Archaeological Resources Protection Act (ARPA) of 1979 (P.L. 96-95) and its associated regulations (43 CFR Part 7) provide a legal framework for authorizing archaeological excavations and other activities on federal lands; the Native American Grave Protection and Repatriation Act of 1990 (P.L. 101-601) and its associated regulations (43 CFR Part 10) provide for the protection and repatriation of Native American graves, human remains, funerary objects, sacred objects, and objects of cultural patrimony on federal lands. The regulations found at 36 CFR Part 63 (related to NHPA and Executive Order 11593) govern eligibility standards for inclusion in the National Register of Historic Preservation, and Executive Order 13007 ("Indian Sacred Sites," 61 FR 26771) directs federal land management agencies "to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites," to the extent that this is practicable, lawful, and does not conflict with essential agency functions (USDI 1997b:194). Other legal restrictions or constraints may also apply, depending on the specific issue involved.

CHAPTER 3. NATIONAL REGISTER ELIGIBILITY: SIGNIFICANCE AND INTEGRITY OF GRAND CANYON RIVER CORRIDOR SITES

Christian E. Downum and Duane C. Hubbard

Eligibility for inclusion in the National Register of Historic Places is a crucial aspect of the Section 106 review process under NHPA. Section 106 review applies to historic properties that are potentially affected by a federal agency's undertaking and are on or potentially eligible for inclusion in the National Register. Thus, establishing Register eligibility is a key part of the Section 106 compliance process.

To comply with NEPA and Section 106 of NHPA, the GRCA-NAU archaeological survey of 1990–91 performed an assessment of the National Register eligibility of sites discovered on the survey; in fact, National Register eligibility documentation and assessment was identified as one of the five principal objectives of the survey (Fairley et al. 1994:1). The GRCA, Reclamation, and others associated with the planning and implementation of this survey recognized that Register eligibility would be a key issue in seeking compliance with NHPA's Section 106, and thus with fulfilling the requirements of the EIS as ordered by Interior Secretary Lujan in 1989. To this end, a portion of the field recording form for the GRCA-NAU survey was devoted to a field and laboratory assessment of the National Register eligibility of each site.

Reflecting the fact that the Grand Canyon has significant historic as well as prehistoric sites, the 1990–91 National Register eligibility assessment was performed separately for historic and prehistoric sites, although a Determination of Eligibility was done for all properties together. A chapter in the original survey report (Coder 1994) was devoted specifically to the historical cultural resources of the river corridor, including a listing of sites, a summary of their contents, and the criteria under which they could potentially be nominated to the National Register (Coder 1994:145–146, Table 25). Historic sites were considered eligible under a variety of potential criteria, most commonly A and D, but also occasionally B and C (see below).

Evaluation of Register eligibility of prehistoric sites resulted in the determination that Criterion D was the most appropriate category. Documentation of National Register eligibility was provided to the Arizona SHPO in two forms: a copy of the final river corridor survey report, which included summary descriptions of each of the 336 archaeological sites found in the river corridor survey area (Fairley et al. 1994: Appendix 1), and a copy of the original page of the survey site recording form, which recorded a verbal description of the site's National Register eligibility.

This documentation was sufficient for the Arizona SHPO, who concurred with most of the National Register eligibility recommendations made by the GRCA-NAU archaeological survey staff (Howard 1991). Additional sites have since been discovered within the river corridor, and much additional information has been gathered that is relevant to the issue of National Register considerations of significance and integrity. As a result of further work by RCMP, the following sites were tested for significance and were found eligible: B:11:284 (Leap 1996c), A:15:035, B:11:278, and G:03:065 (Leap 1994c). Additional sites added to the list which Arizona SHPO found to be eligible for inclusion include Reclamation engineering sites C:09:065, C:09:083, C:09:088, G:02:100, G:02:101, G:02:102, G:02:106 (Leap 1994c).

We propose, therefore, that the river corridor of the GRCA be nominated to the National Register as a Multiple Property Area. The benefits of this nomination would be immediate and direct. According to U.S. National Park Service policy, any consideration of the integrity of an historic property must be linked with the significance of that property as stated through an historic context (USDI et al. 1997; see also NRB15:Section VIII, "How to Evaluate the Integrity of a Property"). Consideration of integrity without significance (as established via historic context) is a meaningless exercise, because "integrity only has meaning insofar as it is a reflection of a historic property's ability to convey its significance" (NRB 15:Section VIII). Thus, a developed historic context is essential to rational (and, according to the NPS, procedurally correct) evaluation of integrity.

So far, the RCMP has evaluated the integrity of sites on a comparatively informal basis by relying on the generalized significance assessments provided by the initial river corridor inventory survey evaluations and SHPO concurrence, and the outcomes of tribal consultations during the ongoing monitoring program. Formal nomination of river corridor sites to the National Register would have the crucially important benefit of formalizing the significance of river corridor sites, while minimizing or eliminating wasteful debates regarding the significance and integrity of individual sites or sets of sites. A formal nomination as proposed in this chapter would also avoid the problem of subordinating tribal values to scientific research questions (Leone and Potter 1992). The approach suggested here involves developing a context that not only focuses on research questions, but also gives equal weight to tribal values and belief systems as they relate to specific sites (Dongoske et al. 1997). Successful completion of a National Register nomination for river corridor sites would create a ratified, formal document clearly stating the criteria under which individual sites are considered to have significance and integrity. Any future challenges would have to be pursued through a set of rigorous, formal, and public procedures for "de-listing" the sites from the Register.

THE NATIONAL REGISTER AND ELIGIBILITY CRITERIA

The National Register of Historic Places is the nation's listing of the districts, sites, buildings, structures, and objects that are significant to our prehistory and history (National Register Bulletin [NRB] 15:Preface). In 1935, the Historic Sites Act (P.L. 74-292) authorized the Secretary of the Interior to create a program to identify and recognize properties of national significance via the National Historic Landmarks listing. In 1966, NHPA authorized the Secretary to expand this recognition to include properties of state and local, as well as national, significance. The National Register thus serves as the official list of properties that are recognized as having importance in terms of American history, architecture, archaeology, engineering, and culture (NRB 15:Preface).

Only a tiny fraction of the significant historic properties in the U.S. have ever been formally nominated to the National Register. Recognizing this fact, Section 106 compliance is mandated for properties in, or eligible for inclusion in, the National Register. Thus, it is not necessary that a property actually be listed in the Register. Instead, a formal evaluation of potential eligibility for the Register is required, usually at a level of thoroughness and detail that is considerably less than that required for a formal nomination. It is at this level—preliminary eligibility documentation and evaluation sufficient for Section 106 compliance—that the RCMP currently operates.

There are several key concepts for determining eligibility for the National Register. One is Historic Context, which is a statement of the significance of a property in terms of themes, geographical limits, and chronological periods (i.e., "theme, place, and time"; NRB 16:Part V). A Historic Context provides the framework within which an individual property can be judged according to its contribution to the history, architecture, archaeology, engineering, or culture of an area. Another important aspect of Register eligibility is that of Integrity, which is defined as "the ability of a property to convey its significance" (NRB 16:Part VIII). Integrity is not necessarily the same thing as the condition of a property. Rather, integrity is related to whether or not a property retains the physical characteristics, including contextual associations, that embody its significance (NRB 16:Part VIII; see also USDI 1997b:10–11). Eight aspects of integrity have been identified, including location, design, setting, materials, workmanship, feeling, association, and, for properties eligible for their contribution to historic and prehistoric research questions, "the property's potential to yield specific data that address important research questions" (NRB 16:Part VIII). It is also important to note that the National Register generally excludes certain types of properties, including those that are primarily religious in nature, those having been moved from their original historic setting, birthplaces or graves, cemeteries, reconstructed properties, commemorative properties, and properties that have achieved significance in the past 50 years (NRB 16:Part VII). Such properties can be eligible for the National Register, but only if their significance is carefully documented and justified with respect to the four defined categories of significance (see below).

To document eligibility for the National Register in a Historic Context, four major eligibility criteria apply (NRB 16: Part VI):

Criterion A, Event. "Properties can be eligible for the National Register if they are associated with events that have made a significant contribution to the broad patterns of our history."

Criterion B, Person. "Properties may be eligible for the National Register if they are associated with the lives of persons significant in our past."

Criterion C, Design/Construction. "Properties may be eligible for the National Register if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction."

Criterion D, Information Potential. "Properties may be eligible for the National Register if they have yielded, or may be likely to yield, information important in prehistory or history."

TRADITIONAL CULTURAL PROPERTIES

Over the past two decades or so, there has been a growing awareness that certain kinds of properties may embody significance deriving from their importance to local cultures and traditions. Through the years, amendments to NHPA and associated regulations have evolved to accommodate a new type of significant historic property, the Traditional Cultural Property. A National Register Bulletin (NRB 38) has been written to provide guidance to those seeking to nominate such properties to the Register, and as discussed in Chapter 2, recent amendments to NHPA provide statutory authority for recognizing such properties as eligible for the Register.

According to National Register Bulletin 38, Traditional Cultural Properties (TCPs) may be eligible for the National Register if the properties possess a traditional cultural significance to the social institutions of any community such as Indian tribes, local ethnic groups, or the nation as a whole (NRB 38:1):

> The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices.
>
> A traditional cultural property, then, can be defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.

The consideration of TCPs has also grown because of an expanded role for consultation with Native Americans and Native Hawaiians, as required by amendments to NHPA. In the current framework of legal compliance, consideration of National Register eligibility of TCPs is an integral part of the Section 106 process, and of general planning and preservation efforts. However, although recognition of TCPs has been evolving for more than a decade, a number of issues remain to be resolved (Dongoske et al. 1998; King 1999; Sebastian 1998), and few such properties have actually been nominated to the National Register. Information regarding TCPs associated with the RCMP are discussed later in this chapter.

A PROPOSED APPROACH TO CONSIDERING NATIONAL REGISTER ELIGIBILTY FOR GRAND CANYON RIVER CORRIDOR SITES

The RCMP believes that enough specific information is now in hand to create a successful National Register nomination for river corridor sites in the Grand Canyon as a Multiple Property Area submission. Such a submission could conceivably be prepared in the coming fiscal year. Given below is an outline of how this submission might be structured in terms of boundaries, historic context, property types, research topics, information categories, and integrity considerations. The present proposal mostly considers historic and prehistoric sites under National Register Criterion D, Information Potential. Other National Register criteria undoubtedly apply to many of the sites monitored by the RCMP, and many of the sites may be considered as TCPs having cultural significance to Native American groups, including the tribes and nations represented as signatories to the PA. Nomination of a set of sites to the National Register initially under Criterion D does nothing to diminish the importance of the same sites and other important cultural properties according to other criteria. The following proposal should not be taken to imply that the research significance of sites is the only, or the most important, criterion that should drive a National Register nomination process. In fact, as discussed below, the title of the proposed Historic Context for National Register Nomination explicitly references "knowledge" and "cultural vitality" of cultural sites as being equally important

THE MULTIPLE PROPERTY AREA APPROACH

A fruitful approach to considering the National Register eligibility of river corridor sites in GRCA would be that of pursuing a Register nomination within the Multiple Property documentation format (NRB 16B). This approach allows multiple properties to be nominated across a broad geographic area based on unifying themes, trends, or patterns. The Multiple Property approach can accommodate multiple historic contexts and multiple historic property types, so long as these are related to one another according to broad criteria such as time period, geographical area, or theme. An advantage of this approach is that it allows maximum flexibility in amending and adding additional properties with the same Multiple Property Documentation Form as a basis for such revisions.

For Grand Canyon river corridor sites, a single historic context could be created titled "Human Adaptation, Resource Utilization, Knowledge, and Cultural Vitality along the Colorado River in the Grand Canyon, ca. 10,000 B.C. to A.D. 1963." This broad context thus encompasses the sweep of human endeavors within the Canyon since the known beginnings of human occupation in the area and extending forward in time to the period of exploration associated with the most recent Reclamation plans to dam the Colorado River in Marble Canyon. The proposed context could incorporate the known range of historic properties documented in the Canyon (see below), and it would allow for the submission of additional eligibility criteria or the addition of new properties as these are developed or discovered. At present, it is possible to elaborate this context sufficiently for submission of the Multiple Property documentation, and to submit a specific nomination for a "Grand Canyon River Corridor Archaeological District," using information gathered by the GRCA-NAU survey and the RCMP. This nomination, if prepared today, could be accomplished primarily with the research questions appropriate under Criterion D. However, it is probably true that at least some of the identified property types (especially historic sites) could be nominated under additional criteria as well, and that TCP considerations could also be included. Preparation of a Historic Context under the broad theme advocated above would provide for sufficient flexibility in the National Register nomination process to integrate the wide variety of archaeological and ethnographic data collected to date by the 1990–91 survey, the RCMP, the various ethnographic studies sponsored by Reclamation and NPS, and other sources of information.

The proposed context is appropriate in scope and format to definition of Historic Context as found in National Register Bulletin 16, and it is consistent with recent Historic Contexts that have been accepted by the Arizona Historic Sites Review Committee. According to NRB 16, "the statement of historic contexts requires a consistent framework: theme, geographical area, and chronological period." Historic Contexts are of necessity broad and encompassing, rather than narrow and restricting. As noted in NRB 16, "care should be taken not to define the context to narrowly so as to limit its applicability to preservation decision making." The proposed context thus includes theme (broadly defined to incorporate scientific research questions in both anthropology and history, historic events and persons, architectural and other built features, and tribal values and beliefs), place (river corridor of Grand Canyon), and time (10,000 B.C. to A.D. 1963). As such, it does not bias one perspective (e.g., scientific research questions) over other values (e.g., tribal perspectives) that would make specific properties eligible for the National Register, and it meets the broad requirements for a successful context as set forth in NRB 16.

BOUNDARIES FOR A RIVER CORRIDOR MULTIPLE PROPERTY AREA

The boundary justification for the proposed Multiple Property Area follows a definition of the Grand Canyon river corridor provided by Fairley et al. (Fairley et al. 1994:2) in their report on an intensive archaeological survey of the Colorado River floodplain in Grand Canyon National Park. The proposed boundaries of the Grand Canyon River Corridor Multiple Property Area therefore would encompass the entire area considered to be the floodplain or riverine zone of the Colorado River within the boundaries of Grand Canyon National Park. This zone is defined at its far eastern and western ends by the boundary of Grand Canyon National Park as it crosses the Colorado River. Between these points on either side of the river, the river corridor is defined in terms of the natural resources that provided a distinctive environment for its human inhabitants, part-time residents, and visitors. Essentially, the river corridor includes all areas within Grand Canyon National Park that have been touched by the Colorado River's waters during historic times, or that contain sediments ultimately derived from the river. Specifically, the district boundaries extend roughly from the river itself up to the area reached by the river at its highest estimated historic level, at about 300,000 cubic feet per second (cfs). The width of this zone varies locally depending on the steepness of the canyon walls and other specific topographic factors. In places, this zone expands to include sand dunes made up of sand grains and other sediments once laid down by the river in the form of alluvial terraces, but later reworked into eolian dunes reaching slightly above the 300,000 cfs mark. Regardless of time period or cultural affiliation, all properties within this zone are in some way related to or affected by the water that flowed through the Colorado River. This water provided or fostered many of the natural resources necessary for human life in the Grand Canyon, and contributed unique aesthetic, symbolic, and spiritual qualities to that life. Boundaries of the proposed district therefore encompass a special set of properties, united by their proximity to and relationships with the resources provided by the Colorado River within Grand Canyon National Park.

The proposed boundaries are completely consistent with current NPS policy regarding National Register boundary considerations as set forth in National Register Bulletin 21 ("Defining Boundaries for National Register Properties") and with boundaries for Multiple Property Area submissions that have been successfully proposed recently in the state of Arizona. It should be emphasized that the proposed boundary is for a Multiple Property Area, not a specific archaeological site or district.

Property Types

The 1990–91 survey of the Grand Canyon river corridor identified 24 site types (Fairley et al. 1994:12–13). In June 1999, the RCMP staff reclassified these 24 site types into 10 sites. The change was made at the request of the PA signatories, who found the 24 site types confusing and sometimes inconsistent. The 10 site types can be considered a proposed set of property types for nominating sites to the National Register under the Multiple Property submission framework identified above. It should be emphasized that these property types do not represent a specific set of "site types" as that term is traditionally understood in a research context, i.e., they are not linked to any specific (and thereby excessively restrictive, for National Register purposes) theoretical orientation, statement, or proposition. They are instead "property types" as that term has been intended for use in the context of a National Register Multiple Property Area nomination, and as the term has been successfully interpreted in previous such nominations in the state of Arizona (e.g., Downum 1988a, 1988b, 1988c, 1997). As such, they represent a compromise set, designed to incorporate multiple theoretical perspectives, research propositions, and tribal perspectives. They do indeed sort individual properties according to multiple criteria of temporal affiliation, formal features, and inferred function, but such is the reality of National Register property type definitions that attempt to incorporate historic properties as diverse as those found within the Grand Canyon river corridor.

In fact, the appropriate National Register Bulletin (NRB 16:Section II) *requires* that property types be defined according to multiple, cross-cutting criteria, because "a property type is a grouping of individual properties characterized by common physical and/or associative attributes." Further, property types can be defined based on "form, function, associations, events, or physical characteristics" (NRB 16:Section II, "Property Type Selection"). The most important aspect of property type definition therefore is not whether the list of property types suits the demands of a specific, fashionable theoretical orientation or model, but whether they can be used to link specific historic properties to historic contexts. As stated in NRB 16, "The selection should be based on a knowledge of the relevant historic contexts, and then on whether or not the type is a manageable and efficient tool for evaluating eligibility for National Register listing."

With these considerations in mind, it should be understood that the property types proposed below reflect potential historic contexts as defined by the original inventory survey (Fairley et al. 1994) and the draft NPS-USBR Historic Preservation Plan. The types proposed below could easily be subdivided on functional, temporal, or formal bases as necessary based on further research or consultation. It should also be understood that these revised site types are *proposed* site types only, and are offered here as a starting point for further elaboration within the proposed historic context (described above). In short, the current list of property types is not perfect, but does fulfill the necessity of creating multiple categories of property types (as outlined in NRB 16) for considering the National Register eligibility of individual properties thus far documented in the river corridor. Past success with National Register Multiple Property Area submissions suggests that these property types are at least a reasonable set potentially acceptable to the Historic Sites Review Committee in Arizona.

Given below are definitions of the 10 revised site types, followed by a discussion of how the types reflect changes in the original scheme of 24 types.

> Property Type 1: Thermal Feature. Sites of this property type consist of fire-cracked-rock scatters, with or without artifacts. The category includes hearths, fire-cracked-rock discard piles, and concentrations of fire-cracked rock.
>
> Property Type 2: Roasting Feature. This property type consists of a single formal roasting pit, with or without artifacts.
>
> Property Type 3: Roaster Complex. These sites consist of two or more formal roasting pits, with or without fire-cracked-rock scatters and artifacts.
>
> Property Type 4: Small Structure. This property type encompasses built habitations and rockshelters with evidence of modification or occupation. The type includes defined and un-defined rooms and storage features. Artifacts and fire-cracked-rock scatters may or may not be present.
>
> Property Type 5: Historic Structure. These sites are historic constructions, including cabins, bridges, and built remains associated with historic mining, stock raising, railroad construction, scientific endeavors, or dam construction.
>
> Property Type 6: Pueblo. This property type is made up of aboriginal constructions consisting of four or more contiguous rooms.
>
> Property Type 7: Artifact Scatter. This is a scatter or concentration of ceramic or lithic debris or flaked or ground stone tools. The category may include trash scatters of historic age.
>
> Property Type 8: Structure–Thermal Feature Complex: This property type encompasses sites having fewer than four pueblo rooms and one or more formal roasting pits. Artifacts may or may not be present.
>
> Property Type 9: Rock Art. This type consists of pictographs, petroglyphs, and inscriptions, including single isolated elements, small groups, large panels, subtle marks, remnant smudges, and historic inscriptions. Artifacts may or may not be present.
>
> Property Type 10: Special Activity Locus. This encompasses unusual or rare indications of past human activity associated with occupation or use of the Grand Canyon river corridor. It includes bedrock mortars, prehistoric mines, burials, isolated ceramic items, and such places as Stanton's Cave.

The site type reclassification presented above involved removing the ambiguous category "camp" and replacing it with a more specific designation (i.e., thermal feature, roasting feature, roaster complex, artifact scatter, small structure, rock art). In addition, the GRCA-NAU survey categories of bedrock mortar, burial, isolated pot, metate, and other cache were combined into Special Activity Locus. Any lithic or sherd scatters recorded by the survey were included under artifact scatters. Likewise, enigmatic features, ephemerally used structures, storage, and water or soil control sites were included under the new property types Small Structure, Roasting Feature, Artifact Scatter, Structure–Thermal Feature Complex, Thermal Feature, or Historic Structure.

Upon review of the first draft, PA members strongly stated that the reclassification of sites was not satisfactory. Of the three responses to this section, two reviewers highly recommended that temporal divisions be made. Other suggestions included classifying sites based on function and cultural affiliation in addition to temporal divisions. One reviewer noted that the reclassifications were inconsistent and not related to either theoretical perspectives or behavioral models. A suggestion was to use ethnographic models for site type or utilize a typological scheme used in the culture area as a basis for comparison.

After further investigation by RCMP staff, site typology can be created using the Grand Canyon National Park's survey site types in conjunction with the original river survey information on the IMACS form. Using a combination of both the IMACS data and GRCA's site typology, sites within the river corridor can be identified by time periods, cultural affiliation, function, or a combination of these. Geomorphic settings can also be included if warranted, as suggested by one reviewer. Overall, site types can be created within the RCMP office based on existing data. RCMP staff can complete this task efficiently with continued assistance and suggestions from PA members. Due to time constraints, the new site types are used in this report, keeping in mind that they are temporary and a third reclassification of site types will be submitted to PA members for concurrence.

RESEARCH QUESTIONS AND INFORMATION CATEGORIES

The Historic Context and Property Types described above provide the framework for organizing and systematizing important research questions and information categories required to answer those questions. Under Criterion D of the National Register, significance of individual properties derives from their potential to answer important research questions that have been posed within a particular context. Currently, the ability of individual sites to answer research questions is only generally known; it is understood, but not documented in detail, that all of the sites currently monitored have enough research potential and ability to convey information to justify consideration as potentially eligible for the National Register. In the proposed Historic Context outlined above, research questions are generally centered on understanding the nature of human adaptation, cultural systems, and belief within the Grand Canyon river corridor. With full development of the context, specific research questions could be elaborated that would provide the mechanism for understanding precisely which questions could be answered by individual sites. This in turn could provide the mechanism for a priority ranking of sites according to not just the ongoing threats to their integrity, but their research potential as well.

A draft Historic Preservation Plan (USDI et al. 1997) has made a start toward identifying some of the important research questions that could be addressed with data contributed by river corridor sites. In this document, eight Theoretical Research Domains were identified: (1) Dating and Chronometrics; (2) Demography, Settlement Systems, and Cultural Affiliation; (3) Socio-Political-Ideological Research; (4) Technology and Industry; (5) Exchange, Trade, and Commerce; (6) Subsistence; (7) Transportation and Communication; and (8) Government. Each of these domains was elaborated in terms of local, regional, and more general research questions, and an attempt was made to identify the databases that would be required to address these questions.

The research domains identified in the above-mentioned 1997 HPP provide an excellent starting point for preparation of a formal National Register Multiple Property submission and accompanying National Register District nomination for the Grand Canyon River Corridor (see Neal et al. 1998 for additional research questions). The broad historic context identified above, "Human Adaptation, Resource Utilization, Knowledge, and Cultural Vitality along the Colorado River in the Grand Canyon, ca. 10,000 B.C. to A.D. 1963," provides a means for integrating the diverse questions posed, and also for integrating additional ethnographic knowledge gathered since the inception of environmental studies of the river corridor. What is required beyond this is identification of the specific information categories present at each property type that might have relevance to answering these questions, and an assessment of the integrity of each site. This information is now available, after more than 10 years of survey and monitoring, and could readily be systematized and placed in the form of a National Register nomination. In addition, the context given above and the information collected so far could be used to document National Register eligibility under Criteria A, B, and C, as well as D.

At some future point, the use of a Multiple Property documentation format would also allow addition of knowledge about TCP considerations involving nonarchaeological places to an existing National Register District nomination. That is, when sites along the river corridor have been nominated as a district under the Multiple Property submission format for their significance under Criterion D, an addendum or revision could be prepared to accommodate tribal perceptions of site significance and integrity, most likely making use of TCP considerations for existing property types.

TRADITIONAL CULTURAL PROPERTY CONCERNS

The issue of TCPs is complex and a full synthesis and relation of this issue to National Register criteria of eligibility is beyond the scope of the RCMP's efforts to date. However, since its inception the RCMP has operated in a framework of intensive tribal consultation, and tribal concerns have been incorporated into the project in multiple ways, ranging from determination of monitoring schedules to proposed remedial actions.

Tribes affiliated with or having an interest in river corridor sites have indicated that the entire Grand Canyon is crucial to maintaining the cultural identity of each tribe's community. The existence and significance of each tribe's traditional cultural properties have been documented through intensive ethnographic research (Ferguson 1998; Hart 1995; Havatone 1992; Hualapai 1992; Masayesva 1992; Roberts et al. 1995:22; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). Although TCPs range from natural resources to cultural resources, the discussion below focuses on ancestral archaeological sites identified by the tribes as TCPs. Determination of Eligibility has been completed for all archaeological sites, including archaeological sites regarded as TCPs. TCPs that are not considered archaeological sites are still under consideration for the National Register, but this process is being pursued outside of the RCMP.

Recent ethnographic literature indicates that TCPs in the Grand Canyon represent a relationship between the tangible and intangible (Hualapai 1992; Masayesva 1992; Roberts et al. 1995:22; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). As tangible resources, the ancestral archaeological sites or TCPs are eligible for the National Register due to their association with events that have made a significant contribution to their culture (Criterion A) and association with the lives of a person significant to their past (Criterion B). Some tribes suggest that certain TCPs are also eligible under National Register Eligibility Criteria C and D. Specific tribal justifications for National Register eligibility are presented in the discussions below.

Grand Canyon National Park has recorded the accelerated physical erosion of archaeological sites in the River Corridor for the past 20 years. RCMP staff have collected data regarding the specific effects of Glen Canyon Dam on downstream cultural resources. National Register Bulletin 38 addresses the issue of disturbance or damage to TCPs due to a federal undertaking such as the existence and operation of Glen Canyon Dam.

Establishing that a property is eligible for inclusion in the National Register does not necessarily mean that the property must be protected from disturbance or damage. Establishing that a property is eligible means that it must be considered in planning federal, federally assisted, and federally licensed undertakings, but it does not mean that such an undertaking cannot be allowed to damage or destroy it. Consultation must occur in accordance with the regulations of the Advisory Council (36 CFR Part 800) to identify, and if feasible adopt, measures to protect it (NRB 38:4).

Since 1992 the RCMP has adopted feasible measures of preservation at archaeological sites (i.e., checkdams, revegetation, trail obliteration) while continuing to document the accelerated physical erosion caused by Glen Canyon Dam (Coder et al. 1994a, 1995a, 1995b, 1994b; Leap et al. 1996, 1997, 1998). The tribes have endorsed the long-term monitoring and preservation of archaeological sites in the river corridor due to this accelerated erosion (Ferguson 1998; Hart 1995; Roberts et al. 1995:22; Secakuku 1997; Havatone 1992; Hualapai 1992; Masayesva 1992; Stevens 1996; Stoffle et al. 1994).

SIGNIFICANCE OF RIVER CORRIDOR SITES TO THE CULTURAL VITALITY OF NATIVE AMERICAN TRIBES AND NATIONS

After extensive review of documentation pertaining to Native American association with the river corridor, it is apparent that the Canyon and its resources contribute significantly to the cultural vitality of the Hopi, Hualapai, Navajo, Paiute, and Zuni tribes. The Havasupai tribe considers the Grand Canyon significant to their culture, but has decided not to participate in the Programmatic Agreement.

Generally, Grand Canyon archaeological sites represent the footprints of tribal ancestors who inhabited this region for thousands of years. Tribal oral histories and traditions reflect the significance of the Grand Canyon in the past and its continued importance to modern-day Native Americans. Each tribe participating in the Programmatic Agreement has indicated that culturally significant places along the river are critically connected with other places outside the river corridor in the Grand Canyon region.

Hopi

The Hopi Tribe considers the Grand Canyon and its resources extremely important because of its past and ongoing role in Hopi history, culture, and religion (Ferguson 1998; Secakuku 1997). The Hopi use the word *Hisatsinom* to refer to the prehistoric Puebloan ancestors of the contemporary Hopi people (Ferguson 1998:251). Hopi cultural advisors inspected 235 prehistoric Puebloan archaeological sites in the Grand Canyon and concluded that these sites are Hisatsinom sites (Ferguson 1998:251). In fact, the Hopi believe that the Grand Canyon archaeological sites are still inhabited by the spirits of Hopi ancestors (Ferguson 1998:251). Hopi cultural advisors on GCMRC river trips have felt the presence of their ancestors while traveling through the Grand Canyon and visiting Hisatsinom sites (Ferguson 1998:252). The Hopi believe that archaeological sites are monuments of Hopi history and that Hopi history is embedded in giving meaning to the landscape (Ferguson 1998:265–266). Cultural advisors indicated that the Hisatsinom sites in the Canyon are also important to the Hopi because their ancestors are buried in many of the archaeological sites (Ferguson 1998:254).

The Hopi suggest that the entire Grand Canyon, from rim to rim, be nominated as an historic district based on its traditional cultural significance (Secakuku 1997:2). However, they also believe that the Canyon includes many properties and locations that are individually eligible to the NRHP under some or all of the criteria.

The Hopi propose that the entire Grand Canyon be considered eligible to the NRHP based on Criteria A, B, C, and D. The Grand Canyon is eligible to the NRHP under Criterion A because of its association with events that have made a contribution to the broad patterns of Hopi history (Secakuku 1997:3). Criterion A is defined by 36 CFR Part 60 as association with events that have made a significant contribution to the patterns of our history. Events can include specific moments in history or a series of events reflecting a broad pattern or theme (NRB 38:11). Association specifics that reflect a broad pattern or theme are clearly outlined within the Hopi letter drafted to the Bureau of Reclamation in March of 1997 (Secakuku 1997).

The Hopi believe that the traditional significance of the entire Grand Canyon is also evident in Criterion B because of its association with numerous personages and deities that are fundamental in Hopi History (Secakuku 1997:3–5). Criterion B in 36 CFR Part 60 is defined as association with the lives of persons significant in our past. The word *persons* can be taken to refer to both tangible persons or gods and demigods who feature in the traditions of a group. The associations of such persons are clearly outlined within the Hopi letter drafted to the Bureau of Reclamation in March of 1997 (Secakuku 1997). Additionally, these sites are eligible under Criterion C because of their overall contribution to the significance of *Ongtupka*.

The Hopi believe that the entire Grand Canyon is also eligible under Criterion D because it has the potential to yield important information concerning Hopi history, occupation, and traditional cultural use of the Canyon (Secakuku 1997:5). Criterion D in 36 CFR Part 60 is defined as yielding, or potential to yield, information important in prehistory or history. The Hopi traditional cultural properties include ancestral archaeological sites, the Colorado River, the Little Colorado River, the Sipapuni, the Hopi Salt Mine, the Hopi Salt Trail and other shrines associated with its use, Lees Ferry, Vasey's Paradise, Shinamu Alter, the Moqui Trail to Cataract Canyon, and other Hopi trails in the Grand Canyon as eligible under one or more National Register criteria (Secakuku 1997:6–11).

A Traditional Cultural Property is any aspect of Hopi cultural history that is of significance, as determined by the Hopi people and religious leaders, by virtue of its role in the development or continuation of traditions that provide the historic foundation of Hopi culture. Hopi TCPs are delineated by the integrity of their geographical location and the knowledge that defines the significance of these components of Hopi culture and history. Hopi traditional cultural properties can include, but are not limited to, landscapes, natural features, springs, ancestral archaeological sites and burials, shrines, and resources and resource collection areas (Secakuku 1997:1).

The Hopi Tribe claims cultural affinity with at least 235 of the sites in the river corridor (Masayesva 1992), which they consider to be ancestral sites and traditional cultural properties.

Hualapai

The geographical and territorial affiliations of the Hualapai people with the Grand Canyon and Colorado River begin with the Hualapai creation account in oral traditions. The Hualapai believe that the Canyon is significant because it was their place of origin. The Hualapai view the entire Grand Canyon as a sacred area (Hualapai 1992:39).

The Hualapai Cultural Resource Division stipulates that archaeological sites and sacred sites have continuing, timeless (i.e. having eternal) significance to their lifeways, beliefs, and values (Hualapai 1992:50). The Hualapai Nation has identified 76 Traditional Cultural Properties along the

Colorado River in Grand Canyon National Park that are founded in Hualapai cultural knowledge, understanding, and practices (Havatone 1992).

Traditional is taken to mean the aspects of social knowledge, experience, actions, behaviors, and materials that are transmitted or passed from one generation to the next. *Cultural* encompasses the domain of what people do and think; it is therefore an expansive concept category (Stevens 1996:2) but is limited to the range of traits, behaviors, materials, and beliefs that are ascertainable and, usually, distinctively Hualapai. The term *properties* has a range of meanings, including geographic places (as in real estate), the elements and items associated with these places, and the *characteristics* of these elements, inclusive of what distinguishes these elements and places from others; these are the attributes that make them distinctive, unique, and important (Stevens 1996:2–3).

Navajo

The Navajo Nation believes that the significance of the river corridor and specific places within it cannot be separated from the larger landscape of which it is a part (Roberts et al. 1995). The Navajo believe that the Colorado River is one of the veins of the earth and that the Humpback God created the Grand Canyon (Roberts et al. 1995:22). The Navajo believe the Colorado River is of divine creation and is itself alive. The Grand Canyon is also the home for many Navajo deities. Many Navajo have explained the different meanings of the Colorado River in their lives as well as the entire Navajo Nation (Roberts et al. 1995:22). Roberts et al. (1995) give detailed information regarding the significance of the Grand Canyon and the Colorado River to the cultural vitality of the Navajo Nation. The Navajo Nation has addressed the issue of National Register eligibility in the Grand Canyon through the following statement:

> The Historic Preservation Plan developed for the Grand Canyon River Corridor District must recognize that the District is defined in terms meaningful in a management context, but not necessarily in a cultural or historical context, and that places and sites identified in the River Corridor District are related to sites and places on the canyon terraces and rims (not to mention more extensive landscapes). For this reason the Navajo Nation has not made specific National Register eligibility recommendations, but as the historic preservation plan for the National Register District is developed the Historic Preservation Department will provide information regarding each site's contribution to the district. (Roberts et al. 1995:113)

Southern Paiute (San Juan Southern Paiute, Kaibab Paiute Tribe,
Shivwits Paiute Band of the Paiute Indian Tribe of Utah)

The Southern Paiutes have long-standing traditional cultural ties to the Colorado River and its canyons; they believe they were created in the traditional lands bounded by more than 600 miles of the Colorado River. Within this traditional land no place is more sacred or special than the Colorado River or Big River Canyon (Stoffle et al. 1994:1). The Paiute also believe that the Colorado River is one of the most powerful of all natural resources on their traditional lands (Stoffle et al. 1994:1). Traditionally the Southern Paiute lived, farmed collected plants, and hunted along the Colorado River, and for this reason the banks of the Colorado contain significant human artifacts and natural elements crucial to the cultural vitality of the Paiutes. The Canyon and Colorado River also have vital significance to the Paiute people because this region became a refuge from the Euroamericans who had historically encroached upon the Paiutes.

Modern Southern Paiutes continue to use the Grand Canyon and Colorado River in traditional ways as mandated by their creator (Stoffle et al. 1994:2). The Grand Canyon River Corridor Survey identified 50 sites as Paiute or Pai/Paiute (Stoffle et al. 1994:2).

The Colorado River is an extremely sacred and culturally significant location to the Paiute people (Stoffle et al. 1994:56). The Paiute people believe that ancestral archaeological sites should be used to help achieve cultural continuity by taking their children to a site to teach about past lifeways (Stoffle et al. 1994:176).

Zuni

The Zuni believe that they first emerged into this world through a sacred place deep within the Grand Canyon (Hart 1995:3), and they have identified many features at Puebloan archaeological sites that represent aspects of their emergence and migration. They have made pilgrimages to shrines and sacred places on the Zuni River and in the Grand Canyon for many centuries and they view these places as the homes and final resting places of their ancestors (Hart 1995:3, 14). Like the Hopi, the Zuni believe that these sites were never abandoned (Hart 1995:16). The Zuni view the Canyon as both alive and sacred. The Zuni Tribe believes that the ancestral archaeological sites (Puebloan sites from river mile 50 to the confluence of Bright Angel Creek) qualify for designation as Traditional Cultural Properties and possess the necessary criteria for inclusion into the National Register of Historic Places (Hart 1995:16). The ancestral sites meet the test for both tangibility and integrity of relationship and condition (Hart 1995:116). They claim the ancestral archaeological sites within this area as the Traditional Cultural Property of the Zuni Tribe.

The archaeological sites are manifestations of those who lived in the region, and are not only representative, but responsible for a broad portion of the history of that region. Many sites are associated with a number of important spiritual, mythic, and real persons of significance to Zuni, and with important narratives that explain the religious and traditional history and meaning of the region to Zuni. Construction at most of the sites embodies distinctive characteristics of recognizable types, periods, or methods. Continued research into these archaeological sites would yield a wealth of information about the history and prehistory of the region, although the tribe opposes most data recovery (Hart 1995:16–17).

TRADITIONAL CULTURAL PROPERTIES AND MANAGEMENT CONSIDERATIONS

Many of the tribes have identified ancestral archaeological sites in the river corridor as Traditional Cultural Properties. Because of this, these sites should be evaluated for eligibility to the National Register. As noted above, this could be accomplished within the historic context proposed for a Multiple Property submission. The tribes have stressed that there is no separation between the tangible, such as an archaeological site, and the intangible, such as the spirits remaining at a site (Ferguson 1998; Hart 1995; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). However, the intangible does not always apply to a religious context. TCPs would be nominatedto the Register not as religious properties (a potentially problematic designation) but as ancestral sites maintaining traditional cultural significance. Even if some sites do have religious connotations, this does not automatically exclude them from eligibility into the Register (NRB 38:25):

> The fact that a property is used for religious purposes by a traditional group, such as seeking supernatural visions, collecting or preparing native medicines, or carrying out ceremonies, or is described by the group in terms that are classified by the outside observer as religious should not be itself taken to make the property ineligible, since these activities may be expressions of traditional cultural beliefs and may be intrinsic to the continuation of traditional cultural practices.

The tribes have also stated their position when dealing with properties that have religious or cultural significance (Ferguson 1998; Hart 1995; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). The preferred actions are preservation measures and continued long-term monitoring of the resources. The consultation process has indicated that the tribes have certain TCPs that are off limits to any mitigation measures, but these are clearly identified in tribal reports and do not include most of the archaeological sites (Ferguson 1998; Hart 1995; Hualapai 1992; Masayesva 1992; Roberts et al. 1995; Secakuku 1997; Stevens 1996; Stoffle et al. 1994). Overall, the tribes maintain that mitigation should be performed due to the adverse effects of man-made disturbance caused by Glen Canyon Dam. If the physical erosion were entirely a natural process at these sites then the tribes would feel much differently about mitigation options. The existence and operation of Glen Canyon Dam causes adverse impacts to downstream archaeological sites and TCPs (Coder et al. 1994a, 1995a, 1995b, 1994b; Leap et al. 1996, 1997, 1998). Given below are brief synopses of tribal positions on archaeological site management with respect to the operation of Glen Canyon Dam.

Hopi

The Hopi tribe has strongly conveyed the position to preserve and protect the archaeological sites in the Grand Canyon from damage or loss. One Hopi cultural advisor explained that he places great value on the Hisatsinom villages and potsherds because these sites were left to pay for the use and settlement of this area, and this is why these ancestral cultural resources should be protected (Ferguson 1998:253–254). Leigh Kuwanwisiwma, the director of the Hopi Cultural Preservation Office, stated his sense of personal loss regarding the erosion of sites along the River Corridor due to the existence and operation of Glen Canyon Dam. Mr. Kuwanwisiwma is concerned that the Hopi are losing information about the past of the Hopi people (Ferguson 1998:267).

The Hopi position regarding excavation of ancestral Puebloan sites along the River Corridor is defined through comments in Ferguson's 1998 report. The general feeling is that the archaeological record should be preserved in situ; however, when in situ preservation is not an option, excavation should be used to retain information vital to the history of the Hopi people. In such unfortunate situations, excavation should be associated with intensive consultation. Hopis believe that valuable information can be obtained from the scientific study of archaeological sites that are in danger of being destroyed (Ferguson 1998:276). When sites are adversely impacted by human land use, many Hopis believe that they should be studied in a sensitive manner so contemporary Hopis have one more means to learn about their ancestors and all knowledge of the physical is not lost (Ferguson 1998:276).

Excavation as a management strategy to mitigate adverse impacts to archaeological sites is controversial to some Hopi but acceptable to others (Ferguson 1998:267). Hopi cultural advisors believe that archaeological excavation may expose some spiritual forces that will hurt people and that this is why consultation is needed during archaeological research (Ferguson 1998:267). The consensus of the Hopi cultural advisors is that Hisatsinom archaeological sites in the Grand Canyon need to be protected from pothunting, vandalism, and adverse impacts (Ferguson 1998:267). The Hopi feel that as a last resort, archaeological sites should be recorded, and appropriate and sensitive studies be performed before these sites are destroyed (Ferguson 1998:267). Mike Yeatts, an archaeologist for the Hopi Tribe, has played an intricate role in the proposal and mitigation of highly impacted archaeological sites along the river corridor (Leap et al. 1999a, 1999b; Yeatts 1998; Yeatts and Leap 1996, 1997).

The Hopi cultural advisors agree that if archaeological sites are not in danger of loss due to erosion, they should not be collected and the BOR and NPS should control erosion so that artifacts are not exposed (Ferguson 1998:270). Cultural advisors think that archaeological materials mark the Hopi claim to the Grand Canyon, and if they are allowed to wash away there will be nothing to demonstrate that claim (Ferguson 1998:271). Another advisor stated that it is wrong for archaeological sites to be eroding from the operation of the dam. Hopi cultural advisors who conducted fieldwork in the Grand Canyon concluded that much of the soil erosion at archaeological sites in the Canyon is not natural but is related to the operation of the dam (Ferguson 1998:272). Because of this erosion the advisors suggest that remedial action is needed to protect the sites from further erosion. The Hopi Cultural Preservation Office has given the National Park Service the capability to respond quickly with remedial action when cultural resources are in need of management (Ferguson 1998:273).

The Hopi cultural advisors suggest that Glen Canyon Dam should be operated so that there is no adverse impact to ancestral graves from man-made erosion (Ferguson 1998:269). The Hopi cultural advisors also suggest that the avoidance of impact to ancestral graves and their in-place protection are better alternatives than the archaeological mitigation of adverse impacts erosion (Ferguson 1998:269). The Hopis recommend caution in assigning interpretive labels to architectural spaces such as kivas in the absence of excavation and intensive data recovery (Ferguson 1998:258).

The protection of sacred sites and access to them are of great importance to the Hopi people (Ferguson 1998:255). The Hopi people consider shrines as places where sacred offerings are deposited or ritual objects are set up (Ferguson 1998:255). The Hopi make it clear that managing shrines in areas subject to adverse impacts includes protection from any adverse impact (Ferguson 1998:257). The position of the Hopi Tribe is that damage to shrines and sacred sites cannot be mitigated and that the loss of a sacred site means the permanent loss of rituals associated with that site and the permanent loss of that portion of Hopi culture (Ferguson 1998:257–258).

Hualapai

Hualapai cultural scholars have expressed a profound concern for the need to preserve Hualapai Traditional Cultural Properties (Hualapai 1992:40). They believe that archaeological sites and other areas of cultural remains are sacred (Hualapai 1992:40). The Hualapai, like the Hopi, have differing views within the tribe regarding the preservation of archaeological sites. Some believe that modern people regardless of environmental threats should leave sites alone, but others believe that sites should be preserved for education and museums.

The Hualapai note that operation of Glen Canyon Dam influences when, where, and how river recreationists interact in the Canyon (Hualapai 1992:44). Many Hualapai consultants are concerned that water releases from Glen Canyon Dam are impacting river resources (Hualapai 1992:45). The Hualapai view the degradation of Hualapai natural and cultural resources as a result of the operations of Glen Canyon Dam or by any other means as threats to tribal sovereignty, economic self-sufficiency, environmental quality, human rights, and the mental and physical well-being of Hualapai citizens (Hualapai 1992:48).

Hualapai cultural resource management is viewed as a necessity for achievement and maintenance of social identity, continuity of lifeways, community well-being, and trans-generational cohesion, communication, and understanding (Hualapai 1992:48). Hualapai cultural scholars believe that the operations of Glen Canyon Dam should be conducted in ways that will provide maximum protection to natural and cultural elements of the entire Grand Canyon (Hualapai 1992:48). The Hualapai have given recommendations for the preservation of cultural resources along the Colorado River in Grand Canyon National Park.

The Hualapai Tribe Cultural Resources Division recommends that the United States Bureau of Reclamation select an alternative for the operation of Glen Canyon Dam that will both protect and preserve the natural and cultural resources in the Grand Canyon. This requires that efforts be made to ensure that any and all economic or technological developments or multiple-use strategies bringing deleterious consequences to the Hualapai Tribe or the Grand Canyon should be prevented, or, if necessary, remediated. Encroachment and destructive impacts on locations and areas of cultural and historical significance should be forbidden by means of law and policy. Mitigation of destructive impacts should be a management strategy for sites only where previously unregulated or unrestricted economic pursuits impinge upon the Hualapai Tribe's cultural, environmental, and natural resources (Hualapai 1992:49).

Navajo

The Navajo have stated that many places of cultural significance are sufficiently above the river and that the affects of Glen Canyon Dam operations will probably not affect them directly, unless there are huge floods (Roberts et al. 1995:112). However, what is more important is the preservation of stories about those places that perpetuate the significance of the place from generation to generation (Roberts et al. 1995:113). The Navajo want to protect the physical places as much as possible from the artificially high rate of erosion and encourage continued Navajo access to help perpetuate the stories and preserve the importance of such places (Roberts et al. 1995:112).

The Navajo Nation endorses a long-term monitoring program developed with the Programmatic Agreement members involved in the management of cultural resources in the Grand Canyon (Roberts et al. 1995:113). The Navajo Nation recommends periodic evaluations of the conditions of Navajo sites and places along the River Corridor. The Navajo Nation also endorses the construction of checkdams and similar measures to slow the erosion at sites in the Palisades Complex and elsewhere (Roberts et al. 1995:113).

Paiute

Paiute tribal representatives have stated that sites near the water (Colorado River) should be protected from destruction by adjusting water releases from Glen Canyon Dam (Stoffle et al. 1994:278). Some traditional Paiute sites have already been lost to erosion and nothing can be done to mitigate the destruction (Stoffle et al. 1994:278). The Paiute have stated that tourist behavior is associated with water release policies, due to dam-related erosion of beaches causing visitors to camp at fewer places, concentrating people into certain areas. The concentration of people then leads to higher occurrences of visitor disturbance at archaeological sites (Stoffle et al. 1994:279).

Tribal recommendations for minimizing disturbance include restricting access to certain sites, better communication with boatmen about disclosing site locations to passengers, increased NPS site edict lectures, and continued relationships between the federal agencies and the Southern Paiute tribes. Other recommendations include ensuring that water levels are maintained as low as possible to avoid rapid fluctuations in water level, reducing trailing by planting cacti or otherwise blocking existing trails, and continued participation in the Adaptive Management Program (Stoffle et al. 1995:155–156, Stoffle et al. 1994:279).

The Paiute have expressed a preservation philosophy for traditional lands, animals, plants, artifacts, burials, and minerals existing on such lands (Stoffle et al. 1994:29). The Paiute preservation philosophy essentially implies that cultural resources should be left undisturbed, preserved as they are and not moved in any way (Stoffle et al. 1994:29). This philosophy includes disturbance caused by scientific research, which is not a belief of the Paiute people (Stoffle et al. 1994:29).

The Paiute people believe that natural elements such as soil, water, rocks, and minerals should be protected from contamination, alteration, and movement (Stoffle et al. 1994:31). The Paiute people believe that artifacts should be left in their original spot so that when their owner returns they will still be there (Stoffle et al. 1994:33).

The Paiute have stated that sacred sites should be completely avoided by park personnel, river-runners, and tourists (Stoffle et al. 1994:295). The Paiute also recommend special protection from visitors for C:13:003, Hematite Mine, Vulcan's Anvil, Bedrock, and Granite Park (Stoffle et al. 1994:295). Indian monitors will visit sites selected by the Southern Paiute tribes on a regular basis to assess their condition and the effect of the water flow and impacts from tourists on the resources (Stoffle et al. 1994:297).

Zuni

The Zuni believe that archaeological features should not be disturbed due to the association of burials with many of these features (Hart 1995:17). If disturbance is absolutely necessary, the Zuni state that archaeological work should be performed by qualified archaeologists in accordance to NAGPRA, Zuni tribal policy, and the Zuni Heritage and Historic Preservation Office (Hart 1995:17).

The Zuni have concluded that the erosion along the Colorado River in Grand Canyon National Park, endangering and actually damaging many archaeological sites, is not natural and has been caused by Glen Canyon Dam (Hart 1995:17). The Zuni are concerned with the amount of sediment trapped behind the dam, which leads to erosion in the terraces along the river where archaeological sites are located.

The Zuni believe that if such erosion is natural, then it should be left alone, but if it is man-made, the erosion should be checked. They believe the dam has created sediment starvation in the river and that this has led to arroyo cutting in the beaches and terraces along the river. For this reason, they have recommended erosion control techniques that could be used to protect sites and repair erosional damage that has already occurred. They suggest using techniques such as those employed by the Zuni Conservation Program in repairing erosion on the Zuni Reservation (Hart 1995:17).

The Zuni believe that any cultural materials unearthed during checkdam construction should not be taken for analysis, but should be placed behind the checkdam (Hart 1995:18). However, the Zuni recommend that the Park Service document cultural remains. The Zuni also oppose soil and pollen samples, even if unassociated with cultural materials (Hart 1995:18).

If erosion cannot be prevented, and if it threatens to destroy or significantly damage an archaeological site or shrine, the team recommended that the National Park Service take action to stabilize the site. The preferred method of stabilization would involve techniques that stabilized the watershed around the site and did not affect the site (Hart 1995:18).

Data recovery from sites should be undertaken only when all other measures fail, and then should be undertaken coupled with consultation with the tribe. The Zuni prefer preventative actions, stabilization, and erosion control to any data recovery (Hart 1995:19).

The Zuni position regarding the discovery of pots, funerary objects, or human remains includes the reburial of such objects according to Zuni tribal policy and NAGPRA (Hart 1995:21). Also, the Zuni tribe requests that Zuni representatives and Park Service archaeologists perform long-term monitoring of Zuni shrines. Archaeologists will not document shrines and should not keep any written records of such features (Hart 1995:21).

CONCLUSION

In legally mandated cultural resource management, eligibility for the National Register is an important issue. Currently, the RCMP operates under a documentation of Register eligibility that was created during the initial river corridor survey of 1990–91 (Fairley et al. 1994). We propose a more rigorous and systematic approach to eligibility documentation by making use of the Multiple Property submission format, and by using all available information from the original survey, activities of the RCMP, and tribal consultations. It is hoped that in the coming fiscal year, additional progress can be made toward the end of formally recognizing and evaluating the National Register significance of monitored sites, so that those sites can be more effectively managed from both research-oriented and tribal perspectives.

PART II

FY99 MONITORING REPORT AND DATA SYNTHESIS FOR FY92–99

CHAPTER 4. GEOMORPHOLOGICAL BACKGROUND

Andrea R. Miller

The downcutting of the Colorado River that produced the Grand Canyon required 5.3 million years to reach its current depth and morphology (Lucchitta 1991:9). The geomorphic history of the Grand Canyon includes long erosional periods dominated by downcutting, with short intervals of backfilling. The Colorado River represents the controlling force of erosion and change. The Rocky Mountains provide the snowmelt necessary to propel the runoff through the course of the Colorado River along the Kaibab Plateau, through the Grand Canyon, and finally ending at the Gulf of California (Collier 1980; Collier et al. 1996; Ford et al. 1974; Hunt 1974).

In 1963, Glen Canyon Dam constrained the Colorado River, changing the geomorphic activities within the Grand Canyon. A review of the Grand Canyon's geomorphic history provides the necessary background to assess the effects of the dam as they relate to long-term, broad processes. This synthesis permits realistic evaluations of changes in geomorphic processes through time and offers a method for dealing appropriately with deviations in the environment of the Canyon and effects on archaeological resources.

Grand Canyon geomorphology relies primarily on the concept of vertical distribution of change (Lucchitta 1991). At the lowest level of the Canyon, the Colorado River responds to climatic variations at both its source in the Rocky Mountains and locally within the Canyon, adding erosive material (both water and sediment) to the Canyon system. Higher above the river itself, slopes and cliffs contain eroded soil and rocks that provide further debris. These react to local variations in climate change, providing a source of change themselves, with dynamic wall activities causing debris flows and contributing sediment for tributary fans. Finally, in between the river itself and the steep canyon walls lies sand deposited primarily from the Colorado River, which provides soil for terraces of the Canyon. These terraces contain large concentrations of archaeological remains and provide an environment for geomorphic activities such as channeling and arroyo cutting.

The overall geomorphology of the Grand Canyon embodies three separate forces at work (Hereford 1993; Hereford et al. 1993). First, the movement of water (fluvial) presents the main erosive agent of the Grand Canyon. Fluvial components include the Colorado River itself (water and sediment transport) as well as channels and gullies along the terraces and tributaries of the Colorado River. Second, tributary debris flows and slope changes within the Canyon (colluvial) create formations that, in turn, affect the Colorado River's course and modify the river's effect on various Canyon deposits. These activities play a small role in protecting or eroding archaeological remains, but function as an important part of the overall Canyon geomorphology. Finally, eolian (wind) processes redistribute sediment, filling some portions of the Canyon and encouraging erosion of others. These processes work together to produce continued change and effect to archaeological resources along the river corridor of the Grand Canyon.

RIVER CORRIDOR GEOMORPHIC SETTINGS

The Operation of Glen Canyon Dam Final Environmental Impact Statement correlates only a narrow gorge of the Grand Canyon to the activity of the Colorado River. Instead, this study outlines several other factors that determine the morphology of the Canyon as it appears today. These activities include running water from the canyon walls, freezing and thawing processes, and abrasion of rock against rock (USDI 1995).

The Colorado River corridor of the Grand Canyon contains five distinct geomorphic settings, as outlined by Thompson et al. (1998). Each of these environments responds differently to erosional processes, including those induced or enhanced by dam existence. Furthermore, different geomorphic settings provide various effects on archaeological resources in the corridor. The five settings are bedrock–talus slope, alluvial fan, fan lobe, deltaic fan, and eolian. These processes work in combination and characterize smaller subsets of previously mentioned geomorphic processes.

The bedrock–talus slope setting provides large amounts of rainfall runoff with "maximum erosive power" (Thompson et al. 1998). Shales slow runoff by providing more permeable surfaces and increased vegetation to catch and absorb runoff. Side canyon alluvium settings include alluvial fan settings, fan lobe settings, and deltaic fan settings. Alluvial fans are characterized by small drainages that deposit local alluvial fans of soft shales, whereas fan lobes represent boulder deposits at the mouths of "medium-sized tributary canyons" (Thompson et al. 1998:42). Fan lobes provide protection for archaeological sites within terraces. Deltaic fans result from large tributary canyon headwaters that form extensive fans at their confluence, often creating recirculation zones. Finally, the eolian setting reworks and deposits sand on terraces. This setting provides a check for runoff due to the sand's high permeability and offers protection for archaeological resources. All of these corridor settings fall within a larger scope of geomorphic activity within the Grand Canyon.

FLUVIAL PROCESSES AND ALLUVIAL DEPOSITS

The Colorado River represents the main force actively changing the Grand Canyon. Although many fluvial geomorphic processes do not affect archaeological resources directly, the changes they produce in the environment of the river corridor as a whole impact terraces containing archaeological remains.

Recirculation Zones

Recirculation zones within the Colorado River are areas of decreased velocity where the main flow separates due to sharp bends or width constriction (Schmidt 1990). In these recirculation zones, sediment builds up and creates sandbars, affording protection from direct river scouring of talus slopes. Moreover, the ephemeral, or fluctuating portions of sand bars act as a buffer for the more stable perennial deposits, further protecting slopes from erosion (Cluer 1992:37).

Separation deposits and reattachment deposits furnish the two types of sandbars present in the Colorado River (Schmidt 1990). These deposits form when water velocity decreases due to constrictions in river width, obstructions (boulders), or changes in river direction (bends and meanders). These types of depositional environments often occur at tributary debris flows, where tributaries dump large amounts of sediment and boulders into the river. Eddies develop at the separation point furthest downstream, marking the beginning of the recirculation zone and the initial sandy deposit (separation bar). Eddies moving in different directions also deposit sand at the reattachment point (reattachment bar) where the river finally reaches the channel edge at an expansion point. These deposits depend on river velocity, sediment content of the river, and tributary debris flows that create the river constriction.

Fluctuating flows, characteristic of the post-dam era, have contributed to significant erosion of some deposits, especially to reattachment bars. The largest and highest sand deposits remain less susceptible to change, but a survey of all deposits shows net degradation (Schmidt and Graf 1990). Overall, separation bars appear more stable than reattachment bars, even when considering vertical aggradation. The upper surfaces of reattachment bars appear especially susceptible during high flow periods when they become "smoothed out" (Schmidt and Graf 1990). These degraded sand deposits afford less protection of slopes that contain archaeological resources.

Rapids

The presence of large boulders carried into the river by tributary floods creates areas of extreme horizontal and vertical constriction. The increased velocity flow paired with a fall in elevation through these narrow portions often forms rapids (Howard and Dolan 1981; Kieffer 1985, 1990). Glen Canyon Dam has decreased flow rates, eliminating seasonal high water floods and impairing the river's ability to move these large boulders. As a result, reworking of rapids now occurs less frequently and on a smaller scale (Howard and Dolan 1981; Kieffer 1985, 1990; Webb et al. 1997).

Terraces

The pre-dam terraces along the river corridor are remnants of dynamic fluvial activity. Terraces represent old floodplains. These terraces, specifically the striped and pueblo terraces, contain rich archaeological deposits (Hereford et al. 1993). Archaeological resources have been exposed due to later downcutting, during which the river's elevation drops and leaves behind the old floodplain. These terraces mainly include sediment from the Colorado River itself, but also incorporate debris from drainages running through the terrace, as well as localized mass wasting and eolian activity. Low post-dam flows and the absence of sediment-laden floods accelerate terrace erosion. This lack of replenishing sediment fosters continued exposure and erosion of archaeological remains.

The highest and oldest terraces of the river corridor, the striped and pueblo deposits, contain prehistoric archaeological remains (Hereford et al. 1993). Large pre-dam floods (100,000 cfs and greater) deposited these upper terraces, and erosive forces, such as wind and rainfall runoff, rework these deposits (USDI 1995). At present, channeling and gullying or arroyo cutting accelerate erosion of these terraces, impacting archaeological resources (Hereford et al. 1993).

Tributaries

Tributaries or side canyons present another fluvial aspect of geomorphic activity operating within the Grand Canyon. In the post-dam environment, these tributaries, specifically the Paria and Little Colorado Rivers, contribute the majority of sediment to the Colorado River system within the Canyon. These tributaries form debris fans at their confluence with the Colorado River, producing channel constrictions. These tributaries run through several terraces, downcutting into them on their course towards the Colorado River. Side canyon downcutting causes direct erosion of terraces that contain archaeological resources.

Eolian Processes

Eolian processes present an example of a local agent along the river that ultimately creates a balance between exposure and burial. Blowing sand forms dunes, covering archaeological deposits with a thick layer of sand and protecting them from erosion by active drainages. However, when wind removes sand from an area, this in turn decreases the amount of cover afforded for that other area. In addition, coppice dunes present a more permanent example of eolian deposition because sand becomes anchored to that area by vegetation. Therefore, these deposits are no longer available for redistribution. At the same time, other deposits become available when erosive forces expose new terraces and floodplain sands to eolian processes.

Channels, Gullies, and Arroyos

Rainfall runoff creates channels and gullies that drain the upper terraces of the river corridor. These channels expose archaeological remains buried within the terraces. Hereford (Hereford et al. 1993) denotes two types of channels: terrace based and river based. Channels furnish examples of streams that begin with a catchment (collecting pool) or subsequent cutting into terraces that flow downward toward some effective base-level, or lowest point. Several factors determine this base-level, including the size of the catchment, the length of the channel, and the type of soil the stream flows over. For instance, a large collecting pool will hold more water, which will have the gravitational power to create a longer, deeper channel with a lower base-level. However, if the water flows over porous (e.g., sandy) soil or over a relatively large, flat terrace, the base-level will be higher (Hereford 1993; Hereford et al. 1993; Kieffer 1990; Thompson et al. 1998).

The aforementioned factors determine whether a channel will remain terrace based or will become river based. This presents an especially important consideration for cultural resource management because monitoring efforts can identify and mitigate terrace-based streams with tools such as check-dams. River-based streams represent a more or less permanent feature (Hereford 1993; Thompson et al. 1998). According to Hereford, sites with river-based drainages have a small chance of being preserved, whereas all other sites, including sites with terrace-based drainages, have a better chance of preservation in place.

With increased rainfall or size of the collecting pool, the channel may deepen and widen, smoothing out the course of the stream. This permits more efficient water transportation, allowing the stream to finally reach the river. When the stream reaches the river, the channel continues to widen and deepen, becoming a permanent feature of the landscape (Hereford 1993; Hereford et al. 1993; Thompson et al. 1998).

The effects of Glen Canyon Dam, specifically the lowered base-level of the Colorado River and the lack of sediment-replenishing floods common during the pre-dam era, have exacerbated these natural processes. This results in artificial acceleration of downcutting by channels seeking this new base-level.

The downcutting of both terrace-based and river-based streams exposes archaeological remains, especially those within the striped and pueblo terraces. This promotes deterioration and loss of these non-renewable resources.

As a result of additional research regarding Hereford's model, a research proposal submitted by GCMRC was awarded to S. M. Wiele (USGS). His task (Wiele 1997) is to examine and forecast the effects of the operation of Glen Canyon Dam on sand deposits that are linked with the preservation of archaeological sites. Wiele is studying this by using a multidimensional model that will demonstrate the complex flow, sand transport, and erosion and deposition patterns.

The model has been used after the flood of the Little Colorado River and during the research flood of 1996 to study the magnitude, placement, and longevity of sand resources primarily in support of physical resources. It is Wiele's intent to broaden the model's utility by applying it to cultural resources along the river corridor. If the erosion of archaeological sites is a result of the lowered base-level and erosion of sand deposits because of the dam, then the restoration or preservation of those deposits could mitigate the destruction of archaeological sites, thereby achieving preservation of cultural materials in place (Wiele 1997:1b). To date, no information has been supplied to the RCMP office on the progress of this study. The anticipated results are expected in Fiscal Year 2000.

CONCLUSIONS

Chapters 5 through 8 of this report focus on the 264 sites within the APE. These sites have been grouped into four categories contingent on the research completed by Richard Hereford (USGS) as discussed above. First, the sites are grouped by the presence or absence of a drainage that is 10 cm or deeper. Second, sites with drainages are sorted by where the drainages flow to: the river, pre-dam terraces, a side canyon, or a combination of areas. Note that according to Hereford, drainages that flowed into a side canyon were not considered in his research because there was such a small occurrence (Hereford, personal communication, October, 1999). RCMP staff, however, have elected to identify sites with side canyon-based drainages as a result of Thompson's report (Thompson et al. 1998).

Drainage identifications are summarized based on the definitions supplied by Hereford (1993) and Thompson (Thompson et al. 1998). *River-based drainages* are streams that drain to the Colorado River: ephemeral streams that flow in direct response to rainfall. River-based streams have longer channels with less variation in length than channels or terrace-based streams. The catchment area of river-based streams is much larger than that of terrace-based streams.

Terrace-based drainages are streams that do not drain to the river: ephemeral streams that flow in direct response to rainfall. The effective base-level of terrace-based streams is controlled largely by the geomorphology of the river corridor. These streams drain to an older and higher depositional level of the Colorado River.

Side canyon-based drainages are streams that drain to side canyons; ephemeral streams that flow in direct response to rainfall (personal communication, Thompson et al. 1998).

Undeveloped drainages are sites with no drainages, or drainages less than 10 cm deep. These sites are commonly observed to have surface erosion, or channel initiation.

Based on these definitions, 118 sites have undeveloped drainages, 52 sites have river-based drainages, 65 sites have terrace-based drainages, six sites have side canyon-based drainages, and 23 sites have a combination of the types.

Drainage information is supplied on the monitoring forms so the initial identification is fairly straightforward. However, if the information on the forms was disputable or not available, supplementary information was gathered from photos, site maps, IMACS forms, and early monitoring forms to comprehensively identify drainage types. Project monitors who are simply familiar with a site further complemented this information. Additionally the monitoring form further defines drainage as either a gully or an arroyo. To distinguish the difference between a gully and an arroyo, RCMP has used the definitions supplied on the initial monitoring form (See Appendix A). A gully has a depth of 10 to 100 cm and an arroyo is greater than 100 cm in depth.

The next four chapters summarize site condition through time based on the accumulated monitoring data. RCMP personnel address two major questions as a result of these chapters: (a) Do the observations and the data collected by the monitoring program provide the appropriate information needed to meet the management objectives required by the PA (USDI et al. 1994) and the MRAP (USDI 1997a)? (b) Can we definitively determine the erosional condition (status) of a site over time?

To address these questions, in-depth analyses of the monitoring data were conducted by the current RCMP staff of N. Andrews, D. Hubbard, J. Kunde and L. Leap. This is the first time such an exhaustive investigation of the monitoring data (site by site) has been completed.

CHAPTER 5. SITES WITH RIVER-BASED DRAINAGES

Duane C. Hubbard and Lisa M. Leap

The RCMP staff is concerned with the drainage processes of pre-dam terraces along the Colorado River and their effects on cultural resources. Short tributary streams that drain prehistoric terraces are the main erosive forces operating on the terraces (Hereford et al. 1993:16). Streams that drain directly into the Colorado River are termed "river-based."

Sites with river-based drainages have always been a high priority in the monitoring effort due to Hereford's hypothesis regarding base-level lowering (Hereford et al. 1993). The RCMP data support Hereford's hypothesis and suggest that the effect of post-dam river-based drainages is a valid and very real concern.

Characteristics of river-based drainages include a catchment area about 12 times larger than terrace-based drainages (median size 16,000 m^2) and a less variable channel length than terrace-based streams (median length 220 m; Hereford et al. 1993:17). When a channel becomes river based, the drainage adjusts to a lower base-level, erosion increases, and the drainage becomes a permanent feature of the landscape. The lowered base-level intensifies the exposure and deterioration of cultural resources once covered by the terrace alluvium. In pre-dam times, large sediment-laden floods plugged river-based drainages. Currently, the Colorado River does not "naturally" regulate the drainages. Figure 8 depicts an extensive and extremely active river-based drainage at site G:03:064.

The RCMP staff identified 70 sites with river-based drainages. Of these, 52 sites contain only river-based drainages, and 18 have river-based drainages combined with other drainage types (see Table 3). Eight sites have river-based and terrace-based drainages, eight sites contain river-based and side-canyon drainages, and two sites feature river-based, terrace-based, and side canyon-based drainages (see Appendix E).

Active on-site erosion is pervasive in this group's (n = 70) monitoring history. In fact, monitors have identified active physical erosion (active gullying and arroyo cutting) at 67 percent of these sites (versus visitor-related impacts at 43%). The percentage of actively eroding sites in this group is much higher than any other group discussed in this report (see Chapter 10). Due to this amount of activity, monitors have implemented preservation options and, if warranted, recovery action. For many of the sites it is too early to tell if preservation work will have a long-term effect on preserving impacted areas. More monitoring of remedial work and measuring change of sediment volume is suggested before certain preservation actions are considered effective or ineffective. The data show that the RCMP staff has successfully identified which sites are actively eroding, recommended remedial action, and implemented these actions.

The long-term photographic record shows that some sites have been losing valuable cultural information for many years. Sites with documented information loss and an eminent threat of continued active river-based drainage erosion are recommended for recovery action. Some geomorphic settings in which river-based drainages occur are not conducive to any form of preservation action; in these situations, data recovery is the only option.

REMEDIAL ACTIONS

FY94 to FY99 RCMP monitors consistently made recommendations for remedial action to sites with active physical erosion and active visitor-related impacts. Seventy-seven percent of the sites with active physical erosion received a preservation action, recovery action, or both.

Monitors reduced the number of remedial actions completed at sites with potentially active physical erosion or no visitor-related impacts. Monitors identified 23 out of 70 sites with potentially active physical erosion (33%) and 40 of the 70 sites (57%) with no visitor-related activity.

Sixteen of the 70 sites received checkdam installation. RCMP staff and Zuni conservators have completed checkdam maintenance at 13 of these sites (81%) since 1995.

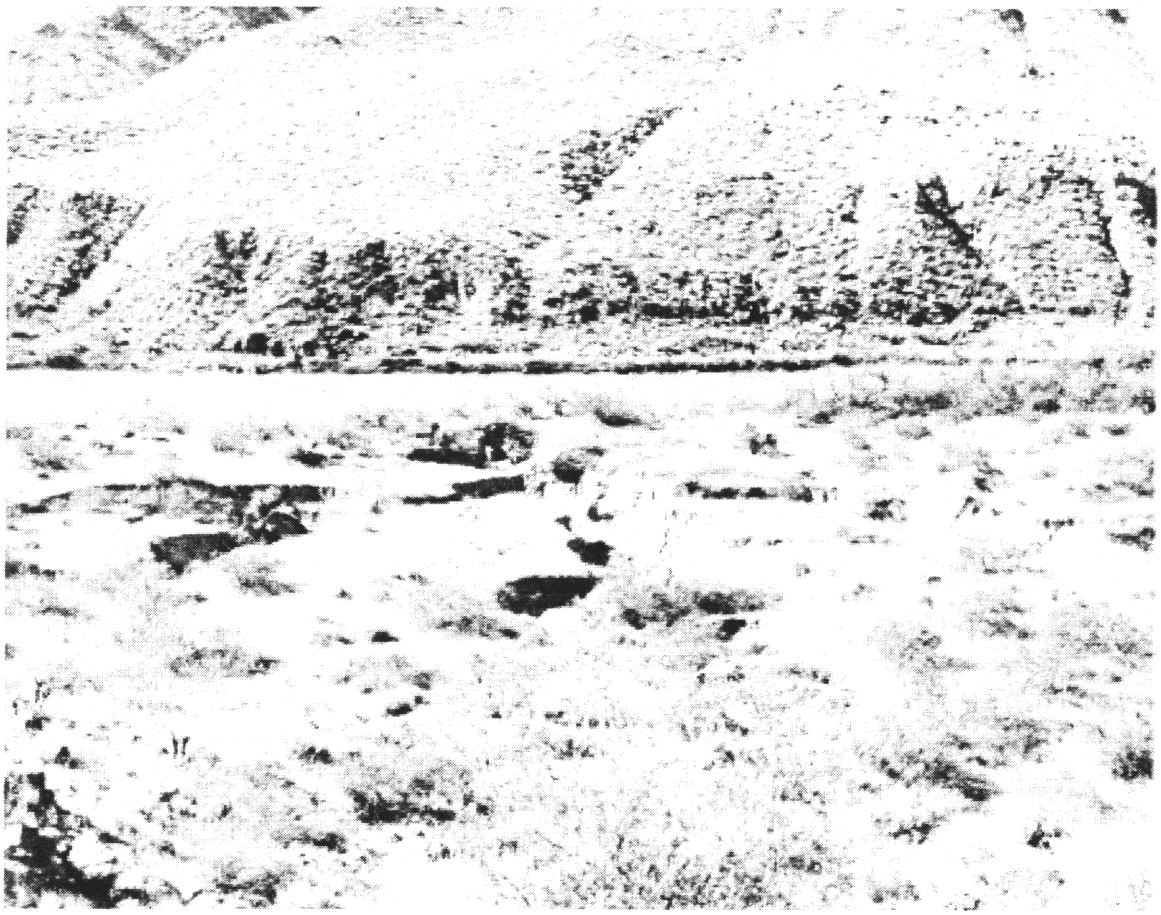


Figure 8. A river-based arroyo at G:03:064 ("Arroyo Grande") that is actively impacting the site. Monitors have recorded active erosion here since FY94.

Table 3. Site Count and Property Types of Sites with Only River-Based Drainages (n = 70)

Site Counts	Property Types
5	Artifact Scatter
3	Historic Structure
5	Structure-Thermal Feature Complex
4	Special Activity Locus
3	Pueblo
19	Roaster Complex
7	Roaster Feature
13	Small Structure
11	Thermal Feature

Only 6 of the 15 inactive-schedule sites received a preservation or recovery action. In contrast, 80 percent of the sites monitored biennially and 100 percent of the sites monitored annually received a preservation or recovery action recommendation. Overall, the remedial action trends for the 70 sites indicate that monitors successfully prioritized the most active sites as shown by monitoring schedules, made appropriate remedial action recommendations, and completed a high percentage of the recommended work. Preservation treatments were completed at 61 percent of these sites, and recovery treatments were completed at 26 percent.

SITES WITH RIVER-BASED DRAINAGES ONLY

A:15:037 Roaster Complex (inactive schedule)

This Pueblo I–early Pueblo II Virgin and late prehistoric–early historic Pai or Paiute site contains four roasting features with charcoal and fire-cracked rock, as well as a possible wickiup outline. Lithic evidence from this site includes flakes, a biface midsection, an obsidian drill, a chert projectile point, and other debitage. In addition, ceramics from this site reflect Hualapai, Paiute, and Virgin styles. The site is located on benches above the river at the mouth of a major side canyon.

Previous Work

The site was initially recorded by GRCA survey personnel in April 1991 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). The RCMP staff has not recommended remedial actions at this site.

Monitoring Data Summary

FY96 monitors recorded an inactive gully at the base of Feature 3 and noted the presence of small rills on the mounded fire-cracked rock of Feature 2. The rest of the site was stable. Although several drainages bisect the site, the drainages were inactive. Monitors have not recorded any visitor-related impacts at this site.

FY99 Recommendations

A:15:037 will remain on an inactive monitoring schedule.

A:15:043 Roaster Complex (5-year schedule)

This aceramic site contains two roasting features as well as two metates and one cobble mano. Two cores and four flakes, one of Presley Wash obsidian, were observed. This site also featured a polished object, possibly of obsidian as well. GCRA survey archaeologists suggested that the site represents a late prehistoric-protohistoric Pai or Paiute affiliation based on the location and the surrounding sites in the vicinity.

Previous Work

GRCA survey personnel recorded the site in February 1991 (Fairley et al. 1994). RCMP staff monitored the site for the first time in FY96 (Leap et al. 1996) and have not recommended any remedial actions for this site.

Monitoring Data Summary

FY96 monitors indicated that the site was in overall stable condition except for its location on the edge of a river-based arroyo. No visitor-related impacts were observed at this site.

Feature 1 is located on a slope and is impacted by sheetwash and gravity creep. Feature 1 is also adjacent to a mature arroyo that drains into the Colorado River. The research flow of March 1996 deposited large amounts of sand at the mouth of the arroyo.

FY99 Recommendations

The RCMP staff recommends visiting the site on a 5-year schedule due to minor erosional activity and its proximity to a river-based arroyo. It is also recommended that the RCMP staff assess the arroyo near Feature 1 for preservation treatment.

A:15:048 Roaster Complex (3-year schedule)

A:15:048 is a cluster of roasting features of undetermined cultural affiliation. The most apparent is Feature 1, exposed on the slope of the highest alluvial terrace; there are whitened limestone cobbles and a few chunks of charcoal in a 4-m-diameter area. The other three possible roasting features (Features 2–4) are low, mound-like clusters of limestone and sandstone cobbles in 1-m arrays. Features 2 through 4 are mostly buried by terrace alluvium and contain abundant cryptogamic soil. There is no charcoal evident on the surfaces of these features. Only a few artifacts were recorded during the survey, including a rectangular basalt mano and historic can. An additional partial mano was identified in FY94. Monitors in FY98 identified new exposure of fire-cracked rock (FCR) in a drainage 10 m north of Feature 1. The site is most likely associated with a rockshelter (A:15:052) located 50 m upslope.

Previous Work

The site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994). This site has been monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). A total station map was completed in FY98 (Leap et al. 1998). Excavations were undertaken at Feature 1 and an FCR scatter in FY99. The excavation report will be disseminated upon completion of data recovery analysis. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

In FY94, the general condition of the site was stable, though it was noted that gullying could impact Feature 2. A partial mano was identified by the FY94 monitoring staff that had not been recorded during the survey.

Between FY94 and FY98, the gully near Feature 1 deepened and became an arroyo, and sheet wash was apparent throughout the site. The drainage system adjacent to Feature 1 became very active and began to pedestal the feature. That this feature could not be preserved in place, so Feature 1 and the FCR scatter were excavated in February 1999. The site is currently monitored every 3 years.

FY99 Recommendations

Continue monitoring this site every 3 years due to the remaining intact Features 2 through 4 and the potential for new exposure of cultural material in the river-based drainages. This potential was realized in FY98 with the exposure of new fire-cracked rock.

A:16:149 Thermal Feature (4-year schedule)

This aceramic site contains five roasting features with three manos and one grinding slab. Archaeologists recorded no chipped stone artifacts or sherds on the surface, though other artifacts may be present subsurface. Cultural affiliation is unknown. FY96 monitors found a newly exposed roasting feature 2 m south-southwest of the depression near Feature 3.

Previous Work

GRCA survey personnel initially recorded the site in November 1990 (Fairley et al. 1994). RCMP staff monitored the site for the first time in FY96 (Leap et al. 1996). FY96 monitors recommended installing checkdams. Monitors and Zuni conservators assessed the drainages in FY97, placed grass in the nick points, and recommended future construction of checkdams in the arroyo impacting Features 1 and 2 (Leap 1997b). A total station map was completed in September 1997. Zuni conservators installed seven checkdams in the river-based arroyo in April 1999 (Hubbard 1999a).

Monitoring Data Summary

The RCMP staff took preservation action in the form of checkdams to reduce the effect of the river-based arroyo adjacent to Features 1 and 2. FY96 monitors recorded active surface erosion, gullying, and minor animal trailing. FY96 monitors also recorded drainage entrenchment with a slight loss of sediment. The on-site drainages were plugged by the research flow in March 1996 (Balsom and Larralde 1996). FY96 monitors were concerned with the river-based drainages at this site because they continue to seek the lowered base-level, and are no longer plugged by predam sediment-laden floods. No visitor-related impacts have been recorded.

FY99 Recommendations

Monitoring will continue every 4 years. Checkdam maintenance will continue annually by Zuni Conservation Project personnel and RCMP staff. If the checkdams are not successful, the RCMP staff will recommend data recovery for Features 1 and 2. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

A:16:153 Roaster Complex (inactive schedule)

This open-air site contains 5–6 roasting features eroding out of an alluvial terrace, plus 3–4 structure outlines. Artifacts include ground stone, Formative Grayware, Cerbat sherds, a lithic scatter, and burned bone. Feature 1 (a roasting feature) appears to have been used within the past few hundred years, as evidenced by abundant charcoal on the surface. Other roasting features are in various states of preservation; common characteristics include limestone fire-cracked rock with charcoal and charcoal-stained soil. The site appears to have had both Pueblo II Formative and late prehistoric–early historic Pai occupations.

Previous Work

The site was initially recorded by NPS survey personnel in November 1990 and was monitored for the first time in FY96. No recommendations were made at this site.

Monitoring Data Summary

FY96 monitors recorded the presence of inactive surface erosion (rills). Monitors noted that the site is extremely fragile and that no visitor impacts were observed.

The site has remained unchanged since 1990. The monitoring team described the site as "extremely stable." They observed no sign of visitation since the survey. The surface of the site is covered by a mature growth of cryptogamic soil so it is vulnerable to visitor trampling. FY96 monitors recommended placing A:16:153 on the inactive monitoring list because too frequent monitoring could cause impact to the site and cryptogamic soil.

FY99 Recommendations

A:16:153 will remain on an inactive monitoring schedule due to its physical and visitor-related impact inactivity.

A:16:158 Artifact Scatter (5-year schedule)

A:16:158 is an aceramic site of unknown cultural affiliation located in a Muav Limestone rockshelter. Artifacts include a Supai Sandstone pecked slab and three chert flakes, along with several possible manos. The pecked slab is flat and river-worn with a distinct pecked central use surface. The slab measures 40 cm long by 30 cm wide and is 6–7 cm thick. Floods have inundated the site; the shelter floor is covered by river-deposited sand and there is driftwood jammed in cracks behind the shelter. FY95 monitors discovered an unrecorded bedrock mortar at this site.

Previous Work

Archaeologists initially recorded the site in November 1990 (Fairley et al. 1994). The RCMP staff monitored A:16:158 in FY92, FY93, FY94, FY95 and FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b). FY93 monitors recommended subsurface testing.

Monitoring Data Summary

This site is situated less than 3 m above the 28,000 cfs level. Water inundated the site during the floods of 1983 and 1984. The site location presupposes that it has been underwater untold times since its creation. The gully impacting the site is river based, although it has reached bedrock in the shelter. The drainage can only become wider not deeper.

FY92 and FY93 monitors observed extensive gullying at this site. FY94 monitors recorded increased eolian activity and the presence of surface erosion, gullying, and animal disturbance. FY95 monitors observed the presence of eolian activity within the shelter. Monitors also noted that visitors had moved the metate in the shelter since 1990.

FY99 monitors recorded active surface erosion, gullying, eolian activity, and packrat disturbance in the shelter. Monitors noted that the gully has reached bedrock and cannot cut deeper into the site. Monitors again noticed that the metate in the shelter had been moved to a different location than in FY95. Three small rocks were placed underneath the metate forming a level place to sit. Monitors attributed the visitation to river-runners due to the close proximity of a river camp below the site.

FY99 Recommendations

Due to the site's proximity to the river and a camping beach, and the shallow depth of the shelter, the RCMP staff recommend that this site be tested for subsurface material. After testing is completed the site schedule will be reevaluated. Monitoring will continue until mitigation is completed.

A:16:174 Roasting Feature (biennial schedule)

A:16:174 consists of two artifact concentrations, a large roasting feature, and scattered heat-treated rock. Lithic evidence includes flakes, a mano or chopper, two grinding slabs, and a mano or pecking stone. Two flake tools probably functioned as cutting or scraping tools. Ceramics from this site consist of three Cerbat Brown Ware sherds. This site represents a late prehistoric–early historic Pai rockshelter situated on an alluvial terrace, abutting steep slopes and local cliffs of conglomerate. Shallow overhangs provide some shelter. FY96 monitors discovered a slate pendant in Area B and FY98 monitors discovered a new mano fragment.

Previous Work

Archaeologists recorded the site in 1990 (Fairley et al. 1994). RCMP staff monitored it in FY93, FY94, FY96, and FY98 (Coder et al. 1994b, 1995a; Leap et al. 1996, 1998). FY98 monitors recommended checkdam installation and in FY98 a total station map was completed (Leap et al. 1998). FY98 monitors also recommended collecting bone fragments for analysis. RCMP staff and Zuni conservators assessed and installed eight checkdams in FY99 and plotted them on the total station map (Hubbard 1999b).

Monitoring Data Summary

The main areas of concern are the gullies below Artifact Scatters A and B. FY93 monitors recorded moderate gullying and arroyo cutting. FY94 monitors recorded the presence of surface erosion, gullying, eolian-alluvial erosion, animal disturbance, and root disturbance. FY96 monitors observed surface erosion, gullying, eolian-alluvial erosion, and active animal disturbance in the rockshelter. The monitors noted that the gully appeared the same and attributed on-site trailing to researchers.

FY98 monitors recorded active gullying, animal burrowing, and inactive surface erosion. Bone fragments were discovered exposed by the active, deep gullies. The other areas of the site have remained in stable condition since FY93.

FY99 Recommendations

The RCMP staff recommends continuing a biennial monitoring schedule and annual checkdam maintenance by Zuni Conservation Project personnel and RCMP staff. Also, bone fragments should be collected and analyzed for species identification. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

A:16:175 Thermal Feature (3-year schedule)

A:16:175 is a series of shallow overhangs with associated fire features and a midden with concentrations of sherds, lithics, burned bone, and charcoal. Two Desert Side-notched points were found at the site. Sherds and projectile points found on the surface indicate a multiple occupation of Virgin Branch and a later Pai or Paiute presence. The site itself is located on the upstream end of a dissected alluvial terrace with on-site gullies and arroyos that drain into the river. This site, with its exceptionally well developed midden, presents evidence for a more intensive or longer-term use of the area.

Previous Work

GRCA survey personnel recorded the site in February 1991 (Fairley et al. 1994). RCMP staff monitored the site in FY92, FY93, and FY94 (Coder et al. 1994a, 1994b, Coder 1995a). Monitors have not recommended remedial actions for this site.

Monitoring Data Summary

FY92 and FY93 monitors observed minor surface erosion at this site. FY94 monitors recorded active surface erosion, eolian-alluvial erosion, animal disturbance (trailing), spalling, and root impacts. Monitors identified on-site gullies draining to the river. Loretta Jackson of the Hualapai Tribe requested that the RCMP staff monitor A:16:175 on a 3-year cycle (Coder et al. 1995a). No visitor-related impacts were recorded at this site.

FY99 Recommendations

The RCMP staff recommend visiting the site on a three-year schedule at the request of the Hualapai. It is also suggested that the on-site drainages be assessed for preservation treatment and that bone and charcoal samples be collected on the next monitoring trip. Charcoal dates and bone identification could add to the temporal and functional information for this site and the surrounding area.

A:16:180 Roasting Feature (biennial schedule)

This site contains at least two buried roasting features, fire-cracked rock, and one red chert tertiary flake. Two manos were found as well as a Coconino Sandstone grinding slab. Cultural affiliation remains unknown. Radiocarbon dates from Feature 1 indicate a date of A.D. 1685 to 1745.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994). The RCMP staff monitored A:16:180 in FY96 and FY98 (Leap et al. 1996, 1998). FY96 monitors recommended installing checkdams at this site. Due to the precarious position of Feature 1 in a river-based drainage cutbank, RCMP staff assessed this site in FY96 for checkdams and data recovery. A total station map was completed in FY96. FY97 monitors recommended planting vegetation, but after assessment it was determined that this action would not be conducted. Feature 1 (a roasting feature) was excavated in FY97 to curtail further loss of archaeological information (Yeatts 1998). After data recovery, Zuni conservators constructed six checkdams in the main drainage to prevent the erosion of Feature 2. All six checkdams needed maintenance in FY99 due to the steep alluvial terrace, heavy runoff through the river-based drainage, and continued drainage downcutting to reach a postdam lowered base-level (Hereford et al. 1993; Hubbard 1999b).

Monitoring Data Summary

FY96 monitors observed increases in gullying, bank slump, and eolian-alluvial erosion at Feature 1. Monitors noted that parts of the feature were beginning to erode into the river-based drainage. RCMP staff took appropriate action by excavating Feature 1 in FY97.

FY98 monitors recorded active surface erosion, gullying, alluvial erosion, and the presence of sheep trails and rodent burrowing. Due to increased drainage activity at this site, monitors recommended checkdam maintenance. RCMP staff have not recorded any visitor-related impacts at this site.

The site is a good example of dam-accelerated erosion that has uncovered archaeological material once protected by abundant sediment. Due to the steep drainage slope, lack of sediment-replenishing floods plugging such drainages, and reduction in sediment available for eolian activity, this entire site could be obliterated in the next few years.

FY99 Recommendations

Biennial monitoring will continue due to the potential for river-based drainage activity at Feature 2. Zuni Conservation personnel and RCMP staff will continue annual checkdam maintenance. If the gully migrates toward Feature 2, data recovery will be recommended. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

B:10:229 Small Structure (inactive schedule)

B:10:229 consists of several areas (designated A–I) of rock alignments and other features situated along a talus slope. Areas A and D–H appear to be agricultural features, primarily terraces and checkdams. Area C is a possible small room outline that may have been a foundation for a ramada-like structure. Area B is an L-shaped wall that encloses a narrow area that may be related to water diversion. Area E is distinct in that it is more of a rectangular garden plot. Area I, found upstream from Area A, consists of two possible wall alignments that seem to be more like sections of a trail than terrace alignments. No artifacts or other cultural remains were found. Cultural and temporal affiliation is unknown.

Previous Work

GRCA personnel recorded the site in April 1991 (Fairley et al. 1994). RCMP staff monitored B:10:229 in FY93 and FY95 (Coder et al. 1994a, 1995b). Monitors have not recommended remedial actions at this site.

Monitoring Data Summary

FY93 monitors recorded extensive gullying and arroyo cutting. FY95 monitors did not record any impacts at this site. Monitors recommended removing the site from an actively monitored schedule to an inactive schedule.

After consulting with other archaeologists in the field, it is the RCMP staff's conclusion that many areas are not a cultural manifestation. These areas were formed as a result of a very active rockslide and therefore, many of the so-called cultural features are in question. Although extensive river-based drainages were recorded on the survey, monitors have identified no impacts at this "site." No visitor-related impacts have been observed.

FY99 Recommendations

The RCMP staff recommend that this site remain on an inactive monitoring schedule. Although there are river-based drainages, they are heavily armored by boulders and large cobbles. Locus A should be tested for intact cultural materials prior to expending any unnecessary monitoring efforts on something that appears to be a natural manifestation. Until subsurface testing is completed to confirm the existence or nonexistence of cultural material, the site description will remain the same.

B:10:249 Historic Structure (inactive schedule)

The site consists of a small rockshelter containing the remains of a low, crude, masonry structure. Two perpendicular single-course upright slab walls form a small enclosure around the back of the shelter. There is a sparse amount of historic trash, including a rusted enamel ware bowl fragment, wire, and a hole-in-the-top can lid. It is probably of turn-of-the-century Anglo affiliation.

Previous Work

GRCA archaeological surveyors recorded the site in 1990 (Fairley et al. 1994). RCMP staff monitored B:10:249 in FY97 (Leap et al. 1997). Monitors did not recommend any action for this site.

Monitoring Data Summary

FY97 monitors observed a single rock element displaced since it was first recorded. Monitors identified a river-based arroyo, but it was not impacting the site. The structure remains well protected; however, the Kanab–Deer Creek trail runs through the site. Despite the proximity of the trail, no visitor-related impacts were recorded at this site.

FY99 Recommendations

The RCMP staff have placed this site on an inactive monitoring schedule due to the lack of physical and visitor-related impacts.

B:10:261 Roaster Feature (inactive schedule)

B:10:261 consists of a roasting pit and four FCR middens in variable states of erosion. An associated artifact scatter includes one mano, one metate fragment, and three Lino Grayware sherds dating from Basketmaker III to Pueblo I. Lithic debris includes flakes as well as a knife base, a drill tip, and a biface fragment. The site is located on a dune-covered terrace in the upper mesquite zone. FY96 monitors found an historic feature of milled boards in a square formation with wooden stakes.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, FY96, and FY98 (Coder et al. 1994a, 1995a; Leap et al. 1996, 1998). RCMP staff have not recommended any remedial actions at this site.

Status and Recommendations

In FY92 and FY93 archaeologists noted that the shallow seasonal drainages affect all the features to a degree, as did continual wind deflation and sediment accumulation. Monitors mentioned that the roasting features were reworked by erosion since the survey.

In FY94 archaeologists recorded signs of deflation, including pedestaling and downslope movement of individual artifacts in various artifact concentrations. This was probably caused by the lack of sand available for eolian processes.

In FY98 archaeologists noted that the site was in stable condition and unchanged since 1994. No physical or visitor-related impacts were observed. An increase in cryptogamic soils was noted on the surface. Monitors believed that the site was in no danger of active erosion or visitation. Monitors suggested that the site be placed on the inactive list because the site was generally in stable condition with minor eolian deposition and erosion.

FY99 Recommendations

B:10:261 will be placed on an inactive monitoring schedule due to the FY98 monitoring recommendation and observation of drainage inactivity.

B:11:275 Small Structure (5-year schedule)

This site consists of two partial walls in a rockshelter at the base of the Bass Limestone. No artifacts are associated with this site. The walls extend from the back of the overhang, defining at least one cleared activity area with charcoal. The structure has been partially filled in with debris from the overhanging formation and silt or sand from alluvial river deposits. Cultural and temporal affiliations are unknown.

Previous Work

Archaeologists originally recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY95 and FY98 (Coder et al. 1995b; Leap et al. 1998). Monitors have not recommend any remedial actions for this site.

Monitoring Data Summary

FY95 monitors recorded the presence of an arroyo and a packrat midden. Monitors observed that the river-based arroyo below the midden had reached bedrock, but that an "offshoot" gully is currently moving toward the wall. FY95 monitors also noted that the outer edges of the site are located on a steep slope leaving some potential for downslope erosion.

FY98 monitors noted that the site is very stable with no changes since FY95. The drainage below the site was filled with abundant vegetation and cryptogamic soil. Monitors described the site as stable with little potential for impacts. No visitor-related impacts have been observed at this site.

FY99 Recommendations

The site will be tested for intact cultural deposits. The RCMP staff believes that there may be no cultural remains left at this site. However, the Hopi people have noted that this site may have cultural value to their people, and prior to implementing any management action, the Hopi would like to be consulted. The site should not be considered ineligible until subsurface tested is completed. RCMP staff will monitor this site on a 5-year schedule until testing is completed.

B:14:105 Small Structure (biennial schedule)

This Pueblo II Cohonina site consists of a small rockshelter with a single room formed by a single-coursed wall of undressed, tabular and blocky sandstone elements. Adjacent to the wall is a light scatter of approximately 25 lithics and 7 sherds. Three roasting features are present below the shelter as well as a single course wall, 2 m long.

Previous Work

Archaeologists recorded the site in 1990 (Fairley et al. 1994) and the RCMP staff monitored it in FY92, FY93, FY94, FY96, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1996, 1998). During the 1996 research flow, scientists used the camp below this site and severely trampled the site area (including camping on the site and rearranging artifacts). RCMP staff recommended trail obliteration work in FY96 and completed it in FY98. Monitors recommended planting vegetation in FY98 because the trails had become small river-based gullies. They also recommended monitoring trail work during regularly scheduled monitoring visits. FY99 monitors assessed the site for more trail work and determined that none would be done due to heavy on-site vegetation. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY92 monitors observed base-level lowering within the drainages on the site. FY93 monitors observed no change in the physical condition of the site but recommended an assessment for retrailing. FY94 monitors noted that the north side of the wall at Feature 1 collapsed and that Features 2 through 5 were stable.

FY96 monitors recorded increased vegetation growth at Feature 5 and minimal deflation and loss of cryptogamic soils at Features 2, 3, and 4. FY98 monitors observed active surface erosion on the site's southern boundary. Several of the trails obliterated in FY97 had nick points that are now defined river-based drainage channels (rills and gullies). Due to post-dam accelerated erosion and sediment loss, these drainages will continue to erode without natural intervention from large sediment-laden floods. Human trails are present throughout the site and visitor-related and scientist impacts have been consistently recorded since 1992. The intensive trailing and subsequent gullies, caused by scientists studying the 1996 research flow, are directly related to dam operations. The visitor impacts are also attributed to commercial river-runners due to a primary camping beach located below the site.

FY99 Recommendations

Biennial monitoring and GRCA trail maintenance will continue to curtail the river-based drainage impacts and visitor-related impacts at this site. The on-site river-based drainages, particularly within the trails, will be assessed for preservation treatment.

B:15:123 Special Activity Locus (inactive schedule)

This site consists of a single plain-ware ceramic jar, originally cached in a small crevice between two limestone boulders. At least one boulder has shifted since the pot was left in place, crushing the jar into several pieces. The jar was probably used for storage; however, it is doubtful that recoverable stored remains survived. The pot may be related to a small rockshelter site located nearby. The jar dates somewhere in the Pueblo I to Pueblo III range.

Previous Work

Archaeologists initially recorded the site in 1990 (Fairley et al. 1994). The RCMP staff monitored B:15:123 in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997). Monitors have not recommended any remedial actions at this site.

Monitoring Data Summary

FY92 and FY93 identified an inactive gully 5–10 m from the pot. Monitors recommended future observation of the gully due to potential impacts.

FY97 monitors recorded no new activity at the gully and overall site stability. No visitor impacts were observed since FY93.

FY99 Recommendations

The RCMP staff recommend taking detailed medium-format photographs of the pot and then changing the site's schedule to inactive, monitored only by GRCA river patrol for ARPA violations. The Hopi Tribe recommends that they be consulted prior to any additional management action.

B:15:138 Thermal Feature (annual schedule)

The site was not recorded during the 1990–91 river corridor survey. Monitors identified and recorded this site in April 1997 (Leap et al. 1997). This site consists of two concentrations of fire-cracked rock and a sparse scatter of lithics and sherds. Feature 2 appears to be the remains of a slab-lined roasting feature. Feature 1 has no intact morphology and is an array of fire-cracked rock with associated artifacts. Multiple trails are on or near the site due to its proximity to a popular side canyon hiked by river-runners.

Previous Work

RCMP staff recorded the site in 1997 (Leap 1997c). The trail directly below Feature 2 was obliterated at the time the site was recorded and a new trail was outlined below the site. Visitors (river runners) destroyed the work the following summer. In September 1997 a total station map was completed (Leap et al. 1997). Though the trail work was destroyed, a second round of obliteration was conducted in October 1998. FY98 monitors recommended planting vegetation. Additional trail work was completed in FY99 (Hubbard 1999b). Access was blocked off to the drainage by using dead brush found in the side canyon drainage. It was determined that the features are most vulnerable to hikers (river-runners) coming back down to camp from the upper Tapeats Sandstone ledges. A small rock cairn was constructed and hidden in the ledges so it is only visible from above. Theoretically, lost hikers will see the cairn from above, directing them down the ledges away from the site. RCMP staff placed deadfall in the drainage to block the upper portion of Feature 2. Approximately 7 m of the area was treated and all work was photographed. FY99 monitors recommended planting vegetation.

Status and Recommendations

Physical impacts recorded in FY97 were minimal and included rilling within the two features. By FY98, archaeologists noted a deep nick point in the gully below Feature 1, and gully compaction at Feature 2 due to trailing. Additional trail work and vegetation (seeding with the aid of jute mat) were recommended along the slope. By FY99 the rilling noted in FY97 had transformed into gullies draining to the river. In FY99 monitors recorded the presence of active sheet washing occurring due to the location of the features at the base of a cliff wall. The gully bisecting Feature 1 has reached bedrock and will not migrate further into the feature. Several nick points are located in the active gully at Feature 2. Also, monitors noted several areas that were cleared and leveled for sleeping. Monitors and GRCA personnel have worked at this site in the past to divert trailing through the site and into the side canyon. Two camps are present near this site and the side canyon is a popular hike for commercial river passengers.

FY99 Recommendations

The site is in poor condition due to its location, active physical erosion, active visitor-related impacts, and continued loss of cultural material. RCMP staff recommend assessing the site for data recovery in FY00. This data recovery project will take minimal time and effort due to the supposed shallow depth of the cultural material remaining. GRCA will continue annual trail maintenance and perform trail obliteration until data recovery is conducted. Also, an annual monitoring schedule will continue until excavation is completed.

C:02:092 Artifact Scatter (3-year schedule)

C:02:092 is an aceramic site located in a Kaibab Limestone rockshelter overlooking the Colorado River. The site contains two Moenkopi Sandstone grinding slabs, two manos, a chopping tool, and a scatter of charcoal. The manos are unifacially ground. The only chipped stone tool was a quartzite cobble with a 10-cm-long area of flake scars that appear to represent a chopping edge. Three fragments of unidentifiable bone were also observed. Cultural affiliation is unknown.

Previous Work

Archaeologists recorded this site in April 1991 (Fairley et al. 1994). The RCMP staff monitored C:02:092 in FY92, FY93, FY95, and FY99 (Coder et al. 1994a, 1994b, 1995b; Hubbard 1999b). FY95 monitors recommended developing a new site map. Monitors have not recommended any remedial actions for this site.

Monitoring Data Summary

Anglers, surface erosion, gullying, alluvial erosion, and cliff spall primarily impact this site. The river-based drainage, located on the upstream side of the site, has a history of activity prior to 1995. However, monitors have not discovered any new features or artifacts exposed in the drainage.

FY95 monitors recorded the presence of surface erosion, gullying, alluvial erosion, and cliff spall. The monitors suggested continued monitoring due to the potential for increasing impacts.

FY99 monitors recorded inactive surface erosion, gullying, and active cliff spall. Monitors confirmed that the drainage flows into the 1983 sand and that it appeared unchanged since FY95.

FY99 Recommendations

The site's monitoring schedule will change from annually to every 3 years due to river-based drainage inactivity. Monitors believe that the site integrity is questionable, based solely on surface remains. It is recommended that RCMP test for subsurface, intact cultural remains before any additional efforts are expended on this site.

C:02:096 Structure–Thermal Feature Complex (annual schedule)

The site consists of two sheltered areas separated by a drainage and talus cone. The upstream area (Locus A) consists of a shallow overhang with a faint wall. The wall consists of small, local limestone cobbles in a single ground-level course. The front of the shelter ledge might exhibit some alignment and level preparation. One large tertiary flake of white-orange Kaibab Chert was noted, as well as a long, tapered river cobble (pestle shape), pecked on two faces with a smooth surface on another margin. Locus B is located about 60 m downstream of Locus A under a west-facing Kaibab Limestone overhang. An arroyo flows beneath the overhang dripline, exposing layers of river-deposited silt and sand interbedded with coarser sand and gravel colluvium. Several layers of charcoal and cultural features are exposed in the arroyo sidewalls as well. O'Connor and others (1994) reported finding fluvial-transported charcoal at a depth of about 2.5 m below present ground surface, near the bottom of the stratigraphic section. The radiocarbon dates from this research dated from 4567 B.P. to 4125 B.P. Monitors in FY97 recorded a partially mineralized, worked stick in Locus A. FY97 monitors discovered new lithics and a Moenkopi corrugated sherd eroding from the Locus B arroyo.

Previous Work

Archaeologists originally recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY95, FY96, FY97, FY98, and FY99 (Coder et al. 1995b; Leap et al. 1996, 1997, 1998; Kunde

1998a). Monitors recommended checkdam installation in FY96. In FY97 the RCMP staff assessed this area for checkdam installation and determined that the arroyo system is at an active stage that would not be conducive to checkdam construction. Surveyors completed a total station map in FY97. In FY97, FY98, and FY99 monitors consistently recommended data recovery for the features exposed at Locus B. FY99 monitors collected charcoal samples for radiocarbon dating from Features 2 and 9. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY95 monitors were unaware of Locus B due to its absence on the site map. Monitors recorded no impacts at Locus A and considered the site stable. FY96 monitors recorded active surface erosion, gullying, arroyo cutting, bank slump, and the presence of alluvial erosion and animal disturbance. Monitors noted that extensive local flooding in 1990–91 and during the research flow caused additional impacts to the sediment terrace that contains this site.

FY97 monitors recorded active rodent burrowing, coyote activity, and the presence of arroyo cutting, bank slump, and cliff spall. Monitors noted that the river-based arroyos at this site are active and beyond preservation treatment.

FY98 monitors identified a large arroyo upstream of Locus A. Although the arroyo is not directly impacting Locus A, RCMP staff recommended monitoring it to track its direction. At Locus B, the arroyo system has been consistently active. Monitors recorded active surface erosion, arroyo cutting, bank slump, and alluvial erosion in the Locus B arroyo.

FY99 monitors recorded active surface erosion, arroyo cutting, bank slump, and alluvial erosion. Monitors identified increased slump at Feature 9 and throughout the arroyo. Overall, the arroyo exhibits recent arroyo downcutting and is extremely active.

FY96 to FY99 monitors have recorded active arroyo cutting at this site. The drainage is river based and several meters deep. Monitors have consistently observed new channel initiation occurring throughout the drainage. Artifacts and features are still present in the arroyo walls but also are washing downslope due to undercutting and bank slump. Visitor-related impacts (trailing) were previously attributed to anglers and scientists. The RCMP staff recommends a phased data recovery approach at this site from FY01 to FY04 (Leap et al. 1999a).

Several members of the PA including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff stopped at C:02:096 on the April 1999 river trip. The group decided that Locus A was in stable condition and in no need of data recovery. Members of the PA agreed that a phased data recovery approach would be appropriate for Locus B (Leap 1999).

FY99 Recommendations

Annual monitoring will continue until data recovery is completed at Locus B. After excavations of Locus B, the monitoring schedule will be reevaluated.

C:02:097 Artifact Scatter (biennial schedule)

The site consists of two Kaibab Limestone rockshelters with sparse but diverse artifacts within them and on the slope below. Shelter 1 has a mostly bedrock floor (there is old alluvial sediment at the back) and contains lithic tools such as one core, a flake scraper, two uni-edge cobble flakes, and a thick biface. Other artifacts include bones, two manos, flakes, and six sherds. There is an historic or modern firepit with rusted cans, plastic, and tattered underwear. Shelter 2 is smaller, but has more interior fill and a possible one-course-high wall enclosure. A core and flake were found on the slope below. Ceramics suggest two possible occupations: Pueblo I and late to early Pueblo III. Tools range from expedient flake tools to bifaces and manos. The artifact assemblage is suggestive of more than just overnight or single-activity use. FY95 monitors found a Tusayan Grayware corrugated sherd at Shelter 2.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY95, FY97, and FY98 (Coder et al. 1995b; Leap et al. 1997, 1998). FY95 monitors recommended trail work at C:02:097. The GRCA trail crew performed retrailing and trail obliteration work in FY96. This site was also looked at closely during the research flow in 1996 (Balsom and Larralde 1996). FY97 monitors recommended more extensive trail work in the area. However, FY98 monitors noted that the extensive trail work completed at C:02:098 will have positive repercussions for trailing around C:02:097.

Monitoring Data Summary

FY95 monitors observed the presence of gullying and alluvial erosion. They noted that the 1983 flood impacted the site and that many of the artifacts most likely washed away. Extensive visitor-related impacts were attributed to anglers. Angler impacts included trailing and abundant trash.

FY97 monitors recorded the presence of gullying, animal-caused erosion, and spalling. Monitors noted that the 45,000 cfs research flow (1996) did not impact the site. Extensive visitor-related impacts were attributed to anglers. Angler impacts included trailing, on-site camping and abundant trash. Monitors removed the trash from this site.

FY98 monitors recorded inactive gullying and alluvial erosion, along with trailing and trash at this site. RCMP monitors observed that heavy rainfall causes flow through the overhang which filters down from above the site. The drainages extending from the shelters downslope are river based. This is also an obvious angler's area due to the types of trash in and around the shelters. Anglers substantially impact many sites near Lees Ferry. Glen Canyon Dam has created and promoted, through dam operations, the establishment of one of the most prominent angler locations in the Southwest.

FY99 Recommendations

The RCMP staff will continue biennial monitoring due to active river-based drainages and visitor-related impacts. GRCA will continue trail maintenance.

C:02:098 Artifact Scatter (annual schedule)

The site consists of an overhang with a charcoal scatter, one sherd, one sandstone mano, and a flake scatter. The terrace at the base of the overhang has been cut by high water, and charcoal is eroding from this cut. Cultural affiliation is unknown.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and RCMP staff monitored it in FY95, FY97, FY98, and FY99 (Coder et al. 1995b; Hubbard 1999b; Leap et al. 1997, 1998). FY95 monitors recommended trail work, planting vegetation, and testing for subsurface cultural material. The GRCA trail crew completed trail obliteration work in FY96. This site was recommended for data recovery in FY97. FY98 monitors recommended installing checkdams and surveyors completed a total station map in FY98. FY99 monitors noted that no new trails were apparent; however, erosion has obliterated some of the previous trail work. FY99 monitors and Zuni conservation personnel assessed the gullies and trails for checkdam construction and scheduled work in FY00. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY95 monitors observed active surface erosion, bank slump, and the presence of surface erosion, gullying, and animal-caused erosion. FY97 monitors noted the presence of surface erosion, gullying, bank slump, and animal-caused erosion. Monitors noted that the bank slump is occurring near the artifact scatter.

FY98 monitors observed active surface erosion, gullying, alluvial erosion, and the presence of bank slump. FY99 monitors observed active surface erosion, gullying, bank slump, and alluvial erosion.

Monitors have consistently recorded angler trails, trash, tackle, and recent charcoal at one end of the overhang. FY97 and FY99 monitors observed channel initiation and several nick points within the old obliterated trails and the main trail.

As at other sites throughout the river corridor, the loss of vegetation and sediment depletion caused by trailing has created extensive gullies that drain to the river. Floods in excess of 60,000 cfs plugged and filled similar gullies in pre-dam times. However, the loss of sediment-rich floods and lack of sand for eolian activity leaves few management options for this site. RCMP has recommended data recovery at C:02:098 for FY02 to FY04 (Leap 1999).

FY99 Recommendations

Annual monitoring will continue until data recovery is completed. GRCA rehabilitation crews will continue trail maintenance in the area regardless of excavation work.

C:02:101 Thermal Feature (inactive schedule)

This site is located in dune sand just below the bottom of an exposed talus slope. It consists of a cluster of fire-cracked rock with a single charcoal chunk in association on the surface. This probable roasting feature is eroding downslope due to deflating sand and water runoff. Cultural affiliation is unknown. The 1983 high water impacted the base of the slope adjacent to the site.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, FY97, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1997). FY94 monitors recommended installing checkdams in the active on-site drainage. In FY96 Zuni Conservation personnel assessed the site for checkdams. In FY97, 14 checkdams were constructed in two active gullies and a total station map was completed for the entire site (Leap 1997b). The main gully was remapped in FY98 to identify the rate of erosion. The Zuni Conservation personnel observed the checkdams in FY98 and suggested that jute mat be used to line the drainage and that several checkdams should be reconstructed. It was also suggested that the river-based drainage be lined with rock and brush up to the 1983 sands. This work was planned for FY99. Upon visiting the site in FY99, RCMP staff observed that the gullies had stabilized themselves and repairs were performed on only 5 of the 14 original checkdams. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Status and Recommendations

In FY92 and FY93 surface erosion in the vicinity was extensive. The sediment terrace was so dissected that there was more drainage than terrace remaining. Archaeologists recommended checkdams or vegetation to stabilize the gullies. In FY94, C:02:101 continued to erode slowly downslope. Checkdam installation was recommended a second time and it was also suggested that a radiocarbon sample be taken to date the site.

In FY97 surface erosion and eolian erosion were both present. The feature was stable, but the gully adjacent to the fire-cracked rock slightly increased in size and depth. In some places, the gully was more than a meter wide and deep, thus transforming it into a river-based arroyo. In previous years, the gully was terrace based.

In FY98 no impacts were observed at the feature. As a result of heavy rains, several checkdams accumulated sediment on the upstream side, but formed new nick points just below the checkdams. Monitors believed that eventually, after substantial rains, these two drainages will connect below the feature and drain to the river. The downstream drainage system was more active than the upstream one.

There are no artifacts associated with the feature. The gullying activity has illustrated that it is possible that artifacts could be exposed to the surface, adding information to the site's age and function. Because of the activity recorded at this site, FY98 monitors changed the schedule to biennial monitoring.

FY99 Recommendations

The RCMP staff changed the site's biennial monitoring to inactive due to consistent feature stability, despite the active river-based drainage. However, Zuni Conservation personnel will continue annual checkdam maintenance and if new material is exposed the RCMP staff will reevaluate the monitoring schedule. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

C:09:031 Special Activity Locus (inactive schedule)

C:09:031 consists solely of the grave of Grand Canyoneer Wilson "Willie" Beigle Taylor who died of a heart attack during a river trip with Otis "Doc" Marston in June 1956. The grave is marked with a bronze plaque.

Previous Work

The grave site is a well-known and often visited location in the river corridor. It was recorded as an actual site by Euler in 1978 and was re-recorded in 1990 (Fairley et al. 1994). The site was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b). The RCMP and GRCA conducted trail work at this site in FY97 (Leap et al. 1997). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

The grave is protected by dense vegetation and exhibits no change since 1990. NPS conducted trail work here in November 1996 to reduce the multiple trails originating at the river to a single trail leading to the grave. The river-based drainage on the site is located within the entrenched trail. The trail work was successful because visitors currently use only one trail. It is recommended that GRCA conduct trail maintenance as needed. No physical impacts were observed during the FY99 monitoring episode.

FY99 Recommendations

The site will be placed on the inactive list due to its stability and the lack of additional information available from the site. The GRCA rehabilitation crew should routinely maintain the trails that are created in this area. Because backcountry access is via the Navajo Nation Reservation, all visitation issues will be discussed between GRCA and the Navajo Nation.

C:09:034 Special Activity Locus (inactive schedule)

The site consists of the remains of Bert Loper's wooden boat, which capsized in 1949 upstream at 24.5 Mile Rapids. Loper died not as a result of the capsized boat, but from a heart attack that occurred in conjunction with the flip. Don Harris found the boat at this location that same year. The bow remains intact, although the rest of the hull is in various stages of deterioration. A metal plaque commemorating Bert as the "Grand Old Man of the Colorado River" was cemented onto a piece of talus limestone about 2 m upslope of the boat.

Previous Work

Archaeologists initially recorded the boat and commemorative plaque in 1972 and re-recorded it in 1990 (Fairley et al. 1994). The Park has monitored the boat annually since 1982, and the RCMP staff monitored it in FY95, FY97, and FY99 (Coder et al. 1995b; Hubbard 1999b; Leap et al. 1997). FY95 monitors recommended trail work and planting vegetation to reduce visitor-related impacts at this site. The site was assessed for planting vegetation in FY97 and the staff determined that none would be planted. RCMP staff conducted trail obliteration and retrailing in FY97. Due to the boat's location near the river, RCMP staff conducted medium-format photography prior to and after the research flow (Balsom and Larralde 1996). FY98 monitors recommended continued trail maintenance.

Monitoring Data Summary

FY95 monitors noted the presence of gullying, surface erosion, and eolian erosion. FY97 monitors observed increased eolian erosion and the presence of gullying. A river-based gully adjacent to the boat was filled in with brush by RCMP staff in FY97.

FY99 monitors recorded inactive surface erosion. Monitors noted that the river-based gully is currently stable and that the revegetation work was successful.

Monitors consistently recorded visitor disturbance in the form of missing and moved boat parts. There is a designated trail that leads directly to the site and it is regularly used during the summer months.

FY99 Recommendations

Because visitation is the primary impact at this site and RCMP staff have descriptively and visually collected all the information at this site, C:09:034 will be placed on the inactive monitoring schedule and monitored annually by GRCA river patrol for ARPA violations. The GRCA trail crew will continue trail maintenance.

C:09:088 Historic Structure (inactive schedule)

This site consists of numerous features and artifacts related to the testing of the alternative Marble Canyon dam site. This project took place from 1949 through 1951. The site consists of several test shafts and their associated tailings, a loading platform, a ferry boat stacked in another ferry boat, numerous painted letters on the cliff face and rock, and industrial trash (cable, nails, iron plates, ladders, wood planks, barrels, blasting wire, food cans, anchor bolts, and a grease bucket). Artifacts are spread over a half-mile length of the river on both banks; the right bank has 13 numbered features (Features 1–13) and the left bank has 3 loci.

Previous Work

Archaeologists recorded this site in 1990 (Fairley et al. 1994). The RCMP staff monitored C:09:088 in FY92, FY93, FY94, FY95, FY97, and FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1997). Monitors have not recommended any remedial actions at this site. A determination of eligibility was forwarded to the Arizona SHPO in FY95 (Leap 1994c) regarding the site's eligibility for the National Register. Although it does not meet the 50-year criterion, SHPO concurred with the RCMP request.

Status and Recommendation

FY93 monitors observed extensive surface erosion and moderate on-site gullying. FY94 monitors observed an active gully and river-based arroyo adjacent to Feature 15. However, the drainage was not directly impacting the feature. FY95 monitors observed no physical or visitor-related impacts at the site.

FY97 monitors noted that there was increased surface erosion and gullying on the large talus cone that extends into the river. The March 1996 research flow truncated the main talus cone (L-1), but also deposited sand below the site on both banks. FY99 monitors noted overall site stability, but noted the loss of research flow (1996) sand in the area.

Early photographs taken by Bill Belknap in 1963 depict large pre-dam beaches in this stretch of the river. Long-term photo replication of the main talus cone (FY99), on river left, depicts an overall loss of sediment and deterioration of the talus cone. River-based drainages are located throughout the site on both sides of the river. However, the drainages are not currently causing direct impacts to specific features.

FY99 Recommendations

All information potential has been retrieved through historic documentation. Therefore, the RCMP staff have placed the site on an inactive monitoring schedule. The site will be monitored by the river patrol for ARPA violations.

C:13:003 Special Activity Locus (inactive schedule)

The site consists of two main areas where the Hopi and perhaps Pai groups mined abundant salt within shallow overhangs. The largest of the areas is 4 m in depth, 1.5 m in height, and 8 m in length. The second is 7 m in length, 1–2 m in depth, and less than a meter in height. The north alcove has 25–30 red hematite pictograph elements above it. Below this same area is a long Tapeats slab with four ground, shallow basins. No other artifacts were observed.

Previous Work

The site was originally recorded by GRCA on 14 September 1960 and was re-recorded by GRCA in 1986. The site was recorded again in 1990. RCMP staff have not officially monitored the site. However, a stationary camera placed across from the site has been taking photos daily since the early 1990s. Also, RCMP staff documented the pictographs and mines with a medium-format camera in FY97 (Leap et al. 1997). The site was closed to visitors in the 1980s.

Status and Recommendation

The site was inundated by the 1983 high river flows. Stationary cameras documented the January 1993 Little Colorado flood, which deposited a substantial amount of sediment below the site. Sediment was also deposited after the 1996 research flow. During the medium-format documentation of the pictographs in FY97, monitors noted that several figures had disappeared since the 1970s due to salt precipitation. Monitors also documented small rills and gullies that were considered river-based drainages. C:13:003 has a long photographic history dating back to the 1960s. Photo replications of this area depicts the loss of large beaches and an increase in exotic vegetation after the construction of Glen Canyon Dam.

FY99 Recommendations

Due to the fragility of the site and requests from tribal signatories of the Programmatic Agreement, the site will remain on an inactive monitoring schedule.

C:13:010 Pueblo (annual schedule)

This is a large, multicomponent habitation site divided into three locales. Locale 1 was recorded in 1965 and Locales 2 and 3 were discovered on a 1983 GRCA monitoring trip. Five structures and 21 features are assigned to Locale 1, including a pithouse, several 1–2 room masonry structures, a pueblo, cists or hearths, and rubble or wall alignments. Four structures and 16 features are noted at Locale 2, including rooms and rubble piles. Locale 3 contains two structures and five features, including a shelter, cists, and wall or room remains. Testing suggests that the site may have had two or three occupations, including Pueblo I Cohonina and Pueblo II Puebloan; ceramics also suggest a late prehistoric–early historic Hopi connection. For details consult the 1984 excavation report (Jones 1986a). The site contains numerous river-based drainages, as depicted in Figure 9.

Previous Work

Archaeologists conducted data recovery at this site in 1984 (Jones 1986a) as a result of high water releases that inundated cultural remains along the river. GRCA closed this site to visitors in 1985 due to the fragility of the terrain. Geomorphologists completed a topographic map of C:13:010 in 1993 using photogrammetry (Hereford et al. 1993). The RCMP staff has monitored the site annually since FY95 (Coder et al. 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). FY95 monitors recommended stabilization and total station mapping. FY96 monitors recommended installing checkdams and data recovery. During the 1996 research flow, the RCMP staff conducted supplemental monitoring efforts at this site (Balsom and Larralde 1996). FY97 monitors recommended data recovery, total station mapping, stabilization, and checkdams. After an assessment in FY97, monitors determined that checkdams would not be effective.

FY98 monitors recommended data recovery. The RCMP staff assessed the site for data recovery in FY97 and FY98. In FY98 and FY99 the RCMP staff implemented a limited data recovery project and completed medium-format photography. The RCMP staff will complete a separate report detailing this work upon completion of the analyses. FY99 monitors recommended additional data recovery. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY95 monitors observed increases in surface erosion and gullying and the presence of arroyo cutting. Monitors noted that the manos at Feature 34 were placed in a leaning position against the metate. These manos were not in previous photos of Feature 34 and obviously were moved from another location on the site. Footprints were observed on the beach and in the dunes below the site.

FY96 monitors recorded increases in surface erosion, gullying, eolian activity, bank slump and the presence of arroyo cutting. Monitors noted numerous rills, gullies, and bank slump throughout the dunes. Most of the features were experiencing extensive and active erosional impacts. Many of the arroyos and gullies on the site were undercutting features and causing them to fall into the active drainages. Monitors observed artifact displacement most likely from visitors.

FY97 monitors observed increases in gullying, bank slump, and eolian erosion, and the presence of arroyo cutting and surface erosion. Structures 9, 11, 20, and 21 and Feature 38 were classified in poor condition due to active erosional impacts. No visitor-related impacts were observed.

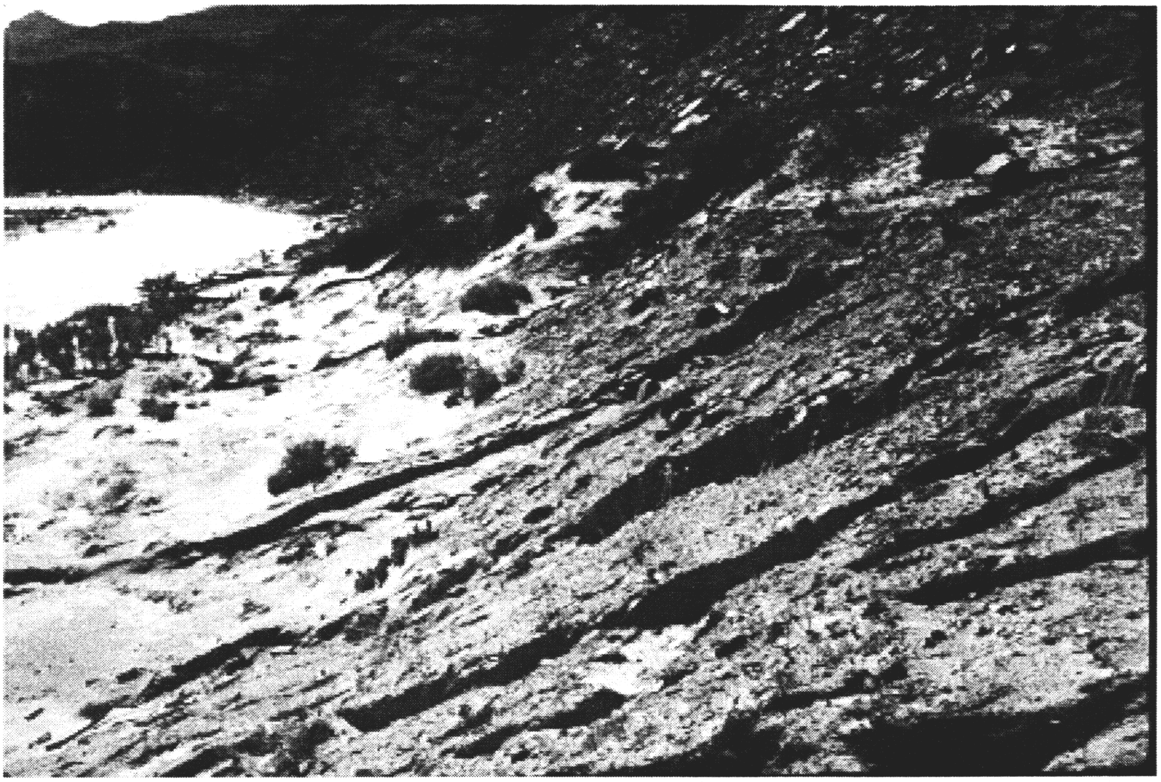


Figure 9. September 1983 photo illustrating the extensive river-based drainages throughout C:13:010; notice that many of the drainages are bisecting the alluvial terraces on their way to the river.

FY98 monitors recorded active gullying, bank slump, eolian erosion, and inactive surface erosion and arroyo cutting. Many of the features were experiencing one of the above-mentioned impacts. Old collection piles were noted on this visit.

FY99 monitors observed active surface erosion, gullying, eolian erosion, rodent burrowing, arroyo cutting, and inactive bank slump. Visitor-related impacts were identified near Feature 34 (artifact movement). Monitors noted that the main drainage and other drainages throughout the site had received recent flow with channeling down the center of the arroyo.

GRCA staff (1978 to 1989) and RCMP staff (1992 to present) recorded consistent drainage activity, bank slump, and erosional obliteration of archaeological features at C:13:010. Although the area is closed to visitors, collection piles and other evidence of visitor disturbance were recorded through the years. An extensive photographic history has developed at this site since the early 1960s. A long-term photographic replication project in FY97 showed the erosional severity of this area over the past 40 years. Data recovery is the only option for this site due to this documented erosion. The drainages on the site are river based and very active, continually exposing new cultural material.

Several members of the PA, including representatives from AZSHPO and GRCA, stopped at C:13:010 on the April 1999 river trip. The group decided that NAGPRA is a consideration at this site and that whole site excavation will be expensive due to the depth of deposits. However, the research potential at this site is tremendous. A phased excavation approach was recommended (Leap 1999).

FY99 Recommendations

Due to consistently recorded active erosion, the RCMP staff will continue annual monitoring until more extensive data recovery projects are implemented.

C:13:099 Structure–Thermal Feature Complex (semi-annual schedule)

This site contains two loci of fire-cracked rock, buried and collapsed structures, and artifacts. Archaeologists identified several charcoal lenses, burned rock features, and artifact concentrations. Many of the features are eroding out of the coppice dunes, bisected by a highly active drainage system. The drainage system has uncovered the majority of this site since 1978, evidenced by several newly exposed features recorded by GRCA and RCMP archaeologists. FY94 monitors recorded Features 6 and 7 eroding from the active drainage. FY95 monitors recorded Feature 8 eroding from the active arroyo. RCMP staff identified two new probable cists eroding from the active arroyo in FY98. RCMP archaeologists tested the probable features in FY99 and did not discover cultural material. Since 1990, the RCMP staff has discovered numerous lithics and sherds eroding from the active arroyo and scattered throughout the drainage system. An assemblage of 40 sherds suggests an early-mid Pueblo II occupation. Lithic evidence from this site includes two mano-like objects, ground to create a knife-like edge, as well as pecked grinding stones and hammerstones. Five charcoal samples were taken from several features in the early 1990s. Dates ranged from 140 years B.P. to 1410 years B.P.

Previous Work

Archaeologists originally recorded the site in 1978. Prior to the implementation of the monitoring program (late 1980s), GRCA conducted excavation and collected samples of a deteriorating feature (Feature 3). The RCMP staff has monitored C:13:099 semiannually since FY93 (Coder et al. 1994a, 1995a, 1995b; Kunde 1998a; Leap 1995c, 1996b, 1997a, 1997c, 1998b; Leap and Hubbard 1996b). FY94 monitors recommended trail work, installing checkdams, total station mapping, and subsurface testing. FY95 monitors recommended trail work, planting vegetation, installing checkdams, subsurface testing, data recovery, and total station mapping. In FY95 the GRCA trail crew performed trail obliteration work along the Beamer Trail, which relocated the hiking trail near the river to reduce visitor impacts.

In September 1995 RCMP staff, representatives from state and federal agencies, and tribal entities constructed 44 checkdams at C:13:099 (Leap 1995d). C:13:099 is the first location where Zuni-style checkdams were built in the river corridor. Archaeologists used a photogrammetric map (Hereford et al. 1993) for recording, prior to completion of a total station map in FY97. Each checkdam was photo-documented before and after its construction with 35 mm prints and slides. FY96 monitors recommended additional trail work and planting vegetation. Trail obliteration work was completed in FY97. RCMP staff conducted additional monitoring efforts during the research flow of 1996 (Balsom and Larralde

1996). FY97 monitors recommended checkdam maintenance and data recovery. FY98 monitors recommended data recovery, planting vegetation, and checkdam maintenance. Checkdam maintenance projects were completed in FY97 and FY98 (Leap et al. 1997, 1998). Monitors recommended medium format photography and projects were completed in FY95, FY96, and FY98 (Leap 1995a, 1996b, 1996d, 1998a). FY99 monitors recommended trail work, planting vegetation, and data recovery. Archaeologists conducted feature excavation and exploratory testing at Features 1, 3, 7, 9, and 10 in FY99. RCMP will disseminate the results of this project after an analysis is completed. FY99 monitors recommended more extensive excavation. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 monitors recorded extensive surface erosion, arroyo cutting, active bank slump, and moderate gullying. Monitors noted channeling in the trail through Locus A, exposure of new artifacts, and extensive visitor-related impacts.

FY94 monitors observed increases in surface erosion, gullying, arroyo cutting, bank slump, and alluvial erosion. Monitors recorded trailing, collection piles, and on-site camping attributed to the adjacent Beamer Trail and the river camp.

FY95 monitors recorded increases in surface erosion, arroyo cutting, bank slump and alluvial erosion throughout the site. Monitors noted that Features 1, 2, 3, 4, 6, and 7 were actively eroding due to the river-based drainage. They recorded increased trailing and the presence of collection piles at Feature 3.

FY96 monitors noted increases in surface erosion, gullying, arroyo cutting, bank slump, and alluvial erosion. Monitors commented on the stability of Feature 5, which has been stable for several years because of its distance of several meters from the river-based arroyo. Monitors noted increased bank slump near Feature 3 and increased bank undercutting at Feature 7. Feature 8 could not be located and extensive on-site rills had increased significantly in depth. Monitors commented on the abundant sediment gathering behind the newly constructed checkdams and the sediment deposited by the research flow (1996). Increased trailing was recorded on the site.

FY97 monitors observed increased gullying, arroyo cutting, bank slump, surface erosion and rodent activity. Increased bank slump was identified at Features 1, 3, 4, and 8. Monitors noted that heavy October rains had caused extensive scouring and undercutting in the drainage. Three checkdams showed signs of breaching. A small collection pile was documented near Feature 2.

FY98 monitors recorded active surface erosion, gullying, arroyo cutting, bank slump, and alluvial erosion. Monitors noted extensive undercutting, bank slump, and channel widening caused by intensive flow through the river-based drainage. Features 1, 2, 3, 4, 6, 7, and 8 were all physically impacted in FY98. Feature 5 remained stable. Monitors recorded a sherd collection pile at the river camp below the site, on-site artifact movement, and extensive trailing.

FY99 monitors observed active surface erosion, gullying, arroyo cutting, bank slump, alluvial erosion, and animal burrowing. All features were classified in poor condition. Monitors noted that artifacts, charcoal, and sediment are consistently washing into the active river-based drainage. Footprints were observed dropping into the arroyo from the river camp.

GRCA archaeologists (1978 to 1989) and the RCMP staff (1992 to present) have recorded intensive erosional activity at C:13:099 for many years. Since 1990, four features have been completely obliterated by the active river-based drainage (Features 2, 4, 6, and 8). Features 1, 3, and 7 have experienced some degree of degradation through channel cutting or bank slump since 1990. Feature 5 is the only consistently stable feature.

The 1996 research flow plugged the river-based drainage; however, the drainage has bisected the 45,000 cfs terrace, reaching the river once again. Many of the checkdams at this site received maintenance due to pooling and breaching. There are still multiple trails throughout the site, due to an adjacent river camp and the Tanner/Beamer Trail. Despite all the effort expended to build checkdams at this site, active erosion continues to occur. It is apparent through monitoring of the checkdams that before the area begins to stabilize itself, erosion will completely obliterate the remaining features.

Several members of the PA, including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff, stopped at C:13:099 on the April 1999 river trip. The group decided that additional excavation should be completed and that the site is in eminent danger because of the river-based arroyo. The site is extensive and whole-site excavation will be very expensive. RCMP staff recommended a phased data recovery approach from FY05 to FY08 (Leap 1999).

FY99 Recommendations

Semi-annual monitoring will continue due to the likelihood of additional cultural materials eroding from the river-based arroyo. A phased data recovery project is recommended within the next 5 years (Leap 1999). GRCA trail maintenance and annual Zuni checkdam maintenance will continue until excavations are completed. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

C:13:100 Pueblo (annual schedule)

This site is an open Pueblo II habitation site. Feature 1 is a rectangular habitation room. Feature 2 is another probable habitation room with a possible south entrance; it has standing walls two to three courses high. Adjoining Feature 2 is Feature 3, a small, more difficult to define structure; there may be another room attached to the southwest wall of Feature 3. Features 4 and 8 are probably associated rooms. Both features are exposed in an arroyo, with walls two to three courses high. Features 5 and 6 are the remains of slab-lined cists of Dox Sandstone. A charcoal stain in a trail evidences Feature 7. South of the dwellings is an eroding drainage 2 m across and 50 cm deep. Lithics and ceramics are scattered down the slope directly above the drainage. There is a heavy ground stone concentration near Features 5 and 6. Ground stone tools consist of six manos, four metates or slabs, eight hammerstones, and two sandstone knives. Seven ceramic sherds were also found. During the September 1995 erosion control project, archaeologists located a new feature (Feature 9) consisting of upright Dox slabs in an arroyo. FY97 monitors discovered two new features. Feature 10 is a charcoal lens north of Feature 7 and Feature 11 is a circular cist or hearth eroding from the drainage.

Previous Work

Archaeologists originally recorded C:13:100 in 1978 and it was monitored by GRCA archaeologists until FY92. Beginning in FY93, the RCMP staff monitored the site semi-annually (Coder et al. 1994a, 1995a, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). FY94 monitors recommended revegetation work, trail work, checkdam installation, total station mapping, and stabilization. FY95 monitors recommended planting vegetation and trail work due to heavy visitation. The RCMP staff conducted appropriate assessments and in FY95 trail work and checkdam installations were conducted (Leap and Coder 1995). FY95 monitors decided that no vegetation would be planted.

This site received additional monitoring during the research flow of 1996 (Balsom and Larralde 1996). FY96 monitors recommended additional trailwork. The area received further trail obliteration work in FY97 and surveyors completed a total station map in June 1997. Prior to completion of the total station map, RCMP staff used a photogrammetric topography map to plot additional features (Hereford 1996). Monitors recommended medium-format photography and projects were completed in FY95, FY96, and FY98 (Coder et al. 1995b; Leap et al. 1996, 1998). FY98 monitors recommended checkdam maintenance, testing, and data recovery at Features 5, 6, 7, 9, 10, and 11 before losing more cultural information. The RCMP staff and Zuni conservators completed checkdam maintenance in February 1998. FY99 monitors again recommended data recovery at Features 5, 6, 9, and 11 and recommended annual maintenance of checkdams. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

An extensive photographic record of the Palisades Delta extends back to the early 1900s. RCMP staff used this record to reconstruct the pre-dam Palisades environment. Long-term photographic replications indicate the pervasive loss of beaches and sediment in this area since the construction of Glen Canyon Dam. A 1909 Stone expedition photo confirms that the pre-dam Palisades shoreline consisted of broad beaches and abundant sediment. Currently, the shoreline is devoid of sediment, and consists of a large expanse of exposed river cobbles.

Monitoring Data Summary

FY92 and FY93 monitors recorded moderate surface erosion, gullying, and minor arroyo cutting. Monitors observed noticeable channeling in the gully that runs along the east side of Feature 1. A trail lined with rock was identified running directly through the site. The trail leads from the river camp to the site. The GRCA trail crew rerouted the trail in November 1992.

FY94 monitors observed increases in surface erosion, arroyo cutting, and alluvial erosion, and the presence of gullying. Monitors noted that the river-based arroyo impacting Features 5 and 6 has increased since FY93. Also, new arroyos were identified in the site area with artifacts visible in the drainage channels. Monitors identified minor trailing through the site since the GRCA trail crew rerouted trails in the area.

FY95 monitors noted increases in surface erosion, gullying, and the presence of arroyo cutting and alluvial erosion. Artifacts were observed washing downslope on the site. A collection pile was identified near Features 5 and 6 and trailing through the site was attributed to the close proximity of the river camp and the Beamer Trail.

FY96 monitors observed increases in surface erosion, alluvial erosion, and the presence of arroyo cutting, bank slump, animal-caused erosion, and root impacts. Monitors noted that the site looks more stable since the implementation of the September 1995 checkdam construction project (Leap and Coder 1995). A piece of bone was observed eroding out of Feature 7 due to gullying. Archaeologists noted that the 1996 research flow had plugged the on-site river-based drainage, transforming it into a terrace-based drainage (Balsom and Larralde 1996).

FY97 monitors recorded increases in surface erosion, gullying, alluvial erosion, and the presence of bank slump and arroyo cutting. Monitors recorded bank slump at Feature 7 and slight deflation at the newly discovered Feature 11. Features 7 and 10 could not be located during the visit. Increased erosion was also noted at Features 5 and 6 due to their location in the river-based drainage. Monitors recorded inactivity within the river-based arroyo and noted that the trail work has significantly reduced visitor-related impacts.

FY98 monitors observed active surface erosion, gullying, alluvial erosion, and the presence of bank slump and arroyo cutting. Features 5, 6, 7, and 8 were termed in poor condition. The faint on-site trail showed no recent use. Monitors suggested testing and data recovery for Features 5, 6, 7, 9, 10, and 11 before more cultural information is lost.

FY99 monitors observed active surface erosion, gullying, and alluvial erosion. Monitors concluded that overall the site is in poor condition. There was evidence of minor flow in the river-based drainage. Monitors noted a faint trail leading from Features 2 to 10, through structural and storage features. Monitors noted that flows over 45,000 cfs could cause river-runners to look for higher camp sites, which would directly impact the site.

Since 1992, RCMP monitors have consistently recorded the impacts caused by the on-site river-based drainage system. The 1996 research flow plugged the drainage, but it has since eroded through the 45,000 cfs terrace and reached the river. The river-based drainage impacts the majority of features at C:13:100. Trails remain present throughout the site, but they show little change since 1992.

Several members of the PA, including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff, stopped at C:13:100 on the April 1999 river trip. The group decided that mitigation of Features 5, 6, and 9 is imperative because they are directly impacted by the arroyo cut. The RCMP staff could complete the work in less than 3 hours. Whole-site treatment could involve using a GPR unit to test for subsurface materials and then using this information to write an RFP to contract out the work (Leap 1999). The RCMP staff recommended a phased excavation approach at C:13:100 spanning FY05 to FY08 (Leap 1999).

FY99 Recommendations

RCMP staff will continue annual monitoring of this site due to its history of active erosion and exposure of new cultural material. RCMP staff recommend that a phased data recovery project be completed in the next 5 years before further cultural information is lost. GRCA trail maintenance and annual Zuni checkdam maintenance and monitoring will continue until excavations are completed. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

C:13:273 Roaster Complex (annual schedule)

This site consists of four roasting features, a slab-lined cist, and two artifact concentrations. The roasting features all contain fire-cracked rock and charcoal. The artifact concentrations at AC-1 include more than 50 items of lithic debitage and about 15–25 ceramic items. The artifact concentration at AC-2 consists of 7 flakes, 10 sherds, and 1 piece of ground stone. Feature 1, a large donut-shaped roasting feature, is similar in morphology to many of the roasters in the western Canyon. Ceramics indicate an early Pueblo I to Pueblo II Cohonina and Puebloan occupation. Radiocarbon dates taken from Feature 5 indicate an earlier occupation of A.D. 575 to A.D. 775.

Previous Work

Archaeologists recorded the site in 1990 and the RCMP staff monitored it in FY93, FY95, FY96, FY97, FY98, and FY99 (Coder et al. 1994a; Leap 1994a, 1995c; Leap and Hubbard 1996b; Leap and Kunde 1998). FY95 monitors recommended stabilization and retrailing. In FY95 the RCMP staff conducted archaeological clearance work prior to a GRCA trail crew retrailing project (Leap 1995e). FY96 and FY97 monitors recommended stabilization for Feature 3 due to its precarious location on the edge of an active drainage. FY97 monitors recommended data recovery for Features 3 and 5. Surveyors mapped the site with a total station instrument, RCMP staff conducted a data recovery assessment, and archaeologists excavated Feature 5 (Yeatts 1998). FY98 monitors recommended data recovery at Feature 3 due to its precarious position on the cutbank of an arroyo. FY99 monitors obliterated an access trail from the side canyon that directly impacted Feature 4.

Monitoring Data Summary

FY93 monitors recorded moderate surface erosion, gullying, and arroyo cutting on the site. Monitors noted that one of the gullies showed downcutting and distinct trails were recorded. FY95 monitors observed increased gullying, bank slump, and the presence of arroyo cutting. Monitors noted that the Beamer Trail is directly impacting the west side of Feature 1.

FY96 monitors recorded the presence of surface erosion, gullying, arroyo cutting, and side canyon erosion. Monitors noted that Feature 3 was very unstable. FY97 monitors observed increased surface erosion and the presence of gullying, arroyo cutting, and alluvial erosion. Overall, the site looked stable in FY97 with the exception of Features 3 and 5. Heavy rains had increased surface runoff throughout the site and increases in vegetation and cryptogamic soil were noted.

FY98 monitors noted active surface erosion and inactive gullying, arroyo cutting, alluvial erosion, and side-canyon erosion. Most of the features looked stable except for Feature 3. Monitors noted trailing and a piece of turquoise. The turquoise is most likely from recent visits by Zuni tribal representatives.

FY99 monitors recorded active surface erosion, arroyo cutting, and inactive gullying. Feature 3 remained in a precarious position impacted by the on-site drainage. Feature 1 showed minor surface erosion. Monitors noted that river fluctuations do not affect visitation to this site because there are no nearby river-runner camps. The Beamer trail runs through the site and is maintained by the GRCA trail crew.

Monitors have recorded surface erosion, gullying, arroyo cutting, eolian-alluvial activity, and bank slump since 1990. The Beamer Trail runs directly through the site. Monitors have consistently recorded visitor-related impacts from hikers at C:13:273. RCMP personnel have consistently recommended excavating Feature 3, stating that it will erode into the active river-based drainage and valuable information will be lost. The site mimics many of the roasting complexes in the western Canyon. Such a site is rare in the eastern Canyon and excavation would provide valuable cultural information for this reason. Monitoring will continue annually due to several active drainages within the site boundary that have the potential to expose or destroy new cultural material.

FY99 Recommendations

Annual monitoring will continue until mitigation is completed. RCMP staff recommend that archaeologists excavate Feature 3 because no form of preservation can stabilize the feature. GRCA will continue trail maintenance. After the excavation of Feature 3, the monitoring schedule will be reevaluated.

C:13:291 Small Structure (annual schedule)

The site consists of standing walls of several structures and Dox Sandstone cists. Feature 1 is a 2-m-long wall and juniper post eroding downslope. Feature 2 is a slab-lined cist with a room exposed in a cutbank. Feature 3 is a wall exposed in a gully. Feature 4 is a hearth or cist. Feature 5 is a cluster of Dox slabs that may be coursed. Artifacts include 19 sherds and lithics, including a chopper, a hammerstone, and a bi-edge tool. Sediment and slope wash cover the site to a depth of more than 1 m in some areas. Apparently the site was constructed on a terrace, and it has since been covered periodically by slope wash and fluvial sand. During the initial recording in 1988 a metate and mano were relocated, documented, and measured. FY95 monitors noted that Feature 2 was completely obliterated by the river-based arroyo. FY96 monitors discovered a Tusayan Whiteware/Sosi Black-on-White sherd below Feature 3. Artifacts indicate a mid-late Pueblo II occupation.

Previous Work

Archaeologists originally recorded the site in 1988 and again in 1990 (Fairley et al. 1994). During the initial recording a metate and mano were relocated above the site. The RCMP staff has monitored the site annually since FY92 (Coder et al. 1994a, 1994b, 1995a, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). Monitors recommended checkdams and total station mapping in FY94, but after further assessment, the RCMP staff and Zuni conservators concluded that the drainages were too mature for checkdams. FY95 monitors recommended some form of stabilization for Features 1 and 4. During the research flow of 1996, visitors created a trail through the site on their way to Unkar Delta. The research flow created extensive cutbank erosion below the site, obliterating the formerly used trail. The RCMP staff obliterated the newly created trail in FY97, at which time a total station map was completed. Additional monitoring efforts including medium-format photography were also conducted during the research flow (Balsom and Larralde 1996). FY98 monitors recommended testing, data recovery, radiocarbon samples, and dendro samples. FY99 monitors recommended data recovery for Features 1, 4, and 5, and continued trail maintenance. Minor trail maintenance was conducted in FY99. RCMP staff could not collect charcoal from the site in FY99 due to the charcoal disappearance through intensive erosion. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

The 1990 survey crew recorded eight arroyos and five gullies bisecting the terrace. FY92 and FY93 monitors recorded moderate surface erosion and extensive gullying and arroyo cutting. Monitors noted substantial erosion of the cutbank below the site due to high water releases in January and February.

FY94 monitors observed increased surface erosion, gullying, and the presence of arroyo cutting, bank slump, and alluvial erosion. Monitors noted that the site is extremely fragile and in poor condition, and that on-site drainages are deepening and exposing new cultural material. Small monitoring crews were recommended due to the fragility of the site. Monitors recorded minor trailing.

FY95 monitors recorded increased gullying and the presence of alluvial erosion. An active gully was noted impacting Features 1 and 4. Feature 2 was completely obliterated. Substantial headward erosion and deepening of the drainages was recorded. Trailing on the site was attributed to river-runners walking from a nearby camp to Unkar Delta.

FY96 monitors observed increased gullying, arroyo cutting, alluvial erosion, and increased animal burrowing. Extensive undercutting of Feature 3 was observed and Feature 1 had increased erosion. Monitors noted that the headcut of the arroyo is very active, causing downslope movement of natural debris and cultural material. The main trail that parallels Features 1 and 5 showed signs of bank slump.

FY97 monitors recorded increased surface erosion, gullying, and the presence of arroyo cutting. Monitors observed increases in impacts primarily at Features 1 and 4 exposed in the active arroyo. Trailing was again identified on the site.

FY98 monitors recorded active rodent burrowing at Feature 4 and active surface erosion and arroyo cutting. Monitors observed new burnt material eroding out of the arroyo that is impacting Features 1 and 4. The well-defined trail below the site was mentioned.

FY99 monitors noted active surface erosion, gullying, arroyo cutting, and rodent burrowing. They stated that the arroyo is moving significant amounts of sediment. Monitors noted that the lower trail obliteration work was destroyed, but then conducted quick trail obliteration work.

Monitors have consistently recorded the active erosion of on-site river-based drainages from 1992 to 1999. A river camp was established upstream of this site after the 1983 flow obliterated the river camp formerly below the site. River-runners that camp at the new upstream river camp established a trail below the site leading to Unkar Delta. The 1996 research flow caused extensive erosion below the site, forcing people to create a new trail through the site.

Several members of the PA, including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff, stopped at C:13:291 on the April 1999 river trip. The group decided that higher flows do not increase stability at this site, but scour the lower terrace. The site is between Furnace Flats and Unkar and has high research potential. Data collection at this site could be compared with both sites. PA representatives recommended testing before contracting the site out for mitigation (Leap 1999).

FY99 Recommendations

The RCMP staff will continue annual monitoring until data recovery is completed between FY01 and FY06 (Leap 1999). GRCA trail maintenance will also continue.

C:13:321 Roaster Complex (annual schedule)

This site consists of four roasting features and a rubble mound of Dox Sandstone. The rubble mound may be associated with an historic cabin (C:13:092) located south of this site. Ceramics, fire-cracked rock, and a shaped Dox Sandstone "lid" were found on the site. More than 30 flakes were present in the roasting features, as well as ground stone including four mano fragments and two cobbles. Ceramic evidence includes several Puebloan sherds ranging from A.D. 1050 to A.D. 1200, though specific cultural affiliation remains undetermined.

Previous Work

Archaeologists originally recorded the site in 1989 and GRCA personnel monitored it until it was transferred to the River Corridor Monitoring Project. The RCMP staff have monitored the site annually since FY93 (Coder et al. 1994a, 1995a, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). FY94 monitors recommended total station mapping and radiocarbon dating of Feature 5. FY95 monitors recommended mapping, testing, and stabilization of Feature 5 in FY95. This site was one of three sites selected for data recovery prior to the research flow in 1996. RCMP staff conducted excavation at Feature 4, the only feature that would have been impacted by the flood. After excavation, the RCMP staff determined that Feature 4 had no subsurface deposits (Balsom and Larralde 1996). Monitors also conducted medium-format photography before and after the flood (Leap 1996b, 1996d). See Hereford (Hereford et al. 1993) for photogrammetric mapping used prior to the completion of a total station map of the site in FY97. In FY97 and FY98, archaeologists recommended observation of Feature 5 due to ongoing erosion. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 monitors recorded moderate surface erosion and increased exposure of Feature 5 due to wind deflation and increased foot traffic from the adjacent river camp. FY94 archaeologists recorded overall site stability, but ephemeral trails were located from the camping beach throughout the site.

FY95 monitors observed increases in surface erosion, eolian activity, root impacts, and the presence of gullying. Feature 5 was slightly deflated and Features 1 and 3 had minor rock movement. Although no visitor impacts were recorded on this visit, monitors warned of the high potential due to the close proximity of a primary river camping beach.

FY96 monitors noted the presence of surface erosion, eolian erosion, and mesquite impacts. Monitors recorded impacts at Features 1, 4, 5, and 6. Monitors noted scattered turquoise located at Feature 1, left by Zuni elders on the previous river trip. On-site camping and trailing were recorded in FY96.

FY97 monitors recorded increases in surface erosion and alluvial erosion around Features 1, 2, 3, and 5. Monitors observed a collection pile at Feature 5 and it was dispersed by the crew. Archaeologists warned of continued basal erosion of Feature 5, which could cause collapse and eventual obliteration.

FY98 monitors recorded active surface erosion and eolian erosion at all features. Monitors observed a noticeable increase in surface erosion around Feature 5 including one slab that is no longer upright. On-site trails were observed on this visit.

FY99 monitors observed active surface erosion and eolian erosion. Monitors identified a shallow drainage adjacent to Feature 3 and recorded on-site camping on and adjacent to Feature 4.

All features are experiencing eolian activity due to their location in an extensive dune field. The RCMP has consistently recorded eolian-alluvial activity, surface erosion and visitor-related impacts at C:13:321. A large and popular river camp is located directly below the site. Monitors identified Feature 5 as highly impacted by a river-based drainage and visitor-related disturbance. The feature is located in an inner-dunal area that appears conducive to runoff during heavy rains.

FY99 Recommendations

Monitoring will continue annually until mitigation is completed. Due to the presence of a river-based drainage impacting Features 5 and 6, and consistent visitor-related impacts due to the proximity of a primary camping beach, monitors will assess Features 5 and 6 for data recovery in FY00. Feature 5 represents the intact morphology of a slab-lined roasting feature. Little is known regarding the temporal nature or cultural affiliation of this kind of feature in the river corridor.

C:13:333 Thermal Feature (4-year schedule)

This Pueblo II site consists of a FCR concentration (Feature 1), with a sparse lithic scatter, a sherd, and tools or manuports. Feature 1 is a 2-m-diameter area of fire-cracked rock with charcoal. The lithic scatter consists of ca. 15 flakes on the southeast end of the site. The sherd was found near the center of the site. Fire-cracked rock is scattered throughout the site. Tools include two travertine fragments with possible polish, a mano and a basalt cobble chopper. The site is exposed in a narrow inner-dunal area that is conducive to runoff to the river. FY95 monitors discovered additional charcoal and some bone fragments near the lithic scatter. FY99 monitors identified a fire-cracked rock feature 10 m west of Feature 3.

Previous Work

The site was recorded by GRCA archaeologists in 1990 (Fairley et al. 1994) and monitored in FY92, FY93, FY95, and FY99 (Coder 1992, 1993; Hubbard 1999b; Leap 1995b). FY95 monitors recommended testing for subsurface cultural deposits and collection of charcoal samples.

Monitoring Data Summary

FY92 and FY93 monitors recorded extensive surface erosion. FY92 and FY93 monitors noted that the site appeared stable since it was recorded in 1990, although minimal on-site camping was evident.

FY95 monitors recorded active eolian erosion and the presence of surface erosion, arroyo cutting, and minor animal trailing and burrowing. The eolian activity was occurring at the lithic scatter and Feature 1. Monitors noted that the dune has redistributed sand over the fire-cracked rock and that the drainage periodically flows between the dunes, as evidenced by recent cutting. Charcoal and bone fragments were discovered and put on the map. No visitor impacts were observed. Monitors recommended monitoring in 4 years due to increasing eolian and alluvial activity.

FY99 monitors noted active eolian and alluvial processes. Inactive surface erosion was recorded. Monitors noted that Feature 1 and the lithic and bone concentration were unchanged. The inner-dunal areas are conducive to local runoff. No sign of visitor disturbance was recorded. A new thermal feature was located on this visit.

FY99 Recommendations

Continue monitoring every 4 years due to eolian activity and the potential for river-based drainage erosion. The site will be assessed for charcoal collection in FY00. A radiocarbon date could produce valuable temporal information and add to the cultural chronology of the river corridor.

C:13:334 Structure–Thermal Feature Complex (3-year schedule)

C:13:334 is an open habitation site with a fire feature, a rock outline, a circular cist, and a lithic and sherd scatter. Lithic artifacts include two probable hammerstones and a Tapeats Sandstone mano. Thirteen sherds indicate a Late Pueblo I–early Pueblo II Cohonina affiliation. The site is located on a low sandy terrace near a large playa. A backpacker in September 1996 reported a white biface associated with this site.

Previous Work

Archaeologists initially recorded the site in September 1990 (Fairley et al. 1994). The RCMP staff monitored it in FY93, FY95, and FY99 (Coder et al. 1994a, 1995b; Hubbard 1999b). See Hereford's publication for photogrammetric mapping of the Palisades Delta (Hereford 1993). Monitors have not recommended any remedial actions for this site.

Monitoring Data Summary

FY93 monitors recorded moderate surface erosion and minor gullying. They noted that the large river-based drainage impacting C:13:099 will eventually migrate and cut through this site. No visitor-related impacts were recorded.

FY95 monitors recorded the presence of surface erosion and alluvial erosion. Feature 4 showed some movement of rocks since the last visit. Monitors observed minor visitor-related impacts at Feature 2 in the form of artifact movement. Overall, monitors considered the site in stable condition.

FY99 monitors noted that the surface erosion feeds into the playa above C:13:099. This surface erosion is part of a very erosive drainage system that has impacted C:13:099. However, the site is higher than C:13:099 and in overall fair condition.

FY99 Recommendations

RCMP staff will continue monitoring C:13:334 on a 3-year schedule due to its proximity to a highly erosive river-based drainage. It will also be assessed for preservation treatment in FY00.

C:13:339 Small Structure (annual schedule)

The site consists of a mid-late Pueblo II habitation buried on an alluvial terrace, composed of a burned rock midden, a buried hearth, and several rock alignments. The burned rock midden, with sparse lithics and ceramics, is located on the north side of the site, eroding out of a cutbank. Two historic hearths are also located on the site. The site is situated against a Dox Sandstone cliff.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and monitored in FY93, FY95, FY96, FY97, FY98, and FY99 (Coder et al. 1994a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). Retrailing was conducted in FY95 after completion of archaeological clearance by the river corridor office (Leap 1994b). Total station mapping was also completed in September 1998. Mitigation was proposed for this site in FY95 (Leap 1995d). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Physical impacts observed during the survey included surficial sheet washing, gullying, active arroyo cutting, and bank slumpage. Human impacts included distinct trails, trail-caused erosion, and rearrangement of rocks. The Beamer Trail intersects this area down to a lower terrace. The FY93 monitoring staff observed sheet wash, gullying, active arroyo cutting, and bank slump.

FY95 monitoring staff noted that the site is situated on a steep and actively eroding terrace. By FY96, Features 1, 2, 3, 5, and 6 were exposed in gullies or steep-sided bank cuts that pose ongoing impacts to the site.

The FY97 monitoring staff noted that impacts were visible at Features 2, 3, and 7. Due to rains, an increase in surface runoff on the west side of Feature 2 was noted. Feature 3 also experienced minor changes on its south side through gullying. This gully was very active, exposing two new, possibly cultural, Dox slabs.

FY98 monitors noted that deepening of the gully bisecting Feature 3 is burying the feature. Feature 7 was stable with minor rodent burrowing on the northeast side. Increased surface erosion at Feature 5 has resulted in movement of fire-cracked rock off the surface, down the cutbank. All other features appeared stable. It was also recommended that seedlings be placed near Feature 1 to decrease the minor rilling. Planting vegetation may help stabilize the cutbank where Features 5 and 6 are located.

FY99 Recommendations

The RCMP staff recommends continued trail maintenance by the GRCA rehabilitation crew. Also, RCMP staff will continue annual monitoring due to active gullying. Data recovery should be conducted at Features 3, 4, and 5.

C:13:345 Small Structure (inactive schedule)

This is an open site isolated in dunes adjacent to the river. During the initial recording, naturally occurring alignments of rock and vertical slabs of sandstone exposed in a debris flow may have been mistakenly construed as cultural. A few white chert flakes were found on the slope of the dune and some cores were noted. Cultural affiliation is unknown.

Previous Work

Archaeologists initially recorded the site in September 1990 (Fairley et al. 1994). The RCMP staff monitored it for the first time in FY96 (Leap et al. 1996). FY96 monitors recommended testing for subsurface deposits to determine if cultural materials exist. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY96 monitors observed that portions of the debris flow and dune had fallen into the arroyo that bisects the site area. Monitors recorded increased alluvial erosion and the presence of surface erosion, gullying, arroyo cutting, bank slump, side canyon erosion, animal disturbance, and root impacts.

FY99 Recommendations

The RCMP staff will assess this site for testing due to feature integrity questions. Upon completion of assessment for testing, the RCMP staff will reevaluate the monitoring schedule.

C:13:347 Small Structure (annual schedule)

This site consists of a masonry wall and metate eroding out of a steep arroyo. FY94 monitors discovered a serpentine pipe bowl fragment eroding from the arroyo next to the wall. The pipe was collected by RCMP archaeologists. FY95 monitors discovered a Black Mesa Black-on-white sherd eroding from the same location. RCMP staff collected the sherd during exploratory testing in FY99. No other artifacts were found.

Previous Work

Archaeologists recorded the site in 1990 (Fairley et al. 1994) and the RCMP staff monitored it in FY92, FY93, FY95, FY96, FY97, FY98 and FY99 (Coder et al. 1994a, 1994b, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). Monitors collected the pipe bowl fragment and curated it at the South Rim in FY94. The pipe was discovered while producing a total station map of the site. FY95 monitors recommended more extensive total station mapping. FY96 monitors conducted medium-format photography before the research flow and recommended checkdam installation and data recovery. FY97 monitors recommended data recovery, testing, and installing checkdams. Zuni conservators and RCMP staff assessed the site for preservation action in FY97 and instead determined that data recovery was appropriate. Surveyors completed a total station map for this site in FY97. FY98 monitors recommended data recovery before more cultural material was lost. The RCMP staff conducted exploratory testing in FY99 to determine if the exposed wall continued into the arroyo cutbank. Testing indicated that the wall does extend into the sediment and that cultural materials are still intact. The large Black Mesa Black-on-white sherd was collected during exploratory testing in FY99 due to its vulnerable position in the arroyo. FY99 monitors recommended more extensive data recovery.

Monitoring Data Summary

FY92 and FY93 monitors recorded extensive arroyo cutting and gullying. Monitors attributed steepening of the alluvial terrace to the 1983 flooding. This direct impact from water releases accelerated bank slump and arroyo downcutting. No visitor-related impacts were recorded and no river camps are in the vicinity.

FY95 monitors recorded increased surface erosion, river-based arroyo cutting, and the presence of rodent burrowing. Archaeologists noted that the arroyo had deepened and a Tusayan White Ware sherd (Black Mesa) was discovered eroding from the arroyo wall. No visitor-related impacts were recorded although the site is near the Tanner-Cardenas Trail.

FY96 monitors observed increased surface erosion, rodent burrowing, and the presence of a river-based arroyo. Monitors noted that a small animal had burrowed behind one of the uprights in the wall and caused extensive erosion. Archaeologists were at this site during the 45,000 cfs flow and recorded no impacts to the site. No visitation was recorded.

FY97 monitors recorded increased arroyo cutting, bank slump, alluvial erosion, and the presence of surface erosion, animal burrowing, and root disturbance. New Dox Sandstone slabs were exposed in the arroyo wall and drainage flow was traced all the way to the river.

FY98 monitors observed new nick points in the arroyo. Overall the site was in good condition on this visit. No visitor-related impacts were recorded.

FY99 monitors recorded active rodent burrowing and inactive arroyo cutting, surface erosion and alluvial erosion. Some grasses were growing out of the arroyo channel on this visit. No visitor impacts were observed.

The RCMP staff has consistently recorded surface erosion, arroyo downcutting, bank slump, and animal burrowing at this site since FY92. Since 1990 new artifacts and charcoal lenses have eroded from the arroyo. The arroyo is river based and the site is located precariously close to the river (ca. 15 m). RCMP staff recorded no visitor-related disturbances, although a river trail is located approximately 10 m below, and the Tanner/Cardenas Trail is located 25 m above the site. No river camps are located in the vicinity. RCMP staff recommend a phased approach to data recovery at this site extending from FY04 to FY06 (Leap 1999). The recommendation is based on the exploratory testing conducted in FY99.

FY99 Recommendations

RCMP staff will continue annual monitoring of C:13:347 until a phased data recovery project is implemented. The Hopi Tribe will be consulted on additional management actions.

C:13:355 Roasting Feature (4-year schedule)

This site consists of four fire features and a pot break. Feature 1 is a pit-lined feature with small sandstone slabs and small limestone rocks. Features 2 and 3 are eroding hearths and Feature 4 is an historic fire feature with a remnant of a Coconino Sandstone anvil stone. This is considered a late-prehistoric (A.D. 1200–1600) Paiute site with a possible historic component. Artifacts include a secondary flake with retouch along one edge and 15 Paiute Brown Ware sherds.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and RCMP staff monitored it in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998). Fairley collected charcoal for radiocarbon dates in 1992; five dates were retrieved spanning from 130 ± 50 years B.P. to as early as 880 ± 60 years B.P. In FY98, monitors recommended an assessment for data recovery and stabilization at Feature 3. In April 1999 PA representatives and RCMP staff decided that no data recovery would be completed at this site (Leap 1999).

Monitoring Data Summary

FY92 and FY93 monitors recorded moderate surface erosion and extensive gullying and arroyo cutting. The extensive erosion was attributed to base-level lowering of the river-based drainages. FY94 monitors observed increased arroyo cutting, which eroded a large portion of Feature 3. FY98 monitors recorded active arroyo cutting, and inactive bank slump, gullying, and alluvial erosion. Monitors noted extensive erosion at Features 1, 2, and 3. Feature 4 was in stable condition. Monitors stated that Feature 2 no longer has data potential.

The RCMP staff has observed no sign of visitor disturbance, although the Beamer Trail passes through the site.

FY99 Recommendations

This site was assessed with PA representatives in April 1999. It was agreed that no data recovery should occur. Further, a decrease in the monitoring schedule is recommended, from biennial to every 4 years. The features remaining at the site, 1 and 4, are in very stable condition. The RCMP staff recommends assessing the on-site river-based arroyos for preservation treatment.

C:13:359 Small Structure (biennial schedule)

This site consists of habitation or storage features and associated artifacts. Feature 1 is a small, wet-laid wall that is probably the remains of a granary. It is within a shallow Bass Limestone overhang and is constructed of Dox and Tapeats sandstone slabs. Feature 2 is a partially exposed structure evidenced by two walls at right angles that are partially buried in the sand. Two meters west is a single vertical slab that may indicate another structure or feature. Feature 3 is another exposed structure composed of a linear alignment of Dox Sandstone slabs with associated sherds and lithics. North of Feature 2 is a 1-m-diameter stain of charcoal flecks and two manuport stones. Nine sherds suggest an early-mid Pueblo II affiliation. Other artifacts include a biface fragment, a chert pebble tool, and a light scatter of flakes.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994). The RCMP staff monitored the site annually from FY92 to FY98 (Coder et al. 1994a, 1994b, 1995a, 1995b; Leap et al. 1996, 1997, 1998). FY94 monitors recommended total station mapping and subsurface testing for cultural deposits. FY95 monitors recommended site stabilization. FY96 monitors recommended excavating the entire site due to intensive erosion. RCMP staff conducted data recovery at Feature 2 in FY97 (Yeatts 1998). Prior to excavation work, a total station map and assessment were completed for the site. Upon completion of the excavation work, the RCMP staff and Zuni Conservation personnel installed checkdams in the gully that bisects Feature 2. Zuni conservators performed checkdam maintenance at Checkdams 1 and 4 in FY99. A stationary camera was placed at this site in FY92 and removed in FY96.

Monitoring Data Summary

FY92 and FY93 monitors recorded moderate surface erosion, gullying, and cliff spall. Monitors noted that a gully was exposing Feature 2, Feature 3 was slumping downslope, and there was a gully below Feature 1. FY94 monitors recorded the presence of surface erosion, gullying, and arroyo cutting. They identified minor downslope movement at Feature 3. Trails on the site were a result of recording the site. No river camps are in the vicinity on this side of the river.

FY95 monitors observed increased gullying and the presence of surface erosion, alluvial erosion, and animal disturbance. Monitors noted that gullying caused minor sediment loss and that the dune is vegetated and stable. No visitation was recorded.

FY96 monitors recorded increased gullying and the presence of surface erosion, bank slump, alluvial erosion, side canyon erosion, animal disturbance, and root impacts. Monitors noted that the active gully continues to impact the site.

FY97 monitors observed increases in surface erosion, gullying, bank slump, and alluvial erosion. Monitors observed the undercutting of Feature 2 by the active gully.

FY98 monitors recorded active surface erosion, alluvial erosion, and inactive gullying. Monitors observed evidence of minor runoff in the gully and deposition behind the checkdams.

The RCMP staff consistently recorded erosional activity and active river-based drainage erosion at this site. Runoff in the gully usually results in sediment deposition behind the checkdams. Monitors have not recorded visitor-related impacts because there are no camps or hiking trails near the site. Monitoring suggests that there is the potential for continued erosion and discovery of new artifacts.

FY99 Recommendations

The RCMP staff will continue biennial monitoring due to the site's history of active erosion. Zuni Conservation personnel and RCMP staff will continue annual checkdam maintenance. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

C:13:368 Artifact Scatter (inactive schedule)

C:13:368 is a small rockshelter with a sparse lithic scatter consisting of less than 15 flakes. A single dart-size side-notched projectile point suggests a possible Archaic occupation. Two modern charcoal areas may have been left by river-runners. However, the charcoal areas could also be historic or even prehistoric in nature. The site is located in a travertine deposit and laminar alluvial sediments are present on the surface, indicating the presence of very high water in the shelter at some point prehistorically. Cultural affiliation is unknown.

Previous Work

Archaeologists recorded the site in October of 1990 (Fairley et al. 1994). The RCMP staff monitored the site in FY92, FY93, and FY95 (Coder et al. 1994a,1994b, 1995b). Monitors in FY95 recommended subsurface testing and collection of charcoal for dating purposes.

Monitoring Data Summary

FY92 and FY93 monitors recorded minor river-based gullying. FY95 monitors recorded the presence of surface erosion, eolian/alluvial activity, spalling, and animal disturbance at this site. FY95 monitors also recorded an increase in bank slump. C:13:368 is directly impacted by runoff coming over the lip of the travertine shelter from above. The runoff has created a small channel that bisects the site and removes sediment. RCMP staff recommended monitoring the gully near the downstream charcoal concentration. No visitor-related impacts have been observed.

FY99 Recommendations

The site is currently on an inactive monitoring schedule. RCMP staff will assess the site for data recovery with the intention to collect intact charcoal. Charcoal located below or intermixed with the alluvial deposits could yield valuable temporal and cultural information related to occupation and flood events.

C:13:381 Thermal Feature (inactive schedule)

C:13:381 consists of a heavily eroded fire feature, lithics, and a burned artiodactyl bone. Artifacts found within the vicinity of the hearth include a projectile point tip, a biface fragment, fire-cracked rock, and a few flakes. Cultural affiliation is not known.

Previous Work

GRCA personnel recorded the site in March 1991 (Fairley et al. 1994). The RCMP staff monitored the site in FY92, FY93, FY94, and FY96 (Coder et al. 1994a, 1994b, 1995b; Leap et al. 1996). Monitors recommended checkdam installation and stabilization in FY96. A total station map was completed in FY97. The site was assessed in FY97 and Zuni personnel constructed three checkdams in the river-based drainage. Checkdam 1 received minor maintenance in FY98. Checkdams 1 and 2 received maintenance in FY99.

Monitoring Data Summary

FY92 and FY93 monitors observed moderate drainage activity impacting the site. Monitors also noted backpacker impacts due to a nearby trail and camp. FY94 monitors recorded the presence of surface erosion, gullying, and on-site trails. FY96 monitors recorded increased surface erosion and gullying, and the presence of alluvial erosion, animal disturbance, and root impacts. There is a backpacker camp on the site.

In FY98 RCMP staff and geomorphologists confirmed that the drainage impacting the site is river based. Prior to FY97, this drainage was considered a terrace-based drainage on monitoring forms.

FY99 Recommendations

The RCMP staff recommends an inactive monitoring schedule; however, checkdam maintenance will continue annually by RCMP staff and Zuni Conservation personnel. If new cultural material is identified during checkdam monitoring visits, then the monitoring schedule will be reevaluated. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

C:13:387 Small Structure (4-year schedule)

The site has six features (Features 1–6), including dry-laid walls, cists, sherds, and two metates. Features 1–4 are wall or slab-lined features that are under or in front of Dox Sandstone overhangs. Feature 5 is a collapsed structure of unknown form and function with some burned limestone at the toe of a low dune ridge. Feature 6 is a small Dox Sandstone wall on a terrace remnant that may be recent or historic. Most sherds were found below Feature 6 on a dune ridge; one large corrugated sherd was on an adjacent ridge slope. The two metates are eroding down the side of a deep arroyo below Features 1 and 2. Generally, the overhang features appear to be storage structures; however, Feature 3 contained remnant mortar. Ceramics suggest a Pueblo II cultural affiliation.

Previous Work

Archaeologists recorded the site in October 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY96 and FY97 (Leap et al. 1996, 1997). FY96 monitors recommended checkdam installation; however, an assessment by Zuni Conservation personnel in FY97 determined that none would be installed. RCMP staff took detailed measurements and photographs of two metates impacted by the active arroyo in FY97. Archaeologists did not collect the metates but moved them into the lower portion of the headcut. Monitors have not recommended any other work at this site.

Monitoring Data Summary

FY96 monitors recorded increased surface erosion, gullying, arroyo cutting, bank slump, eolian-alluvial erosion, and animal burrowing. Monitors confirmed that one of the drainages reaches the river.

FY97 monitors recorded increased surface erosion, arroyo cutting, bank slump, eolian-alluvial erosion, and animal burrowing. Heavy rain had impacted the two metates exposed in the large arroyo. The river-based drainage is moving on-site deposits into a riverside cobble field. No visitor-related impacts were recorded at this site because no river campsites are located in this area.

FY99 Recommendations

Due to the past erosional activity at this site, RCMP staff will monitor C:13:387 in FY00 and will subsequently monitor the site every 4 years.

G:03:004 Roaster Complex (annual schedule)

The site is located at the mouth of a major side canyon and is situated less than 100 m from an established boat camp. This site contains several roasting features, two rockshelters, rock images, and historic remains. The two rockshelters have a midden containing charcoal, burned soil, fire-cracked rock, and artifacts. One shelter has several historic mason jars and other trash dating to the 1930s, plus the inscription "M BUNDY." The ceiling of this shelter, below the inscription, has some faint hematite figures. The remaining features are roasting pits. In addition to the historic component, the site may be affiliated with both Pueblo I–III occupation and late prehistoric–early historic Pai or Paiute. A FCR concentration with no artifacts on the downstream side of Indian Canyon is probably affiliated with the main site. During FY96 monitors added historic cans to the site map, and in FY97 monitors discovered a newly exposed slab-lined feature (Feature 8) between Features 1 and 2. In FY98 archaeologists recorded a chert awl in the midden area that was not previously identified.

Previous Work

This site was initially recorded in 1972 and was revisited several times throughout the 1970s. Sherds were collected and analyzed and a few notes were taken. No further descriptive work or mapping was completed, but on each occasion more sherds were collected and typed. NPS survey personnel re-recorded the site in 1991 (Fairley et al. 1994). From FY93 to FY95 the site was monitored twice a year, and in FY96 the monitoring schedule changed to annual (Coder et al. 1994a, 1995a, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). In FY95 retrailing and trail obliteration were completed and minimal work was completed on a total station map.

In FY97 more trail work was needed and medium-format black-and-white and color photographs were taken of the historic inscription. After trail work was completed in FY95 a letter was published in the *Boatman's Quarterly* requesting that visitors use the designated trail that leads directly to the "Bundy jars," and not traverse through the prehistoric areas (Bulletts 1995). Commercial users did not honor this request and more trail work was needed in April 1997. RCMP staff drafted a second letter to the Park's concessionaire representative in June 1997 regarding commercial use of the area. This letter requested that the commercial guides use the new, designated trail or the commercial outfitters would be responsible for any necessary mitigation. To date, NPS has agreed to allocate funds to address recreational impacts. However, this work is contingent on tribal consultations. A final assessment for trail maintenance was conducted in FY99. This assessment was to implement trail work prior to excavations and to produce a plan for a new trail after excavations are completed. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Since FY93 the main impact recorded at this site has been visitor-related disturbances. In FY93 extensive trailing was observed due to increased awareness of the site and the popularity of the location as an overnight camp as well as a common lunch spot. Archaeologists recommended that G:03:004 be mapped in detail using a total station.

In FY94 and FY95 the site was not being adversely affected by physical impacts. However, monitors believed that the potential existed due to localized rainstorms. A trail was entrenching on the north side of Features 2 and 7, leading to the midden and rock shelter (Feature 1). Recorders noted that if no work was completed soon the trail would be too deep to control.

Trail work was completed in FY95 and it had a positive effect. FY96 monitors found the site to be fairly stable. The local packrat community caused the only noted disturbance.

By FY97 animal burrowing had increased at Features 2 and 4, and surface erosion, gullying, side canyon erosion, and spalling were all present but inactive. Two new artifact piles existed in front of Feature 1. Historic cans and jars were piled together on the ledge west of the feature. Shallow digging was observed in the midden area of Feature 1. It was undetermined if the digging was visitor related or animal disturbance. Deadfall used for trail obliteration in November of 1995 was moved aside and the old trails were being used again.

Physical disturbances were more evident at Features 1–5, 7, and 8 in FY98. Feature 6 illustrated some surface erosion to the south-southeast. Archaeologists were not worried about these physical changes because they thought they would repair themselves. No recommendations were made for preservation intervention.

Visitor impacts were more visible at Features 1, 2, and 8 in FY98. There was a large collection pile (70+ artifacts), general foot trampling, and historic artifact movement. Trail maintenance was suggested due to new trailing. It was recommended that Feature 8 (a cist or probable hearth feature) be excavated before its integrity is lost, and that surface collections occur near Features 1, 2, and 8 before several of the diagnostic artifacts begin to disappear.

Surface erosion and gullying continued to be active in FY99. Monitors reported that checkdams would not curtail sediment loss due to the location of the features so close to bedrock. The trail from the Tapeats Sandstone ledge was still being used despite repeated trail obliteration and retrailing efforts by the GRCA and RCMP personnel. It has now entrenched into a gully. Data recovery continues to be recommended. The RCMP staff believes that this site will be excavated in the next 2 years with NPS Fee Demo funds; these funds from increased entrance fees are returned to the Park for specific projects such as excavation, vegetation, road maintenance, and trail maintenance. Consultation with tribal members and AZSHPO may alter this time frame.

FY99 Recommendations

Annual monitoring will continue until the site is excavated using GRCA Fee Demo funds. Excavations will center on Features 1, 2, and 8 with limited excavation in the other roasting features. A more extensive total station map should be completed before data recovery. The research design will include a preservation plan consisting of data recovery and the creation of a trail system. All work is contingent on AZSHPO and tribal consultation. The Hopi Tribe recommends closing the site to visitors.

G:03:028 Roaster Complex (biennial schedule)

The site is divided into six loci of activity (A–F). Locus A consists of two roasting features with fire-cracked rock, ash, charcoal, a lithic concentration, and some ceramics. Locus B is a light scatter of lithic debitage, including a point base and a sherd. Locus C is a tight concentration of about 20 flakes and a sherd. Locus D contains three blow-out or dug-out areas that may be wickiup depressions with associated flakes and fire-cracked rock, plus additional fire-cracked rock and lithic concentrations and a grouping of buried slabs. Locus E is an area of possible domestic activity, represented by four possible wickiup depressions—some with encircling stone "foundations," and associated lithics, sherds, ground stone, and fire-cracked rock. Locus F has one well-defined roaster, and other fire-cracked rock concentrations that may represent more roasting features. Lithic debitage consists of a wide variety of cherts and obsidian, and reflects expedient reduction. Pueblo II Formative sherds dominate at Loci A, B, and E, whereas late prehistoric–early historic Pai sherds are seen at Loci C, D, and also E. The site is located on low stabilized dunes covering an alluvial terrace.

Previous Work

The site was officially recorded in 1991 by NPS personnel (Fairley et al. 1994) and monitored in FY93, twice in FY94, and once in FY95, FY97, and FY99 (Coder et al. 1994a, 1995a, 1995b; Hubbard 1999b; Leap et al. 1997). The GRCA trail crew obliterated extensive trailing in FY95. In FY96 the features were located with a total station instrument and overlain on the 1995 topographic map produced by Hereford (Hereford et al. 1996b). In FY96, a GRCA trail crew also completed trail obliteration, retrailing, and vegetation to deter visitation (Leap 1996f). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 and FY94 monitoring staff observed that active gullying and deflation were impacting this site. Human trails were channeling runoff, resulting in gully formation. FY94 monitors recommended that the gullies be stabilized to prevent further development.

FY95 monitoring staff observed a decrease in visitation and changed the monitoring schedule from annual to biennial. FY97 monitoring staff recommended that Loci A and F be priority areas for monitoring due to their proximity to trails.

FY99 monitoring staff noted recent rodent burrowing near the top of Feature 1, near the creosote bush. Locus B was stable and showed no change. Locus C was stable with the exception of a trail on the west side. FY99 monitors noted that Features 1 and 2 have active surface erosion causing downslope movement of sediment. There was also a noticeable increase in vegetation at Feature 1. Features 3 and 4 are currently stable. Loci B through E were stable with no changes in physical erosion. The RCMP staff recommend that the GRCA trail and rehabilitation crew conduct more extensive trail obliteration, especially near Locus C. The obliterated scouting trails adjacent to Features 1 through 3 have the potential to become gullies. The RCMP monitors will continue biennial monitoring due to active physical erosion.

FY99 Recommendations

The RCMP staff recommends continued trail maintenance by the GRCA rehabilitation crew in conjunction with Hualapai consultation and participation. RCMP staff will continue biennial monitoring.

G:03:034 Roaster Complex (biennial schedule)

The site is located on both sides of a drainage that cuts through a dune-covered alluvial fan. Locus A is on the downstream side of the drainage and Locus B is on the upstream side. Features 1 through 6 and Feature 10 are located in Locus A. All features but Feature 2 are roasting or fire features (Feature 5 has an associated pot break). Feature 2 is a rock cairn and rebar that attests to some form of historic activity. Archaeologists discovered a few chert and rhyolite flakes, a biface knife base, and a hammerstone. Features 7 through 9, at Locus B, are all roasting features. This site may be related to G:03:031, a rockshelter located slightly upstream and above this site. Prehistoric artifacts, including 10 Shinarump Gray Ware sherds, suggest a Pueblo I–early Pueblo II Virgin affiliation. FY94 monitors found what they believed could be a burial just downslope of Feature 6.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY94, FY95, FY97, and FY99 (Coder et al. 1995a, 1995b; Hubbard 1999b; Leap et al. 1997). FY94 monitors recommended total station mapping and FY95 monitors recommended testing for subsurface cultural materials. This area was assessed in April 1997, and RCMP staff determined that no data recovery was warranted. RCMP staff conducted an assessment for charcoal samples in FY99 and determined that sampling would disturb the features' stability.

Monitoring Data Summary

FY94 monitors recorded increased eolian erosion and the presence of surface erosion, gullying, arroyo cutting, side canyon erosion, and animal-caused erosion. Monitors noted deflation throughout the site. Monitors also noted that although the site is located upstream of a river camp, no visitation was evident. FY95 monitors observed increased eolian activity, and the presence of surface erosion, gullying, arroyo cutting, and bank slump. They noted extensive eolian and drainage impacts at most features on the site. On-site footprints were noted on this visit.

FY97 monitors recorded an increase in bank slump and the presence of surface erosion, arroyo cutting, eolian erosion, side canyon erosion, animal disturbance and root impacts. Monitors noted physical changes at many of the features. FY99 monitors recorded active surface erosion, eolian erosion, and inactive arroyo cutting. Eolian processes were evident throughout the site and Feature 1 had minor downslope movement of rock. No sign of human visitation was evident. The RCMP staff identified the drainages on this site as river based.

FY99 Recommendations

The RCMP staff will continue biennial monitoring, paying particular attention to Features 8 and 9. The on-site river-based drainages will also be assessed for preservation treatment.

G:03:038 Roaster Complex (biennial schedule)

This site consists of four roasting features, a possible wickiup ring, and associated ceramics. Feature 1 is a scatter of fire-cracked rock. FY97 monitors discovered a new roasting feature at the contact of the alluvial terrace and the talus slope. An RCMP archaeologist recorded a newly exposed roasting feature on the September 1998 mapping trip in close proximity to the river. Sherds indicate a multicomponent site with Pueblo I–early Pueblo II Virgin and late prehistoric–early historic Paiute occupations.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY96 and FY98 (Leap et al. 1996, 1998). FY96 monitors recommended checkdam installation. In FY97 an assessment was made and Zuni conservators installed brush linings. Surveyors completed a total station map in FY97. FY98 monitors recommended installing jute mat to curtail deflation and establish vegetation. Zuni conservators performed maintenance on all the previous brush checks and added 11 rock checkdams in FY99 (Hubbard 1999b). FY99 monitors noted on the April river trip that additional checkdam maintenance is needed. They assessed Feature 4 for data recovery and decided to continue monitoring the preservation treatment instead of excavating. During a September 1998 mapping trip an RCMP archaeologist discovered a new roasting feature below the main site area near the river. The archaeologist recommended data recovery at this feature due to its physical condition and potential for lost cultural material.

Monitoring Data Summary

FY96 monitors recorded the presence of surface erosion, gullying, eolian erosion, side canyon erosion, and animal trailing. Monitors were concerned with an active gully and noted that heavy flow through the drainage will impact Features 1 and 3. Monitors questioned whether Feature 2 was a cultural feature.

FY98 monitors recorded active surface erosion, gullying, and inactive bank slump. All of the checkdams had deposition of sediment behind them. Monitors noted that the features are stable but in precarious locations. No visitor-related impacts were recorded.

An RCMP archaeologist discovered a newly exposed thermal feature and an associated Tapeats Sandstone pecked slab during the September 1998 mapping trip. The feature is extremely close to the river and is also impacted by the on-site river-based drainage.

FY99 Recommendations

RCMP will continue biennial monitoring at this site. Zuni Conservation personnel and RCMP staff will continue annual checkdam maintenance. RCMP staff will assess the newly found roasting feature, near the river, for data recovery. The RCMP staff also recommends that the river-based drainage be remapped to measure its rate of activity. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

G:03:041 Roaster Complex (annual schedule)

This site consists of three large roasting features. Archaeologists recorded a sparse lithic scatter, two cores, a chopper, and one Tizon wiped sherd. The late prehistoric–early Pai site appears to have been a temporary hunting camp, based on the absence of grinding implements and abundance of bone.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY96, FY98, and FY99 (Hubbard 1999b; Leap et al. 1996, 1998). The RCMP staff recommended stabilization in FY96. In FY97 the site was assessed for checkdams and Zuni Conservation personnel constructed three rock and brush linings in the drainages below the site. A total station map was completed in FY97. FY98 monitors recommended planting vegetation and obliterating trails caused by remedial work projects. The RCMP staff assessed this area for trail obliteration and planting vegetation in FY99 and found that the trails were recovering naturally. Checkdam maintenance occurred at one checkdam, and six additional checkdams were built in FY99. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY96 monitors recorded increases in surface erosion and gullying. Monitors noted an increase in headcut advancement at Feature 3. The gully that bisects Feature 2 appeared to be filling in with grass and cryptogamic soil.

FY98 monitors identified active alluvial erosion at Feature 3 and noted that Feature 2 was in poor condition. The monitoring schedule was changed from biennial to annual in FY98 due to the consistent erosional activity at this site.

FY99 monitors recorded active surface erosion and gullying. Feature 1 had active erosion at Checkdam 1. Feature 3 had active gullying at Checkdam 2 and downslope movement of fire-cracked rock. Feature 2 had increased vegetation and minor surface erosion.

The checkdams have showed only minor deposition, although monitors noticed slight pooling behind some. Checkdam 1 (where Feature 2 is located) is in a much more active system than Checkdam 2. The RCMP staff have not recorded visitor disturbance at this site.

FY99 Recommendations

RCMP staff will continue annual monitoring due to the site's active erosional history. Checkdam maintenance will also be conducted yearly. Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume.

G:03:043 Thermal Feature (biennial schedule)

This site consists of five eroded hearths and fire-cracked-rock areas. Artifacts identified include lithics, charcoal, and ground stone. No ceramics were recorded on the site. One thick biface or scraper and two pecked-slab metates were recorded. Cultural and temporal information are unknown.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). See Hereford et al. (1996) for photogrammetric mapping conducted in this area. Hereford also collected charcoal from an isolated hearth located near the site's upstream side. The radiocarbon dates from this sample indicated a date of 830 ± 100 years B.P. FY98 monitors recommended data recovery at Features 4 and 5.

Monitoring Data Summary

FY94 monitors recorded increased bank slump falling into the active arroyo. Features 4 and 5 are located on the downstream side of the arroyo. No visitor-related impacts were recorded. Monitors noted that this would be a good site for obtaining radiocarbon dates.

FY98 monitors recorded ongoing bank slump due to the active arroyo near Features 3, 4, and 5. Monitors had a difficult time finding Feature 3. Sheetwashing and gullying were also occurring adjacent to Feature 1. The gully near Feature 1 eventually runs into the large arroyo where Features 3, 4, and 5 are located.

All of the features show a history of active erosion and are in precarious situations. FY98 monitors confirmed that the arroyo impacting Features 5 and 8 reaches the river. Monitors have not recorded visitor disturbance at this site.

The RCMP staff stopped at G:03:043 on the April 1999 river trip and decided that the site's location across from a highly concentrated site area gives this site research potential. Therefore, this site should be considered for whole site excavation after testing (Leap 1999).

FY99 Recommendations

The RCMP staff recommends a biennial monitoring schedule due to the precarious location of the features. Data recovery is recommended for Features 4 and 5 because they are in danger of being lost due to bank slump (Leap 1999). Monitoring will continue until assessment and mitigation is completed.

G:03:055 Thermal Feature (5-year schedule)

This site contains two thermal features with a light lithic scatter and a few hand tools. Archaeologists recorded a single brown undifferentiated Pai or Paiute utility ware during the survey, as well as one cobble mano. The two thermal features may be the same roasting pit.

Previous Work

Archaeologists recorded the site in March 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY96 and FY99 (Leap et al. 1996). FY96 monitors recommended stabilization at this site. Surveyors completed a total station map in FY97. The RCMP staff assessed the site for erosion control work in FY99 and recommended that work be focused on the upstream gully. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY96 monitors recorded the presence of surface erosion, gullying, arroyo cutting, eolian activity, and animal disturbance. The arroyo was deep but had not changed since 1991. Vegetation was covering the dune, making the area appear stable.

FY99 monitors recorded active surface erosion, animal burrowing, and eolian activity. Monitors identified an increase in surface erosion around the feature, but the feature remained unaffected. A large river-based arroyo runs adjacent to the northeast edge of the site. Thick vegetation covers most of the site, serving as protection. No human visitation was recorded and no camping beaches are located near the area. FY99 monitors noted that flows higher than 90,000 cfs would impact the dune terraces below the site.

FY99 Recommendations

The RCMP staff will monitor the site every 5 years to document any artifacts that might be exposed from the expansion of the river-based arroyo and surface erosion.

G:03:060 Roaster Complex (3-year schedule)

G:03:060 consists of a roaster complex with 13 features and artifacts. Artifacts include hand tools, ground stone, flakes, and five Moapa sherds, which indicate a Virgin Branch component. Tools include one flake chopper, two biface tips, two bifaces, and two grinding stones. The site is located on a river terrace covered by partially stabilized dunes. Runoff from the surface reaches localized channels that flow directly into the Colorado River. FY95 monitors found two bifaces at Features 1 and 6. FY97 monitors discovered a large biface (knife) and FY99 monitors recorded a thermal feature (Feature 14) next to a gully on the site's north side.

Previous Work

Archaeologists recorded the site in April 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY94, FY95, and FY99 (Coder et al. 1995a, 1995b; Hubbard 1999b). FY99 monitors recommended obtaining charcoal samples from Feature 13 and total station mapping.

Monitoring Data Summary

FY94 monitors recorded the presence of surface erosion and alluvial-eolian erosion. FY95 monitors noted increased animal disturbance and the presence of surface erosion, gullying, arroyo cutting, and eolian disturbance. No visitor impacts were recorded at this site.

FY99 monitors identified active surface erosion, arroyo cutting, bank slump, and animal burrowing. Gullying was recorded but no increases were observed. Because of the large site area (80 x 200 m) and its location at the base of an active talus slope, major erosional impacts are inevitable. FY99 monitors recommended taking a charcoal sample and data recovery from Feature 13 before it is obliterated.

FY99 Recommendations

Monitoring will continue every 3 years at this site due to ongoing physical erosion. The RCMP staff recommends collecting a carbon sample from Feature 13 and completing a total station map.

G:03:064 Roaster Complex (annual schedule)

This site consists of 15 features, including mostly roasting features. Charcoal lenses are present in several of the arroyo cuts. Artifacts associated with the roasting features include lithics, ceramics, a shell bead, and ground stone. Lithics include a flake drill and a reworked Elko Corner-notched projectile point. The ceramic assemblage suggests a multicomponent site: Pueblo I–III Formative and late prehistoric–early historic Pai or Paiute. This could be one of the most informative sites in the western Grand Canyon with potential for dating and chronology-building. FY96 monitors discovered a large Redwall Chert point tip exposed in the river-based drainage across from Feature 1. FY97 monitors discovered a chert awl at Feature 6. RCMP staff on the September 1997 mapping trip discovered newly exposed Jeddito Yellow Ware sherds, obsidian flakes, an olivella shell bead, and two new probable roasting features or FCR scatters exposed by the river-based arroyo. FY98 monitors discovered new FCR features exposed by the arroyo. FY99 monitors discovered seven new charcoal lenses exposed in the river-based arroyo.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and RCMP staff monitored it at least annually since FY94 (Coder et al. 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). In FY93 archaeologists collected radiocarbon samples resulting in a range of dates from 170 ± 50 B.P. to 2670 ± 140 B.P. In FY94, monitors recommended planting vegetation, installing checkdams, and total station mapping. FY95 monitors conducted medium-format photography of the active drainage (Leap 1995a). FY95 and FY96 monitors recommended testing and total station mapping.

In FY95 total station mapping began and in FY97 a complete map was produced. During the intensive mapping, archaeologists discovered two new roasting features, new lithics, ceramics, and an olivella shell bead. FY96 monitors also recommended either an attempt at stabilization or full site excavation. FY98 monitors recommended obliterating trails caused from 5 days of intensive site mapping and data recovery. After further assessment it was determined that the trails were recovering naturally. FY99 monitors recommended data recovery and remapping of the arroyo headcuts to identify their rate of advancement. The RCMP collected charcoal samples from Charcoal Lens D and Feature 1 in FY99. The samples will be sent for dating in the near future. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY94 monitors recorded the presence of surface erosion, gullying, arroyo cutting, bank slump, alluvial erosion, animal-caused erosion, and root impacts. Monitors noted that the arroyo had cut deeper since the 1993 visit. Bank slump was recorded at Feature 8. No visitor-related impacts were recorded. FY95 monitors noted increases in surface erosion, gullying, arroyo cutting, bank slump, alluvial erosion, and animal disturbance. They noted extensive deepening and widening of the river-based erosion. Overall, the site was in poor condition.

FY96 monitors recorded increases in surface erosion, gullying, arroyo cutting, and bank slump, and the presence of animal-caused erosion. Monitors recorded extensive increases in erosion, formation of new headcuts, and bank slump. FY97 monitors recorded increases in surface erosion, gullying, arroyo cutting, bank slump, and animal disturbance, and the presence of alluvial erosion and root impacts. Many of the features appeared stable although some parts of the arroyo had new nickpoints and appeared deeper and wider. Monitors noted that there was high potential for continued erosion at this site.

FY98 monitors recorded active surface erosion, gullying, arroyo cutting, bank slump, and inactive animal disturbance and alluvial erosion. Monitors recorded extensive downward cutting up to a meter deep. They noted that the charcoal lenses were in danger of obliteration.

FY99 monitors recorded active surface erosion, gullying, arroyo cutting, bank slump, animal disturbance, and inactive and alluvial erosion. Monitors noted extensive downward arroyo cutting. A large flash flood had impacted the drainage, washing most of the vegetation within the arroyo out to the river (including large mesquite trees). The flood caused extensive bank slump throughout the drainage, extreme headcut advancement, and obliteration of previously identified charcoal lenses. Also, seven new charcoal lenses were identified in the arroyo.

The RCMP staff has consistently recorded active surface erosion, gullying, arroyo cutting, bank slump, eolian-alluvial processes, animal disturbance, and root disturbance. This site, commonly referred to as "Arroyo Grande," continues to be one of the most erosive sites monitored by RCMP staff.

FY99 Recommendations

G:03:064 will remain on an annual monitoring schedule until a data recovery plan is implemented. The RCMP staff recommends a phased approach to data recovery and consultation with the Hualapai staff regarding the development of a data recovery plan for Arroyo Grande.

G:03:067 Roasting Feature (biennial schedule)

The site consists of five fire-cracked-rock middens with associated lithics and a dispersed flake scatter. Archaeologists discovered two thin bifaces and one Moapa Brown Ware sherd upslope of Feature 1, suggestive of a late Pueblo I–early Pueblo II Virgin affiliation.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored it annually from FY92 to FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b). In FY95 the monitoring schedule changed to biennial and the RCMP staff monitored the site in FY97 and FY99 (Leap 1995a; Leap et al. 1997). FY94 and FY95 monitors recommended obliterating on-site trails. The GRCA trail crew conducted trail obliteration in FY96. FY99 monitors recommended trail maintenance and assessment for brush and rock linings in the drainages near Features 1 and 4. The RCMP staff assessed the site and determined that no checkdams would be built.

Monitoring Data Summary

FY92 and FY93 monitors recorded moderate gullying and arroyo cutting but overall inactive physical erosion. Extensive trailing was recorded. FY94 monitors identified surface erosion, alluvial erosion, and trailing throughout the roasting features. FY95 monitors recorded erosional stability at this site. Monitors noted that a trail bisects Feature 3 and that there is a nearby camp.

FY97 monitors recorded overall feature stability and extensive trailing. FY99 monitors identified active surface erosion and gullying. They noted minor surface erosion at Feature 3 and a nearby drainage on the downstream side of Feature 4. A gully was active on the western edge of Feature 1. Extensive trailing was still a problem at this location.

FY99 Recommendations

The site will remain on a biennial schedule due to the proximity of a camping beach and recently recorded erosional activity. GRCA trail maintenance will continue due to three large and heavily used camps below this site.

G:03:076 Roasting Feature (3-year schedule)

This site consists of the deflated remains of a single roaster partitioned into three segments by local runoff and vegetation. A single cobble mano is located on the surface. Archaeologists observed no diagnostic materials and cultural affiliation is unknown. The site is situated on the remnant face of a dune, abutting a rock-strewn talus slope.

Previous Work

Archaeologists recorded the site in March 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY96 and FY99 (Hubbard 1999b; Leap et al. 1996). FY96 monitors recommended stabilization for this site and it was reassessed in FY97. RCMP staff decided that no work would be done.

Monitoring Data Summary

FY96 monitors recorded the presence of surface erosion, gullying, and animal-caused erosion. They also noted that Feature 2 was eroding downslope, but Features 1 and 3 remained stable. No visitor-related impacts were noted. FY99 monitors identified the site in good condition with no changes since the FY96 visit. No visitor-related impacts were recorded.

FY99 Recommendations

RCMP staff will monitor G:03:076 on a 3-year schedule due to the potential for erosional activity.

SITES WITH RIVER- AND TERRACE-BASED DRAINAGES

Eight sites are identified as having river- and terrace-based drainages. Four (C:02:085, C:05:031, C:13:098, and C:13:272) of the eight sites represent active arroyos and gullies. Based on the research conducted by Hereford (Hereford et al. 1993), the RCMP staff considers sites with river-based drainages as directly impacted by dam operations due to base-level lowering to compensate for the current river level.

C:02:085 Thermal Feature (iInactive schedule)

This site consists entirely of a charcoal stain with bits of charcoal and a few associated pieces of animal bone. The stain is a circular area about a meter below the present terrace surface. It may be the remains of a buried hearth. No associated artifacts were seen. Cultural affiliation is unknown.

Previous Work

This feature was initially documented in 1991 by NPS personnel (Fairley et al. 1994), and was monitored in FY93, FY95, and FY97 (Coder et al. 1994a, 1995b; Leap et al. 1997). Melis and other paleo flood researchers collected charcoal in the late 1980s to date flood deposits; however, no dates have been reported to the Park.

Monitoring Data Summary

In FY93 monitors saw the site as unstable and unprotected. It experienced extensive surficial sheet washing, bank slump, arroyo cutting, and minor gullying. Human trailing was moderate. In FY95 the condition of the site was the same. In FY97 the feature could no longer be identified due to continual erosion. At that time the site was placed on the inactive list. Monitoring will occur only as needed; i.e. another research flow may impact the bank, thus exposing new features.

FY99 Recommendations

It is apparent that site integrity is questionable. It is therefore recommended that limited excavation occur to identify any additional intact, subsurface cultural remains. Results of the limited data recovery will determine future site management actions.

C:05:031 Small Structure (biennial schedule)

The site consists of two Loci (A and B) with two structural features (Features 1 and 2) and three areas of FCR concentrations (Features 3–5). Artifacts indicate a Pueblo I–early Pueblo II affiliation. Note that Feature 2 is natural, not cultural, according to investigations by the FY97 monitors.

Previous Work

NPS survey personnel recorded this site in 1990 (Fairley et al. 1994). Monitoring occurred annually from FY92 through FY95, except that in FY94 the site was monitored twice. In FY95 the schedule changed to every other year (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1997).

Monitoring Data Summary

In FY92 and FY93 archaeologists observed the positive and negative effects of the eolian process. The largest erosional element on the site was an arroyo cutting the slope at the southern margin of Locus A. Visitor-related impacts were minimal. It was recommended in FY92 that checkdams be built and annual monitoring continue.

In FY94 monitors found the site to be fairly stable although sand was eroding and not being replaced. The same observations were made in FY95 but a biennial monitoring schedule was recommended.

FY97 archaeologists observed minor deflation at Feature 5, and the gully between Features 3 and 4 seemed to be infilling. No human disturbances were observed. The main concern at the site was the active gully between Features 3 and 4. Monitors determined that if the gully showed additional downcutting in 2 years, it would be a candidate for checkdam construction.

By FY99 archaeologists noticed that the gully near Features 3 and 4 exhibited new nick points and an increase in alluvial erosion. However, the upper portion of this same gully, below Feature 1, had filled in with sediment. This site is one of the best examples demonstrating a cut and fill process. No preservation treatment was recommended for the site in FY99 because for the majority of the time, it has been moderately stable. Therefore the request for checkdams in FY92 was not seen as a necessary action. Biennial monitoring will continue due to the erosion and deposition process observed by monitors in the gully between Features 3 and 4.

FY99 Recommendations

Biennial monitoring will continue. RCMP personnel recommend a preservation assessment. Vegetation may play a significant role in stabilizing the active dune-gully area.

C:13:098 Historic Structure (annual schedule)

This historic mine and cabin site contains two loci. Locus A consists of two mine adits at the base of the Palisades cliff along the Palisades fault. The main adit is situated about 10 m above the surrounding terrain with an extensive tailing pile below it. The second adit is located about 10 m below and 20 m south of the main adit. About 225 m south-southwest is Locus B, which includes a log cabin constructed of driftwood logs. The cabin measures 2.6 x 4.1 m (interior) and is five courses high. The floor is partially paved with sandstone slabs, with a log and board bed frame in the northeast corner. A canvas tent probably formed the upper walls and roof. About 4 m due south of the cabin door is a driftwood log "fence". This structure is made of stacked logs up to four courses high. It may have been a windbreak.

Artifacts date from 1900–1920 to the mid-1930s. In FY98 monitors found a cist feature eroding out of the drainage near the cabin.

Previous Work

This site was initially recorded by Euler and Jones in 1978 and then re-recorded by NPS personnel in 1990 (Fairley et al. 1994). GRCA documents from 1929 and 1930 reveal an investigation made by the Park Service on the lode mining claims by George W. McCormick and others in May 1913 (Busch 1930; Daly 1929). The RCMP staff monitored the site semiannually from FY93 to FY98 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1996, 1997, 1998). In FY98 it was determined that annual monitoring would suffice, therefore monitoring occurred only once in FY99 (Kunde 1998a). See Hereford (Hereford 1996; Hereford et al. 1996b) for a photogrammetric topographic map of the immediate area. In FY95 the cabin and associated artifacts were photographed with a medium-format camera. Currently, and prior to the inception of this program, NPS trail crews maintained the trails in the area.

Monitoring Data Summary

From FY93 to the present monitors have observed visitor impacts (trailing and collection piles). This site is very visible and is located near a heavily used backcountry trail. Most of the visitor impacts were observed in the fall, after the summer season. Although visitor-related impacts are pervasive they are not the main attributes for site deterioration, and they have minimal effect on site integrity. Palisades Delta is a very erosive area. Several geomorphologists and sedimentologists have researched the area and have come up with similar findings (Hereford et al. 1993; Lindsey and Fisher 1999; Thompson et al. 1998). The delta has one of the largest catchment systems within the RCMP. Soil composition is very different from other deltas within the Colorado River corridor. Salinity content is very high and therefore water runoff does not saturate the ground (Lindsey and Fisher 1999). It pools up, then releases at an incredible velocity. Although some locations on the delta experience these activities more, the entire delta is in a very active erosional state by comparison.

In FY93 archaeologists noted surface erosion throughout the site but no defined channels were apparent. FY94 and FY95 monitors recorded the gullying process occurring near the cabin (see Figure 10). Two separate erosional channels had headcuts to within 1 m of the cabin. At this time preservation treatments were recommended along with limited testing and continued trail maintenance. In September of 1995 the area was assessed for checkdam installation. Upon further evaluation, no checkdams were placed. However, checkdams were placed in the surrounding areas designated as sites C:13:099 and C:13:100.

In FY97 archaeologists observed increased surface erosion at the cabin, in a gully west of the cabin, and near the artifact concentration. The rills near the artifact stump also exhibited some movement. A small gully with several headcuts developed on the north side of the cabin, yet despite all this activity, human disturbance was determined to be the only impact. Artifact movement and displacement and the formation of small collection piles were observed. During the second monitoring episode of FY97, the site appeared stable; however, it was recommended at that time to plant vegetation in the rills near the cabin.

During the first monitoring episode in FY98 the site was not actively eroding at a noticeable rate. The second monitoring episode for the fiscal year demonstrated the same condition. Archaeologists, however, did discover a newly exposed cist feature approximately 30 m southwest of the cabin.

After further assessment, it was recommended that the site be monitored annually, concentrating on the gully activity. It was also recommended that GRCA trail maintenance continue, to keep visitors from creating multiple trails to the cabin.

Physical impacts to this site in FY99 were at a minimum. The gullies leading to the cabin were not active. The cist appeared stable with no further exposure of the slabs. Even visitor-related impacts were comparatively at a minimum in FY99. Few footprints were observed, but several collection piles were recorded. FY99 site management included annual monitoring of the physical impacts and continued trail maintenance by GRCA.

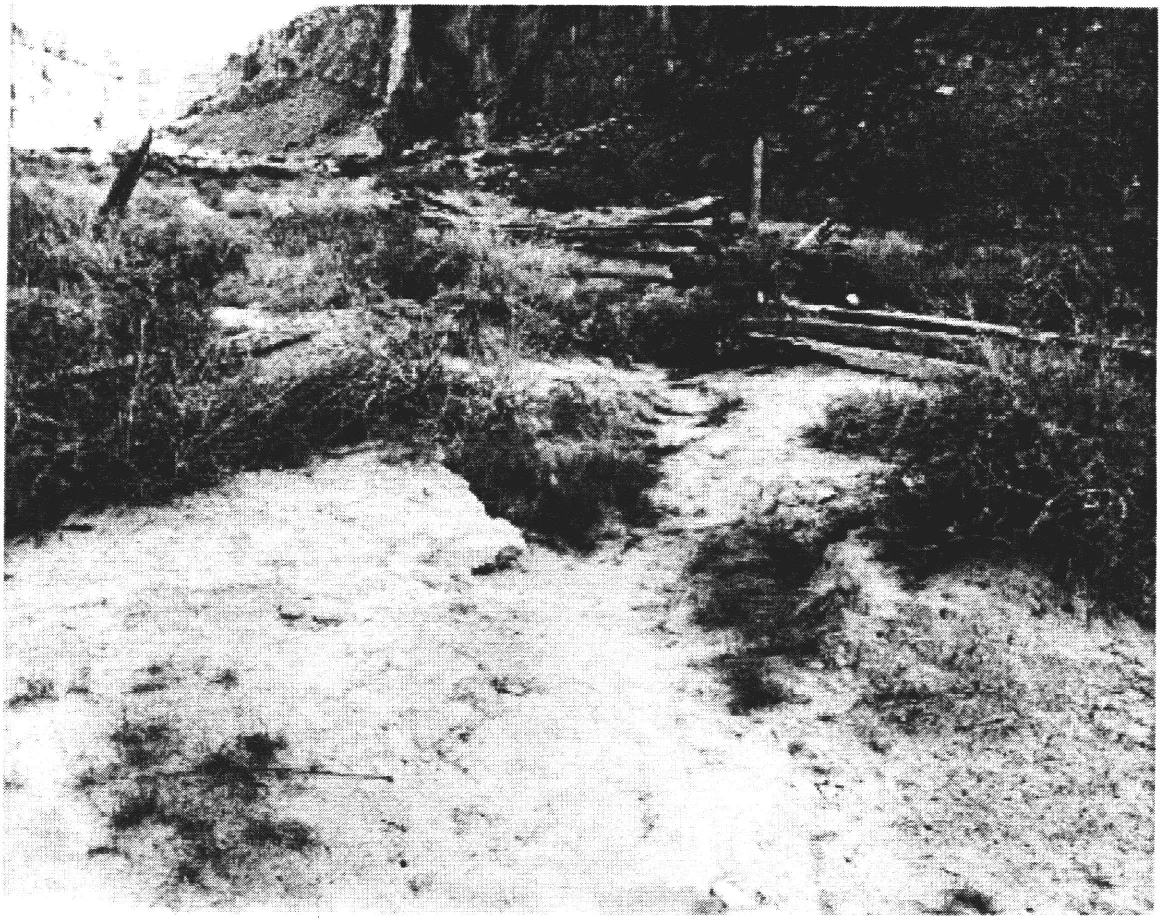


Figure 10. Gullying observed and recorded in FY95 at site C:13:098. The gully extends toward the cabin and travels down to a more extensive drainage system that bisects site C:13:099. Since this photo, checkdams have been placed in the more extensive system and brush has been thrown over the channel area located in the center of the photograph. As a result, monitors have recorded that this gully has not deepened.

FY99 Recommendations

Annual monitoring will continue with the RCMP, and GRCA will continue trail maintenance. This maintenance should include planting grasses to prevent or curtail further erosion and foot traffic.

C:13:272 Small Structure (biennial schedule)

This is a multicomponent site with two separate loci. Locus A consists of two masonry structures (Features 1 and 2) with a sparse scatter of artifacts, and a more enigmatic feature (Feature 3) consisting of a curving cluster of mostly small sandstone rocks eroding out of a deflated area. These rocks seem too small for building elements, but do not look fire-cracked either. Artifacts are generally sparse at this locus, but include sherds, lithics, a metate, a two-handed mano, and a small mano with a beveled face that may also have been used as a knife. Locus B contains two concentrations of sandstone cobbles (Features 4 and 5) that may be hearths. No artifacts are associated. Ceramics suggest a PII date for Locus A and a protohistoric date for Locus B.

Previous Work

This site was originally documented by Balsom and Fairley in 1984 and was recorded in greater detail by NPS survey personnel in 1990 (Fairley et al. 1994). The site has been monitored annually since FY92 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). The drainages situated within the site have been studied by geomorphologists (Hereford et al. 1993; Thompson et al. 1998) and have been mapped on a topographic map using aerial photogrammetry (Hereford 1993; Hereford et al. 1993). In 1991, Fairley collected carbon from Feature 5. The dates range from 330 ± 50 to 40 ± 60.

C:13:272 was also one of the sites monitored prior to and after the spike flow (Balsom and Larralde 1996; Burchett et al. 1996). This monitoring included medium-format photography. In FY99 a soil description encompassing the site area was completed by NRCS (Lindsey and Fisher 1999).

Monitoring Data Summary

The site is subject to an ever-changing system of gullies and seasonal channels flowing across the surface. Physical impacts observed during monitoring include surficial sheet washing, gullying, and active arroyo cutting. No immediate threats to the site were identified until FY96, when archaeologists noted that the site was generally stable, but channel initiation was forming near Feature 3. The FY96 monitors did change the schedule from annual to biennial due to the history of site stability.

In FY99 minor deflation was observed in the center of Feature 1 but Features 2 and 3 were in stable condition with increases in cryptogamic soil and vegetation. Features 4 and 5 exhibited minor pedestaling of the features.

The Beamer Trail transected the site prior to FY93, adding to the adverse impacts. The GRCA trail and rehabilitation crews rerouted the trail below the site in 1993. Since then, the old trail has not received use. In FY99 RCMP personnel recommended that GRCA continue annual trail maintenance and that biennial monitoring continue due to the gully activity discussed above.

FY99 Recommendations

Biennial monitoring will continue and it is also suggested that the drainage system be evaluated for preservation treatment. NPS trail maintenance will continue.

G:03:002 Roaster Complex (4-year schedule)

The site consists of at least 10 roasting features, an enigmatic rock alignment, and scatters of artifacts and fire-cracked rock. The terrace measures 100 m (N-S) by 40 m (E-W). The roasting features are of various configurations and stages of deterioration, and all have gneiss, schist, granite elements, and charcoal. Other faint scatters of fire-cracked rock may represent additional eroding features. Ceramics appear to be mostly representative of late prehistoric through historic Pai and Paiute affiliation. Tools include an obsidian Desert Side-notched projectile point, and various manos, grinding slabs, and metates. A few historic artifacts were noted, possibly from Hualapai use of the area around 1860–1920. These artifacts include brown and purple glass, a metal Indian tinkler, and a knife-opened can.

Previous Work

The site was first recorded in 1962, was revisited in 1972, and was officially recorded in 1991 by NPS survey personnel (Fairley et al. 1994). Site monitoring occurred in FY93, FY94, and FY95 (Coder et al. 1994a, 1995a, 1995b; Fairley et al. 1994). In FY95 the site schedule changed to biennial, and in FY97 the schedule was changed to every 4 years (Leap et al. 1997). Thompson and others (Thompson et al. 1996) completed a photogrammetric topographic map in 1995. The features were plotted with a total station in FY96 and overlain over the photogrammetric map. The map identifies the terrace-based and river-based drainages, thus enabling RCMP personnel to direct their attention to the drainages that could impact the site. Also in FY96, GRCA completed trail obliteration. In FY97, Zuni Conservation personnel made an assessment and five checkdams were constructed in a drainage downstream from the site (Leap 1996f; Leap et al. 1997). In FY98 the checkdams were stable; however in FY99 heavy rains impacted the checkdams. Maintenance included alterations on three original checkdams and construction of two new checkdams. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

From FY93 to FY95 the physical impacts observed consisted of surface runoff, deflation, localized gullying, and animal trailing. Visitor-related impacts (river-runners and researchers) as seen in the form of trailing, were moderate to extensive and needed to be curbed across the entire Granite Park area. In FY95 archaeologists recommended monitoring the site biennially.

In FY97 all features except 4 and 7 were in excellent and stable condition. Feature 4 was experiencing minor pedestaling on the west side, and the rill west and adjacent to the feature was filled in with cryptogamic soil, thus stabilizing the area. Feature 7 experienced minor surface erosion on the east side. Visitor-related impacts were not observed.

In FY99 monitors recorded the site as stable, and cryptogamic soils flourished throughout the site area. The site was scheduled for monitoring every 4 years.

FY99 Recommendations

The site will be monitored in 4 years, and checkdam maintenance will occur yearly. Although the checkdams confirmed much runoff, the site itself showed no evidence of heavy rains. It is recommended that the arroyos with the checkdams be researched to determine the effectiveness of the checkdams. While doing so, the current site map should be updated using a total station instrument.

G:03:006 Roaster Complex (4-year schedule)

The site consists of four roasting pits (Features 1–4) and an overhang shelter (Feature 5). Sherds and lithics are associated with both areas. Feature 1 is a roasting pit composed of burned limestone cobbles. Just outside are FCR clusters that appear to be discard piles. Features 2 and 3 are side-by-side roasting features. Feature 2 has a circular depression and may have been placed in the former discard pile of Feature 3. Charcoal is associated with both features. Feature 4 is another roasting pit with a shallow, conical-shaped interior depression with charcoal fragments. Feature 5, the shelter, is 7 m long, 2 m wide, and of variable height. Four sherds as well as lithics are located outside the shelter. Ceramics suggest both PI–PII Formative and late prehistoric-protohistoric Pai occupation.

Previous Work

Euler originally recorded this site in 1973. In 1991, the site was mapped and recorded in detail by NPS survey crews (Fairley et al. 1994). Monitoring occurred in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998).

Monitoring Data Summary

No physical or visitor-related impacts were observed in FY94 or FY98. The drainage systems adjacent to the site were inactive. It was recommended that the site be placed on the inactive list due to the overall stability of the site and the drainages.

FY99 Recommendations

Given additional geomorphic information, a 4-year monitoring visit is recommended. According to Hereford (Hereford et al. 1993), continued erosion is quite probable. The drainages should be assessed for preservation treatment.

G:03:024 Roaster Complex (biennial schedule)

The site consists of five roasting features with associated ceramics and lithics. The artifacts are concentrated around the FCR middens as well as dispersed downslope. Tools include tabular grinding slabs, cobble manos, a drill or perforator, and a cobble chopper. Raw material types include Kaibab and Redwall chert, chalcedony, and Partridge Creek Obsidian. Unidentifiable burned bone was also observed. The ceramic assemblage suggests a Pueblo II occupation, late prehistoric–protohistoric Pai, and historic Pai and Paiute, the latter suggested by a few broken brown glass fragments and a metal artifact. In FY94 monitors found a chert biface west of Feature 2 newly exposed in an active gully.

Previous Work

The site was first recorded in 1991 (Fairley et al. 1994) by NPS survey personnel and was monitored in FY93, FY94, FY95, FY97, and FY98 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1997, 1998). In FY96, GRCA, Hualapai representatives, and RCMP personnel completed trail obliteration. A letter was published in the *Boatman's Quarterly* requesting minimal use of this area by researchers and river-runners (Jackson and Leap 1996). A total station map of the features was completed and overlain on a topographic map produced by Thompson et al. (Thompson et al. 1996). In FY97, Zuni Conservation personnel completed an assessment, and as a result, five checkdams were constructed near Features 2, 3, and 4 (Leap 1996f; Leap et al. 1997). In FY99 all checkdams had minor restructuring and an additional nine were installed. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

From FY93 to FY95 archaeologists noted an active gully near Features 2, 3, 4, and 5. See Figure 11 for this active gully adjacent to Features 2 and 3. Social trailing developed across the site as a result of recreation and research.

In FY97 the same gully widened and undercut the gully walls, causing charcoal exposure and bank slump. By FY98 monitors did not observe any additional physical impacts. The checkdams, installed in FY97, looked unchanged with very little water runoff occurring in the area. The site appeared very stable and in good condition. It was recommended in FY98 that the monitoring schedule change from annual to biennial.

FY99 Recommendations

Biennial monitoring is recommended. Feature 4 should be investigated because it is possible that the heavy rains in FY99 may have completely destroyed this charcoal feature. If any carbon material is present and intact, it should be collected for dating purposes. Annual checkdam maintenance will continue. It is also recommended that the arroyos with the checkdams be measured to acquire volumetric sediment changes and the effectiveness of the checkdams. The site map should be updated with a total station instrument. It is also recommended that GRCA conduct trail maintenance as needed. All work conducted in the future will be completed after consultation with the Hualapai Nation.

G:03:025 Roaster Complex (4-year schedule)

The site consists mainly of roasting features with some historic trash. Feature 1 is a FCR scatter with a cluster of five partially buried limestone and sandstone slabs at the center. Feature 2 is a fire-cracked-rock "ring" with a cleared center. Feature 3 is a classic donut-shaped roaster. Feature 4 is a bowl-shaped depression encircled by fire-cracked rock. Feature 5 is a ring of FCR cobbles around a depressed, cleared center. Feature 6 is a cluster of five grinding slabs, three manos, purple glass, wire, and 45 Southern Paiute sherds from a pot break. Feature 7 is a jumble of slabs and cobbles with two lithics and a sherd in the vicinity. Feature 8 is a probable surface hearth—a concentration of fire-cracked rock with charcoal. Artifacts, except for the Southern Paiute utility ware sherds, are few, and

Figure 11. Localized gullying recorded in FY94 at site G:03:024. This gully is directly adjacent to Feature 3, to the left of the photo, and heading directly towards Feature 2, located upslope of Feature 3. Brush checkdams were placed in this gully in FY97. In FY99 heavy rains initiated maintenance of the checkdams, which included adding small gravels to the already existing brush checkdams.

include a crude biface and 10 or more tertiary flakes of a variety of material types. Historic trash is scattered throughout the site and includes a kerosene lamp base, tin cans, machined wood, and glass. The site assemblage possibly reflects both Paiute and Hualapai use of the area around the turn of the century. In FY95 archaeologists documented two cairns 8 m north of Feature 1.

Previous Work

This site was initially recorded by NPS personnel in 1991 (Fairley et al. 1994) and was monitored in FY93, FY94, FY95, and FY97 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1997). After monitoring in FY95 the site was placed on a biennial monitoring schedule. In FY97 the monitoring schedule was once again changed to every 4 years. In FY96 the area was assessed for erosion control. As a result, GRCA and RCMP personnel and Hualapai representatives completed trail obliteration, and Zuni personnel built three checkdams just outside the site boundary. At this time, the features were plotted with a total station and overlain on a topographic map produced by Thompson and others (Thompson et al. 1996), and a letter was published in the *Boatman's Quarterly* requesting river-runners and researchers not to disturb this area (Jackson and Leap 1996). In FY97 and FY98 minor checkdam maintenance was completed.

Monitoring Data Summary

In FY93 monitors noted a high potential for adverse impacts at this site due to a combination of factors: surface runoff, arroyo formation, deflation, animal trampling and trailing, and visitations. However, in FY94 and FY95, archaeologists observed the site in stable condition. Ephemeral trailing was evident due to the local Bighorn sheep population.

In FY97 archaeologists recorded an increase in cryptogamic growth over the entire site, and visitor-related impacts were not a problem. The monitoring schedule was changed from biennial to every 4 years.

FY99 Recommendations

Site monitoring will continue on a 4-year schedule due to the potential for the river- and terrace-based drainages to become active. Checkdams will be monitored annually, and NPS will conduct trail maintenance as needed. It is also recommended that studies be conducted to determine the effectiveness of the checkdams by measuring change in sediment volume above and below the checkdams. Prior to any work, the Hualapai Nation will be consulted.

SITES WITH RIVER- AND SIDE CANYON-BASED DRAINAGES

Eight sites have river-based and side canyon-based drainages. Six (A:15:005, A:15:039, G:03:003, G:03:020, G:03:072, and G:03:080) of these sites are identified as actively eroding due to arroyo cutting and gully movement. Based on the research conducted by Richard Hereford (Hereford et al. 1993), the RCMP staff interprets sites with river-based drainages to be related to dam operations due to direct base-level lowering.

A:15:003 Roaster Complex (biennial schedule)

This is a multicomponent site with a PII Virgin occupation, and later Pai or Paiute and late historic affiliations. It consists of two loci (A and B). Locus A occupies a sandy terrace at the base of a Muav cliff face with talus slopes below. There are numerous roasting pits in this area, suggesting that this was a major activity focus. Historic and modern (post 1950s) material is present, and protohistoric (Pai or Paiute) use of the area is suggested by the recent appearance of charcoal on the surface of the ground. Locus B consists of three feature areas. Feature 1 is an overhang shelter at the base of the Muav that was used by PII Virgin peoples. A midden downslope contains 1930s-era trash as well as flakes, sherds, and charcoal. Features 2 and 3 are around the bend of the Muav cliff face. Feature 2 is a cleared area with flakes and charcoal and a boot heel. Feature 3 is another cleared area with stacked rocks.

Previous Work

The site was originally recorded by Euler in 1978 and was incorporated into the river corridor sample in 1990 (Fairley et al. 1994). RCMP archaeologists monitored the site in FY93, FY94, FY96, and

FY98 (Coder et al. 1994a, 1995a; Leap et al. 1996, 1998), and to date have yet to perform any remedial activities. Gellis (USGS, Albuquerque, NM) termed the erosion at this site as "minor" with "no distinct drainages on slope, colluvium, or talus" (Gellis 1994). Since his visit, very distinct drainages have been created.

Monitoring Data Summary

In FY93 the only noted disturbance to the site was visitor impact due to the river camp located just downstream. It was not until FY94 that archaeologists noted more detailed physical impacts. They observed the site as susceptible to damage from extreme high water and side canyon flooding. The surface drainages located on the site were terrace based in FY94. Project monitors also recorded the presence of small gullies draining into the local side canyon wash. In FY96 monitors recorded similar observations.

Physical changes were not evident; however, monitors did note a minor increase in sediment deposition on Feature 1. They also mentioned that the two gully systems noted in FY94 and FY96 could directly impact features at the site in the future.

FY99 Recommendations

The gullies should be assessed for preservation treatment. Until an assessment is made, biennial monitoring will continue.

A:15:005 Structure–Thermal Feature Complex (annual schedule)

Three loci define this site. Locus A consists of hematite pictographs on fallen angular limestone boulders. Locus B contains two expedient single-coursed walls against a cliff base with lithics and ground stone. Charcoal concentrations are also identifiable on the surface. Locus C contains two roasting features and sparsely scattered artifacts, including flakes, charcoal, ground stone, and several brown ware sherds. This site may be associated with late prehistoric–early historic Pai or Paiute use.

Previous Work

Euler originally recorded the site in 1984. The site was re-recorded by NPS personnel in 1991 (Fairley et al. 1994), and monitored by RCMP staff in FY93, FY95, FY96, FY97, FY98, and FY99 (Coder et al. 1994a, 1995b; Kunde 1998a; Leap et al. 1996, 1997, 1998). In FY97 GCMRC personnel completed a total station map of Locus C and trail work was conducted by GRCA. GRCA continues minor maintenance as needed (Leap et al. 1997). The hematite elements were photographed with a medium-format camera in FY97. The Southern Paiute Consortium visited this location to conduct ethnographic interviews regarding the pictograph panel. In FY99, Zuni Conservation personnel assessed the site for checkdam work. Five checkdams were installed in an active gully near Feature 1 (Kunde 1999b). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Prior to FY98, physical impacts to the site were at a minimum. It was not until FY98 and FY99 that gullying and arroyo cutting accelerated, predominantly in Locus C (Features 1 and 2). Feature 1 is located in the flood sands at the mouth of a large drainage. Gullies run east and west off the southern portion of the feature. If the checkdams placed in the drainage in FY99 are unsuccessful, recovery options will be recommended. Currently, charcoal is abundant on the surface of Feature 1 and actively eroding.

The gully adjacent to Feature 2 was very active in FY98 as seen by additional nick points and a larger headcut. See Figure 12 for the new nickpoints observed in the gully near Feature 2. This gully reached the dune field in FY98, less than 5 m from the river. Prior to the flood of 1996, this gully was terrace based. It is the most noticeable increase in gully expansion, compared to several monitored sites, since the beginning of the monitoring program.

In FY93 it was noted that human trailing developed as a byproduct of visiting the pictograph panel (Locus A), thus creating the potential to degrade the cultural materials at Loci B and C. The monitors speculated that visitation to the pictographs would be difficult to curtail, and as a result, a designated Park trail was created. More cairns were placed along the trail to eliminate multiple trailing.

Figure 12. Photograph showing the activity noted at the river-based gully near Feature 2 at A:15:005. In October of 1997 (FY98), the gully demonstrated much activity in the form of several new nickpoints and headward movement of the headcut (toward Feature 2). One major nickpoint is located below the photoboard. Prior to the research flow of 1996, this gully was considered terrace-based.

In FY95 trails became more prevalent. They led from the side drainage to Loci B and C and multiplied throughout the roasting features and artifacts. By FY97 these trails deepened by approximately 25 cm and showed signs of gullying. Trail work was completed after FY97 observations. In FY98 heavy rains were evident as noted by the presence of several nick points in the previously obliterated trails. Annual maintenance of the trails will continue by GRCA because people do frequent the area.

FY99 Recommendations

Annual monitoring is appropriate due to activities observed within a year's time at Locus C. GRCA will continue trail maintenance annually, and RCMP and Zuni personnel will continue checkdam maintenance annually. Researching (measuring) gully movement would be very beneficial to studying rates of erosion and success of checkdams.

A:15:033 Thermal Feature (4-year schedule)

This site is a thermal feature situated on a stabilized dune. Artifacts reflect occupations by Puebloan and Pai (Cerbat) people. A few cans from the first half of the twentieth century are also present on the surface. In FY96 archaeologists identified a pot break, and in FY97 a wickiup ring was newly recorded by archaeologists during a total station mapping trip.

Previous Work

The site was initially recorded by NPS survey personnel in February 1991 (Fairley et al. 1994) and monitored for the first time in February 1996 (Leap et al. 1996). The site was mapped with a total station in FY97 (Leap et al. 1997) in anticipation of preservation work.

Monitoring Data Summary

The site is generally stable with an increase in vegetation and cryptobiotic soils since 1991. Some pedestaling of small rocks due to locally heavy rains was reported at Feature 2. Feature 1 has a new rodent burrow. In FY96 minor preservation treatment in the main gully near Feature 3 was recommended, but upon further assessment, no work was warranted at that time because the gully was not directly threatening the feature.

FY99 Recommendations

A 4-year monitoring schedule will continue. Priority will be to assess the drainage system near Feature 3 for preservation treatment (checkdams or planting vegetation) to prevent further movement toward the feature.

A:15:039 Roaster Complex (3-year schedule)

This is a late prehistoric–early historic Pai site that consists of two or three roasting features situated in reworked eolian sand. One roasting feature is well defined, with an interior depression surrounded by abundant fire-cracked rock and charcoal-stained soil. Two other FCR concentrations are more amorphous; one is probably an additional eroded roasting feature, and the other may simply be a refuse area. The features and artifact assemblage, which includes sparse lithics and three unformalized grinding slabs, suggest brief use of the site as a food processing camp, although occupation may have been repetitive.

Previous Work

A:15:039 was initially recorded by NPS survey personnel in January of 1991 (Fairley et al. 1994), and monitored in FY92, 93, 94, 95, and 99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b).

Monitoring Data Summary

Prior to FY95 the site was monitored annually, but in FY95 RCMP staff recognized that the site was in fairly stable condition. Erosion was only occurring on the margins of the site. As a result, monitors suggested a less frequent monitoring schedule and the next visit was not until FY99.

Upon visiting the site in FY99, RCMP archaeologists were astonished at the site's condition. Within a few months prior to the visit, a heavy rainfall increased surface erosion, gullying, arroyo cutting, and side canyon erosion. The earlier defined, minor rilling and gullying, located south of Feature 3, was more defined and drained into the fire-cracked rock. The gully north of and adjacent to Feature 2 was also very active. The gully had an incised channel with only one nick point heading in the direction of the fire-cracked-rock feature. It extended into the 1983 sand with its deepest nick point measuring over 1 m. Feature 1 exhibited active surface erosion, gullying, and bank slump. Sheetwash was observed throughout the site boundary. No visitor impacts were noted.

FY99 Recommendations

Because of the entrenched gullying and arroyo cutting in FY99, it is recommended that the drainages be assessed for preservation treatment. A 3-year monitoring schedule will continue. This would be another good site to map with a total station and research the geomorphic process of arroyo and gully cutting.

G:03:003 Roaster Complex (annual schedule)

The rockshelter (Feature 1) was originally recorded by Gumerman and Euler on 4 September 1969, and the GRCA survey crew added four roasting features (Features 2–5) in 1991. Feature 1 is a shallow overhang and midden. There is a large amount of lithic debris, including obsidian flakes, an Elko base, a biface tip, and ground stone fragments. Charcoal, ashy soil, and fire-cracked rock are also present. Ceramics suggest both late Pueblo I to early Pueblo II Formative and late prehistoric–early historic Pai affiliations. The remaining features (Features 2–5) are roasters of varying sizes, some with tools or flakes and ceramics. In the monitoring episode of FY92 monitors noted nails, more projectile points, and sherds, and the FY96 monitors found a projectile point at Feature 2 near the dripline and trail.

Previous Work

Euler and Gumerman initially recorded this site in minimal fashion in 1969. Sherds were collected and an analysis was completed. Field notes state that the condition of the site was "undisturbed" and the potential for a rewarding excavation was "excellent." Euler and Jones visited the site again in 1981. More sherds were collected and a simple sketch map was made. G:03:003 was recorded in more detail by NPS survey personnel in January of 1991 (Fairley et al. 1994).

River corridor monitors visited the site in FY92 and FY93, twice in FY94, once in FY95, and then semiannually beginning in FY96 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999a; Kunde 1998a; Leap et al. 1996, 1997, 1998). In FY95, site overviews were taken with a medium-format camera. In FY96 the features were plotted with a total station unit and overlain on a topographic map created by Thompson and others (Leap 1997a; Leap et al. 1996; Thompson et al. 1996). At this time Zuni Conservation Project personnel also assessed the site for checkdam installation (Leap 1996f). Three checkdams were built in the river-based drainage downstream from the site (Leap 1996f; Leap et al. 1996). They were placed in this drainage at the suggestion of Thompson and Burke in FY96. According to their aerial photogrammatic maps, this particular drainage could cause some substantial site destruction if untreated. From FY96 to FY98 the three checkdams were in good condition with little to no maintenance required. In FY99, however, a heavy rainstorm occurred, and as a result, the Zuni Conservation team and RCMP staff constructed 10 new checkdams in the river-based drainage, and extensive work was completed on two of the original checkdams. A few large rocks were removed from the third original checkdam to define a central channel. The new checkdams need to be placed on the 1993 Hereford map with a total station. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

The site receives a great number of visitors, and as a result, multiple trails bisect features and several collection piles exist. Aerial photographs taken over the last 25 years show a geometric increase in the social trailing at Granite Park in general. This trend is enhanced by the local bighorn sheep, who spend considerable time in this area due to the lush grass growth accompanied by the wet winters. NPS and Hualapai representatives have performed retrailing and trail obliteration in FY96 and FY97, yet people continue to visit the site. A letter was published in the *Boatman's Quarterly* by Jackson and Leap (1996) requesting that river-runners and researchers to minimize their impact to the area.

Monitoring Data Summary

Since FY92, visitor-related impacts have been observed in waves. In FY95 there was a dramatic increase in visitation. Concurrently, in March of 1995 there was a major flash flood in Granite Park Wash. As a result of the increased visitation and the local side canyon flood, the channel widened and truncated the base of the trails. The trails all became side canyon-based drainages (gullies) traveling from the rockshelter (Feature 1 and midden) to Granite Park Wash. These trails and runoff channels have several nick points which downcut during each episode of rain.

In FY96 the channels slightly recovered and vegetation began to grow in the old trails. However, in FY97 visitors heavily impacted the area. The main trail on the ridge became more defined and at least four new trails from Granite Park Wash to the site were well defined. A collection pile, located on the overhang, included a previously recorded basalt point, a chert biface, and approximately 50 other artifacts. A second collection pile was located below the midden, near Feature 2. This consisted of 10–20 artifacts. In general, regardless of the trail obliteration work completed for the last 3 years, people continue to visit the shelter.

In FY98 and FY99 visitor-related impacts were minimal as evidenced by infrequently used trails leading to the site. In FY98 annual monitoring was advised after the commercial season. Yet, FY99 recommendations were that the Hualapai cultural office monitor this site twice a year, due to visitor-related impacts, while the RCMP monitoring staff and Zuni conservators continue annual visits to the site to monitor checkdam activities.

Additional recommendations made during the FY99 monitoring visit were that NPS should continue trail maintenance in conjunction with the Hualapais on the trails and channels leading from Granite Park Wash to the rockshelter, and that G:03:003 should be mapped in detail using a total station. Although the artifacts are not in situ, a detailed record would benefit the archaeological record. No new actions will be taken on this site without direct input from the Hualapai Nation.

FY99 Recommendations

Based on the information supplied above, it is apparent that most of the activity on the site has been caused and is caused by visitor use. It is highly recommended that the Hualapai Nation play a larger role in site management because a portion of the site is located on Hualapai land. Trail maintenance should continue annually as a joint effort by the tribe and GRCA. RCMP and Zuni personnel will continue checkdam maintenance annually on the river-based drainage. A total station map of the site needs to be updated. Determination of the effectiveness of the checkdams by measuring change in sediment volume was recommended. The Hopi people suggest closing the site to visitors. Annual monitoring is recommended.

G:03:020 Roaster Complex (annual schedule)

The site has seven main features divided into two loci, A and B, each on opposite sides of a large side canyon. Locus A contains Features 1, 2, 5, 6, 7, 8 (a newly exposed hearth feature recorded by RCMP staff last year), and 9, a newly exposed charcoal concentration found during the FY99 excavations at this site. Locus B contains Features 3 and 4. Feature 1 was originally described as being two charcoal lenses eroding from a high dune with associated fragments of burned bone. Feature 2 is a large classic donut-shaped roasting pit with a number of manos, charcoal, and a few flakes. Feature 3 is an eroding roasting pit with a discernible rock outline on top. Feature 4 is a diffuse scatter of fire-cracked rock. Feature 5 is a disturbed area of fire-cracked rock at the edge of the side canyon. Feature 6 is another eroding FCR area with bone, and Feature 7 is a roaster deposit exposed by a small arroyo. Cultural affiliation is unknown, but presumed to be Pai or Paiute. See Figure 13 for the newly exposed hearth (Feature 8).

Previous Work

The site was originally recorded in 1978 by Euler with further recording by NPS personnel in 1991 (Fairley et al. 1994). The site has been monitored at least annually since FY92 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). Zuni Conservation Project personnel assessed the site in the fall of FY99 and determined that checkdams were not an appropriate stabilization procedure. In FY97 a total station map of the site was completed (Leap et al. 1997). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

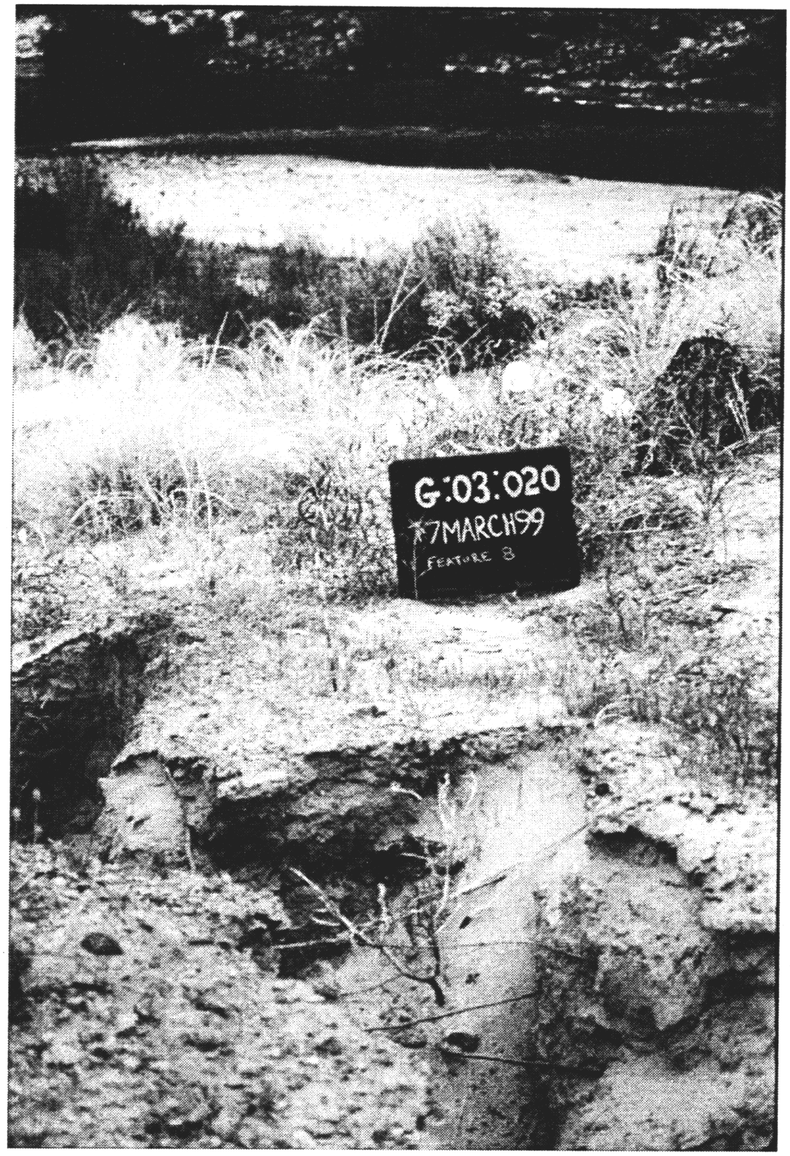


Figure 13. Feature 8 of site G:03:020 was newly exposed in the fall of FY99. This feature and Features 7 and 9 were excavated in the spring of FY99. This former foot path is now a mature river-based gully. No preservation work will be implemented because personnel from the Zuni Conservation Project believe the gully will fill in due to its deep and narrow nature.

In the spring of FY99, Features 7, 8, and 9 were excavated. Results of the excavation will be written and sent to PA members after the collected samples are sent to the appropriate analysts. Currently, the samples are housed at the Flagstaff office until funding is provided. After excavations, trails were obliterated.

Monitoring Data Summary

In FY92 and FY93 headward erosion of the local arroyo and gully system were noted as the main adverse impact to the site. They also noted that Feature 7 was nearly gone due to this process.

Archaeologists assessing the site in FY94 noted that the gullying at Feature 2 increased since FY93, and Features 5 and 6 were suffering from wind deflation with no replacement. Yet, it continued to be Feature 7 that exhibited the most change since FY93. Similar site conditions were noted in FY95.

Minimal changes were observed in FY96. These consisted of minor increases in surface erosion at Feature 1 and increased vegetation growth and eolian movement throughout the site.

In FY97 archaeologists noted that Feature 7 continued to be the most physically impacted area. It was evidenced by active runoff (surface erosion) within the gully. A large amount of charcoal was eroding from Feature 7, and collection of carbon and botanical samples was recommended. The gully adjacent to Feature 2 showed no change near the feature, but the nick point near the feature was slowly moving upslope. Some type of stabilization was recommended for this gully for the following year. In FY97, the first visitor impact to the site was a commercial use trail located on the north side of the site, near Feature 7. The trail was not well defined, but trail obliteration was recommended.

FY98 archaeologists observed that all but one feature were in stable, yet poor condition. Feature 7 continued to erode downslope into the gully. The gully adjacent to Feature 2 showed signs of sediment erosion but it did not directly impact the feature. The headward movement at that time was away from the feature. Monitors noted a trail present below Feature 2, leading into Fall Canyon. This same trail ran through the site, upstream past Feature 7 to the boat beach. Trail obliteration was recommended once again.

In FY99 the same intense rainstorms that were changing the status of several sites in the western end of Grand Canyon also demonstrated impacts to this site. Archaeologists monitoring the site noted that Features 1, 5, and 6 were in stable condition, with no change since FY98. However, the heavy rains caused much change to the drainages at Features 2 and 7. The gullies and arroyos widened and deepened dramatically. As a result of the rains a new feature (Feature 8) was exposed in a third gully adjacent to Feature 7. A fourth gully formed on the southeast side of Feature 2. At this time several terrace-based drainages became river based. A highly visible trail leading from the upstream camp to near Feature 7 became a highly incised gully with multiple nick points after the torrential rains.

Trail obliteration occurred in FY99 while data recovery was performed at Features 7, 8, and 9. Feature 2 will probably be the next concern at this site. The continual activity of the gullies and arroyos surrounding this feature will definitely have an impact to this rather large, donut-shaped roaster.

FY99 Recommendations

Annual monitoring is recommended, Feature 2 should be assessed for data recovery. All work will be approved by AZSHPO and tribal PA members culturally affiliated with the site.

G:03:072 Roaster Complex (annual schedule)

This is an extensive roasting feature complex that includes an overhang shelter previously recorded as historic site G:03:023. The prehistoric component of that site is described here as G:03:072. Fourteen features (Features 1–14) are present. All but Feature 1 are roasting features or hearth/fire-cracked rock scatters of various shapes and sizes, some with associated ground stone, lithics, and sherds. Feature 1 is the overhang shelter, which, in addition to the historic component described as site G:03:023, has a prehistoric component consisting of a lithic scatter downslope of the shelter and in the shelter fill. Ceramics observed indicate that this may be a multicomponent site, with both late Pueblo I–early Pueblo II Virgin and late prehistoric–early historic Pai and Paiute occupations. On a total station mapping trip in FY98 RCMP monitors identified newly exposed diagnostic artifacts in a gully. They include one biface, sherds, and ground stone.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994), monitored once in FY93, and monitored annually since FY95 (Coder et al. 1994a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). In FY96 an assessment was made for checkdam installation. In FY97 a total station map was completed and 14 checkdams were placed in three river-based and side canyon-based drainages (Leap et al. 1997). In FY99 checkdam maintenance resulted in building two new checkdams and altering one original checkdam. Minor to moderate alluvial deposition as a result of building checkdams is evident in two of the four drainages with checkdams.

Monitoring Data Summary

Throughout the monitoring of this site, only three features have been consistently, actively eroding: Features 11, 12, and 14. All other features are in stable condition with potential activity. In FY95 and FY96 Feature 14 was subject to erosion from two small gullies and Features 11 and 12 were impacted by a single gully (all river based).

By FY97 checkdams were installed near Features 11, 12, and 14, but erosion continued. Feature 11 showed an increase in gullying, Feature 12 showed an increase, though minor, in eolian deposition, and the gully at Feature 14 appeared as though it deepened. It was recommended at this time to excavate Feature 14.

In FY98 additional activities were occurring at the three features. The gully bisecting Features 11 and 12 appeared wider, almost giving the appearance of reaching equilibrium. However, Feature 14 continued to exhibit degradation.

FY99 Recommendations

Annual checkdam maintenance and archaeological monitoring will continue at the site. It appears that Features 11 and 12 are going through a cut and fill process that may not threaten the features; however, data recovery is suggested for Feature 14 (Leap 1999). Updates on the current total station map are warranted not only to complete accurate site documentation but also as a means to research the drainage processes and determine the effectiveness of checkdams by measuring the change in sediment volume.

G:03:080 Structure–Thermal Feature Complex (annual schedule)

The site is divided into two loci. Locus A contains numerous lithics, sherds, hand tools, and extensive rock images. The pictographs and lone petroglyph are in poor condition. Spalling and salt seep have covered several of the images. This locus is on a sheltered bench at the base of a basalt cliff, just upstream from the dune that Locus B is located on. Locus B consists of nine separate structural and fire features. Numerous artifacts are present, including fire-cracked rock, lithics, ceramics, ground stone, tools, shell fragments, and charcoal. This site has excellent potential for buried materials and datable features. Ceramics suggest a late prehistoric–early historic Pai affiliation. In March of FY95 monitors recorded a newly exposed thermal feature (Feature 9).

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored once in FY92 and FY93, and annually since FY95 (Coder et al. 1994a, 1994b, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). In FY97, medium-format black-and-white and color prints were taken of Locus A, and an attempt was made to sketch several of the distinct rock art figures.

Monitoring Data Summary

In the years prior to FY97 the site was in overall stable condition. The only noteworthy comment was a minor increase in visitation in FY95. It was not until FY97 that the site began deteriorating at an increased rate. It began with only minor rilling near Feature 3, and increased visitation at Locus A. Locus A had three collection piles in the shelter, and a pothole was observed. This hole was of considerable size (30 x 30 x 7 cm) in the northern portion of the shelter. An ARPA violation notification was sent to the River District Rangers and the Hualapai Nation, and the case was turned over to Chuck Sypher, GRCA ARPA coordinator at that time.

By FY99 visitor-related impacts (trailing) were observed at an all-time high. Trails led from the camp, across Locus B, to Locus A. The pictographs (Locus A) are a popular attraction stop for commercial and Hualapai river-runners.

Observations in FY99 showed Feature 5 impacted by headward erosion, a direct result of trailing. Feature 6 had new evidence of sheetwash, with fine sediment particles shifting throughout the feature. A new river-based gully located 1.5 m upstream from Feature 9 was also recorded. Although the gully is not directly impacting Feature 9, a change in the drainage's course could threaten the feature.

In FY99 the RCMP staff suggested yearly monitoring and recommended that several trails be obliterated by planting vegetation throughout the site. They noted that visitor-related impacts, in particular trailing, should be addressed and managed by the Hualapai Nation.

FY99 Recommendations

Annual monitoring will continue by RCMP staff, and Locus B should be assessed for preservation treatment. It is highly recommended that the Hualapai Nation participate more in site management. RCMP personnel recommend that NPS and Hualapai representatives conduct trail obliteration and retrailing before the damage is irreparable. It is also recommended that the drainages be assessed for preservation treatment. The Hopi Tribe suggests closing the site to visitors.

SITES WITH RIVER-, TERRACE-, AND SIDE CANYON-BASED DRAINAGES

C:13:009 and C:13:070 represent sites with river-, terrace-, and side canyon-based streamflows. Both sites demonstrate active gully and arroyo cutting since FY92 and are considered directly impacted by dam operations because they have river-based drainages. This interpretation is based on the conclusions drawn from Hereford's work (Hereford et al. 1993).

No preservation treatments have been made for these sites because the arroyo and gully cutting are too advanced to complete efficient and effective preservation actions. Data recovery, however, has been completed at site C:13:070. Carbon samples were taken from the roof fall at Locus D in February 1999. The report will be disseminated to PA members after funds have been allocated for the analyses.

C:13:009 Pueblo (biennial schedule)

C:13:009 is an extensive prehistoric habitation area containing structures, water control features, and numerous and diverse artifacts. The site occupies both sides of a major side canyon. This site was recorded and mapped in two distinct loci. The artifact assemblage is dominated by Pueblo II–early Pueblo III ceramics. Numerous tools used as percussion items and abraders were observed, but there is a curious lack of chipped stone and metates. A distinct prehistoric trail can still be seen above the site disappearing up into the cliffs.

Previous Work

Portions of this site were previously recorded several times. The site was originally designated C:13:009 and 9A in 1965 by Euler and Taylor. C:13:009A corresponds to the GRCA river corridor survey Locus A (upstream of the side canyon), and C:13:009 corresponds with the GRCA Locus B (downstream of side canyon). Since that time various sherd collections have been conducted in 1976, 1984, and 1989. NPS survey personnel recorded the site in detail in 1990 (Fairley et al. 1994). The site was monitored by RCMP staff in FY93, FY94, FY97, and FY99 (Coder et al. 1994a, 1995a; Kunde 1998a; Leap et al. 1997). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998). Additional monitoring research was conducted at this site during the research flow of 1996 (Balsom and Larralde 1996) including medium-format photography. See Figure 14 for an example of a medium-format photo showing the developed gullies located near Features 10 and 11.

Monitoring Data Summary

In FY93 and FY94 erosion was ongoing across the site. The physical impacts observed included sheet washing, gullying, and arroyo cutting. Visitor-related impacts were also exhibited by numerous collection piles and distinct trails. Locus B was removed from the monitoring schedule in FY97 because it is located just outside the project area.

Figure 14. A medium-format photograph of the gullies located near Features 10, 11, and 20 of C:13:009. The features are located on the edge of the bank. This photograph was taken prior to the research flow of 1996. No remedial activities have occurred in this area. In FY99, Features 10 and 20 were recommended for excavation before they are lost to continued gully downcutting.

In FY97 physical impacts to the site were specifically identified at Features 10, 11, and 14, where downslope incremental movement was observed due to their location on the upstream cutbank facing the river. Extreme high-water flows in excess of 120,000 cfs would erode the base of the cutbank proximal to the secondary channel of the Colorado River below these features. Archaeologists noted that the rest of the features were in stable condition. In FY97 completion of an instrument map and a detailed ceramic analysis were recommended.

FY99 evaluators found most of the features receiving minor to moderate physical impacts since FY97. They observed continual movement of artifacts, charcoal, and sediments downslope into an arroyo. Feature 1 had minor downslope movement of artifacts and charcoal-stained soil. Animal burrowing exposed new charcoal fragments and artifacts proximal to Feature 1. Feature 2 had minor bank slump, and Feature 3 exhibited minor surface erosion. Features 4 and 5 remained unchanged. Monitors recorded increased sediment deposition in the drainage adjacent to Feature 6 and minor rock movement at Feature 7 due to active drainage undercutting.

Visitor impacts to the site in FY99 included two collection piles near Features 10 and 11 and footprints between Features 12 and 14. Visitors to this site may be river-runners who camp downstream at a popular camp and hike up across the dunes to the site.

FY99 site management called for more thorough site documentation and data recovery for Features 10 and 20 before they are completely lost.

FY99 Recommendations

Biennial monitoring is appropriate for both loci, dependent on the FY99 observations. It is recommended that this site be mapped in more detail and that data recovery be completed at Features 10 and 20, as recommended in FY99. This site is very large and can hold much information concerning the eastern portion of the Canyon in relation to the other large pueblos in the vicinity. While mapping the site, more ceramic documentation will be completed.

C:13:070 Small Structures (annual schedule)

This site has four loci (A–D) and is situated on a highly dissected structural terrace. Locus A has three artifact scatters near the drainage mouth and along the terrace edge to the northeast. Locus B is a rubble mound that suggests a small masonry structure. Abundant sherds and lithics are located around the structure and upslope. Locus C consists of a dense scatter of charcoal (historic) and artifacts scattered over the surface. Locus D includes several artifacts and three to four charred logs exposed in an arroyo that may be the remains of a roof. The quantity and diversity of artifacts suggests that this is a habitation site; however, few architectural features are visible. Artifacts indicate a Pueblo II–early Pueblo III occupation. In FY96 monitors found small mammal bones on the northeast edge of Locus A, and in FY97 they found a basalt axe fragment in the artifact concentration of Locus D. Both the roof remains and the axe fragment are rare in the Grand Canyon.

Previous Work

The site was originally recorded in 1973 and was re-recorded in 1991 by NPS personnel (Fairley et al. 1994). The site was monitored in the previous years by GRCA, and more recently monitored under the RCMP: once in FY93, twice in FY94, FY95, and FY96, and annually since then (Coder et al. 1994a, 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). In FY95, medium-format photographs were taken for drainage documentation. In FY95 PA members wanted RCMP staff to select certain sites to measure artifact movement within one square meter. These surface analysis units were removed in FY96 as per discussions with PA representatives (Leap et al. 1996). The results of one year were inconclusive and highly subjective. In May 1996 the Zuni Cultural Resource Advisory Team (ZCRAT) monitored the site and their recommendation was to install several checkdams. A total station map of Loci B, C, and D was completed in September 1997 in anticipation of some type of preservation treatment (Leap et al. 1997). After further assessment in FY97 and FY99, Zuni Conservation Project personnel indicated that installing checks "would be a time-consuming, expensive, and risky effort." It was determined that the arroyo systems were (are) too advanced for any practical stabilization effort. In FY99 samples were taken from the charred logs (possible roof fall) at Locus D. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

In FY93 physical impacts included sheet washing, gullying, active arroyo cutting, animal trailing, wind deflation, bank slump, and dune migration. Visitor impacts included collection piles, distinct trails, and on-site camping. Semiannual or quarterly monitoring was recommended.

FY94 archaeologists saw an increase in surface erosion due to deflation and bank slump. Increased gullying was observed at Locus D. The lack of free sand available in the system to protect this site was noticeable. A recommendation was made to monitor the site in the spring and the fall and to write a plan for limited excavation accompanied with preservation.

In FY95 the site demonstrated continual increases in surface erosion, bank slump, and gullying at Locus D. Planting native vegetation was recommended to slow the erosional process. No visitor impacts were documented.

FY96 archaeologists recorded the same activities found in FY94 and FY95. In addition, one of the upright manos was tilted significantly and a trail onto the fragile terrace had developed at the upstream access point to the site (caused by researchers and tribes). Additional suggested preservation treatments included installing checkdams or conducting some form of stabilization in the active gullies. Trail obliteration was also recommended between Loci A and B. Annual monitoring would continue through FY99.

A more detailed evaluation of the site was conducted in FY97. Locus A showed increased deflation in the gully. Locus B appeared stable despite its location on a very fragile area. The drainage systems at Locus D were found to be moderately to extensively active due to water runoff and bank slump. Burned logs continued to erode from a very active arroyo. The trail from Locus A to Locus B previously recommended for trail obliteration healed itself.

FY98 archaeologists noted that all four loci appeared unchanged since last monitored in FY97. The arroyos and gullies throughout the site also showed no changes. At Locus A there were 10 rocks in a circle, a possible tent ring.

Unlike FY98, monitors in FY99 observed active bank slump, gullying, arroyo cutting, and surface erosion at Locus D. Loci A, B, and C were stable but in poor condition. A data recovery proposal was prepared for this site within the 5-year budget plan (Balsom and Leap 1999).

FY99 Recommendations

Annual monitoring will continue until excavations are completed. Excavations should concentrate on Locus D with limited excavations elsewhere on the site. It is a very valuable site due to the abundant cultural material continually exposed through erosion. This is yet another site that could be useful in learning more about active drainage systems in the Canyon.

CHAPTER 6. SITES WITH TERRACE-BASED DRAINAGES

Jennifer L. Kunde and Lisa M. Leap

Alluvial terraces along the river corridor provide evidence of active flooding and sediment deposition in pre-dam times. Vegetation has anchored the terraces in some locations; a lack of vegetation in other areas creates a highly active and eroding terrace. Vegetation is, however, only a temporary barrier to the downslope extension of drainages. Active erosion has been identified on all pre-dam terraces in Glen, Marble, and Grand Canyons (Hereford et al. 1993).

Long-term depletion of sediments in the Colorado River, caused by the existence and operations of Glen Canyon Dam, has altered the erosional balance along the river corridor, resulting in an increase in erosion by streams draining the predam terraces (Hereford et al. 1993; Thompson et al. 1998). Geomorphologists researching the river corridor in the Grand Canyon have determined that "the presence of the dam with subsequent long-term reduction of sand concentration and peak-flow rates probably intensifies erosion" (Hereford et al. 1993:2).

Because the late Pueblo II sites are contemporaneous with the latest cycle of aggradation in the Grand Canyon, these sites and subsequent later occupations are visible on the surface of predam alluvial terraces. Long-term monitoring over the last 8 years has enabled archaeologists to identify locations where cultural remains are concentrated and the artificially accelerated erosional processes are active. As mandated in Section 106 of the NHPA, Reclamation is responsible for treating locations identified as affected by dam operations. All sites with terrace-based drainages are indirectly affected by dam operations.

One way of treating these affected areas is to identify the places most likely to continue to erode and employ preventative measures in these locales. Erosion control structures, such as traditionally designed Zuni checkdams, have been identified by PA signatories as an acceptable treatment for cultural remains threatened by erosion. Potential remedial actions designed to curtail further site destruction have been identified in several documents and reports guiding the RCMP (Fairley et al. 1994; USDI 1977a; USDI et al. 1997). The greatest potential for effective intervention exists before terrace-based drainages become river based.

Terrace-based drainages do not drain to the river, but instead die out on the older and higher base-level of the Colorado River, analogous to the river level prior to the construction of Glen Canyon Dam. This base-level is above the river at the level of the predam terraces.

The characteristics of terrace-based drainages include smaller catchment basins, averaging 1,300 m^2 but varying in size over three orders of magnitude (Hereford et al. 1993), which implies a high degree of variability in size among terrace-based drainage systems. Terrace-based drainages also have short channel lengths, averaging approximately 60 m (Hereford et al. 1993). All terrace-based drainages have the potential for increased arroyo cutting and breaching of the terrace level. Terrace-based drainages become river-based drainages when their catchment area is larger than 3,000 m^2 and the channel ends less than 100 m from the river (Hereford et al. 1993).

Monitoring of the terrace-based drainages where cultural resources are concentrated allows the RCMP staff to identify when drainages are likely to become river based. Monitoring also enables the RCMP to recommend and implement erosion control measures to curtail loss of cultural materials and information before terrace-based drainages develop into river-based drainages. As Hereford et al. reported, "any terrace-based stream can probably degrade to the lower effective base-level of the post-dam era through downcutting and subsequent expansion of the drainage network, increasing catchment area and channel length" (1993:18).

The original cultural resource inventory and subsequent monitoring efforts have led to the identification of 65 sites containing solely terrace-based drainages; an additional 5 sites have side canyon-based and terrace-based drainages. A listing of all sites with terrace-based drainages, including physical and visitor-related activity and site condition, can be found in Appendix F. See Table 4 for the site counts associated with property types.

Table 4. Site Count and Property Types of Sites with Terrace-Based Drainages (n = 70)

Site Counts	Property Types
6	Artifact Scatter
4	Historic Structure
2	Multi-complex
2	Other
16	Roaster Complex
12	Roaster Feature
1	Rock Art
13	Small Structure
14	Thermal Feature

Five sites are monitored annually, 11 are monitored biennially, and 46 are monitored every 3–5 years. Inactive monitoring schedules are currently assigned to eight sites with terrace-based drainages. Only 29 of the 70 sites with terrace-based drainages have been monitored three or more times since FY92.

Most sites are currently categorized as potentially active (the physical movement of arroyos and gullies has not yet been detected through monitoring) rather than active, and are therefore being monitored less frequently. This does not mean that sites with terrace-based drainages are becoming stable. The decrease in monitoring frequency is a result of recognition that these sites are presently inactive. Thirty-six percent of these sites show active physical erosion, versus 13 percent showing visitor-related impacts.

REMEDIAL ACTIONS

Physical erosion, which includes surface erosion, gullying, arroyo cutting, bank slump, or eolian-alluvial erosion, is active at 25 sites. Of these, 12 sites have received 37 preservation treatments: checkdam construction at 9 sites, retrailing at 2 sites, medium-format photography at 3 sites, planting vegetation as a form of stabilization at 2 sites, and trail obliteration at 4 sites. Total station maps have been completed at 11 actively eroding sites. Of the 9 sites with checkdams, additional maintenance work has been completed at 6 sites: extension of the water diversion bar at B:14:107, minor maintenance at C:13:006, lowering the height and building up the sides of four checkdams at C:13:346, alteration of four checkdams and construction of one new checkdam at G:03:026, rebuilding two completely blown out checkdams at G:03:040, and reconstruction of an existing checkdam and construction of four new checkdams at G:03:058.

Nine sites contain a total of 48 checkdams; 35 percent of these are located in terrace-based drainages required additional maintenance work. These preliminary results, contrasted with the figures presented in Chapter 5, suggest that checkdam construction in terrace-based drainages is an effective treatment for curtailing erosion of predam alluvial terraces. The RCMP staff anticipates increasing preservation treatments at sites with terrace-based drainages.

Forty-five sites currently have potentially active erosion. Preservation options have been completed at five of these potentially active sites: retrailing at B:11:272, trail obliteration at A:16:160, trail maintenance, checkdam construction and trail obliteration by GRCA at C:13:005, checkdam construction at C:13:336, and medium-format photography at C:13:365. Total station maps were completed at five sites with potentially active erosion. Preservation treatments have been completed at 28 percent of these sites, and recovery treatments have been completed at 10 percent.

The completed preservation and recovery options have been appropriate for these sites. Because most of the sites are currently potentially active, it is logical that only 12 preservation options have been completed at eight potentially active sites. Review of the 8-year monitoring history of sites with terrace-based drainages has resulted in modifications to the preservation and recovery options made during regular monitoring activities. Additional recommendations have been made and some previous recommendations have been re-assessed and deemed inappropriate for certain locations. Most notable is the recommendation that all terrace-based drainages be assessed for preservation treatment options to prevent further downcutting and the potential shift to river-based drainages.

Preservation options implemented at terrace-based drainages have the potential of preventing further downcutting of drainages, and the development of river-based drainages. It is further recommended that the success of the existing checkdams at nine sites be evaluated by measuring changes in sediment volume.

It is also recommended that the RCMP staff and PA signatories discuss measuring terrace-based drainage catchments and drainage distances from the river to prioritize terrace-based drainages with the most potential for becoming river-based drainages. All terrace-based drainages should be assessed immediately for preservation treatment. In addition to preservation treatment, drainages should be documented by counting the number of nickpoints present and the size and location of headcuts (Neal et al. 1998; Thompson et al. 1998).

As the RCMP continues to collect data, particularly at locations that have been monitored only one or two times, information on active terrace-based drainages will be crucial. Identifying and treating terrace-based drainages may successfully curtail the evolution of terrace-based into river-based drainages, resulting in a more cost-effective approach to cultural resource management.

INDIVIDUAL SITES WITH TERRACE-BASED DRAINAGES ONLY

A:15:004 Roasting Feature (5–year schedule)

A:15:004 is an historic Hualapai site containing two loci, A and B. Locus A consists of two fire features, as well as cans, milled lumber, and a badly deteriorated canteen. Locus B consists of a pot break and lithic scatter. This site is located along a Muav Limestone bench at the mouth of a major side canyon, situated on an alluvial terrace

Previous Work

The site was originally recorded by Euler in 1976 and was re-recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994). It was monitored in FY93, FY94, and FY98 (Coder et al. 1994b, 1995a; Leap et al. 1998).

Monitoring Data Summary

Impacts recorded during the survey include local arroyo and channeled surface runoff. A flash flood in an adjacent drainage during the spring of FY93 had no impact to the site. Throughout all monitoring visits, the site was recorded in good, stable condition with no threatening impacts.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages as detailed by Hereford (Hereford et al. 1993), the inactive schedule will be changed to a 5-year monitoring schedule; this site will be monitored in FY2003. The terrace-based drainage should be assessed for drainage treatment including headcut documentation and nickpoint counts.

A:15:020 Roaster Complex (4-year schedule)

A:15:020 is an extensive Puebloan and protohistoric Pai site with fire features, activity areas, stained soil, and associated artifacts. The site consists of 13 distinct roasting features with several concentrations of fire-cracked rock dispersed throughout the site boundary. There is also an overhang rockshelter with a large midden below it. Two Hopi sherds were found on the surface. The site is located on an alluvial terrace. It is in good condition and exhibits little evidence of surface erosion or adverse impacts from visitation. FY98 monitors identified chert projectile point tips in the midden. Pecked stones were also newly identified at Feature 4.

Previous Work

The site was originally recorded during the river corridor survey (Fairley et al. 1994) and was monitored in FY93, FY94, and FY98 (Coder et al. 1994a, 1995a; Leap et al. 1998).

Monitoring Data Summary

Only a few photographic comparisons could be made due to the lack of previous photographs. Based on these limited photographs and on-site observations, the site appeared stable throughout the three monitoring visits. In FY98 photographs were taken of all the features. During the next monitoring episode, the new photographs will aid in better observations.

FY99 Recommendations

This site will be monitored in FY2002. If the arroyos and gullies continue to be inactive, monitoring frequency will decrease. It is recommended that the terrace-based drainage be assessed immediately for preservation treatment including headcut documentation and nickpoint counts.

A:15:022 Roaster Complex (5-year schedule)

This site consists of three distinct fire features, scattered fire-cracked rock, and a surface assemblage of lithics and sherds. A single Desert Side-notched point was located on the surface. Sherds represented by Southern Paiute, Cerbat (Hualapai), and formative Puebloan wares indicate multi-component occupations. The site is located on a dune-covered basalt bench.

Previous Work

The site was initially recorded by NPS survey personnel in January of 1991 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Based on the FY96 monitoring visit, minor gullying on the site has reached the local drainage that empties into the river. It originated on a bedrock terrace so there was no effect on the site due to base-level changes in the system. Channeling of runoff did not effect cultural features. The greatest threat to A:15:022 was the combination of the long-term effect of wind deflation and locally intense rainfall. No human visitation was discernible. No remedial actions were warranted at that time.

FY99 Recommendations

Monitoring will continue on a 5-year schedule. Preservation treatment including headcut documentation and nickpoint counts is recommended for the terrace-based drainage.

A:15:028 Roaster Complex (5-year schedule)

This site consists of three overlapping fire pits with scattered fire-cracked rock, ceramics, and ground stone. Ground stone tools dominate the artifact assemblage, and ceramic evidence suggests a late prehistoric–early historic Pai or Paiute occupation. The site is located on a stabilized dune underlain by locally derived debris flow deposits. Cryptogamic soil is well developed at this location and virtually covers the site.

Previous Work

The site was initially recorded by NPS survey personnel in November of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Monitors in FY96 noted that the site had remained stable since 1990. Feature 5, situated in a low localized catchment area, had a small channel that showed no downcutting. Two manos photographed during the survey were moved slightly but no other evidence of human visitation was recorded. The soil and biotic crust on the surface reflected long-term stability.

FY99 Recommendations

Monitoring will continue every 5 years. The RCMP staff recommends that the terrace-based drainage be assessed immediately for preservation treatment including headcut documentation and nickpoint counts.

A:15:031 Thermal Feature (5-year schedule)

A:15:031 is a Virgin site consisting of four distinct concentrations of fire-cracked rock, a sherd and lithic scatter with Moapa Gray Ware sherds, and an activity area delineated by a circular rock alignment with the presence of at least three metates and several manos. The site is located along the base of a Muav Limestone cliff. A dense growth of mesquite, arrow weed, and tamarisk separates the site from the river.

Previous Work

This site was recorded in January of 1991 (Fairley et al. 1994), and was monitored in FY92 and FY95 (Coder et al. 1995b, Coder et al. 1994b). A total station map was completed in FY96 (Leap et al. 1996).

Monitoring Data Summary

In FY92 and FY95 channeled surface runoff and localized arroyo cutting were identified as potential impacts at the southern site boundary, yet the site was stable and unchanged since 1991. It was placed on the inactive monitoring schedule in FY95.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages, as detailed by Hereford (Hereford et al. 1993), the inactive schedule will be changed to a 5-year monitoring schedule. This site should be monitored in FY2000. RCMP personnel recommend that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:15:032 Thermal Feature (5-year schedule)

This site consists of a small concentration of fire-cracked rock with charcoal, a cleared depression, and Lower Colorado Buff Ware and Aquarius Brown ceramics. The thermal feature is 90 cm in diameter with fist-sized chunks of limestone and sandstone. One large sandstone slab rests next to this feature. Adjacent to the thermal feature is a cleared depression that may have been a habitation space for a wickiup. A clearing in the mesquite 15 m south of the thermal feature contains a concentration of ceramics and a large limestone slab. The ceramics are from at least two separate vessels. No lithics are present. Cultural affiliation is unknown. The site is located on a highly dissected alluvial terrace.

Previous Work

The site was initially recorded by NPS project personnel in November of 1990 (Fairley et al. 1994) and was monitored for the first time in September of 1994 (Coder et al. 1995a). A total station map was completed at this location in FY96 (Leap et al. 1996) in anticipation of preservation work.

Monitoring Data Summary

Drainages exist along both the northern and southern boundaries of the site. When monitored in FY94, the site was recommended for the inactive monitoring schedule.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages, as outlined by Hereford et al. (1993), it is recommended that this site be placed on a 5-year monitoring schedule. The site should be monitored in FY2000. The terrace-based drainage will be assessed for preservation treatment including headcut documentation and nickpoint counts. It is also recommended that a carbon sample be taken from the FCR feature to secure a date for the occupation of this site.

A:15:035 Roasting Feature (4-year schedule)

A:15:035 consists of a single roasting feature and charcoal-stained soil eroding out of a sandy slope. No artifacts were found associated with the roasting feature. Cultural affiliation is unknown.

Previous Work

The site was originally recorded by the NPS survey crew in 1991 (Fairley et al. 1994) and was monitored in FY93 and FY97 (Coder et al. 1994a; Leap et al. 1997). This site was tested for National Register eligibility in FY94 (Leap 1994c). Intact cultural remains were uncovered, and the AZ SHPO concurred with National Register eligibility.

Monitoring Data Summary

Surface creep and channeled surface erosion were impacting the site in FY93. In FY97 the upper portion of the site showed an increase in vegetation and appeared more stable than in previous photographs. The lower portion of the site seemed to be accumulating terrace sediments and fire-cracked rock, but it was difficult to determine because no photographs were available for comparison. No evidence of human visitation was recorded.

It was recommended in FY97 that the site be visited in FY98 with new photographs to determine the extent of any changes and to review the monitoring schedule. Because no change was detected, the site was not monitored and a 4-year schedule was assigned.

FY99 Recommendations

This site will be monitored every 4 years. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts. Carbon sampling would aid in dating this site.

A:15:038 Thermal Feature (5-year schedule)

This site consists of a single roasting feature and an artifact assemblage of Cerbat and Moapa sherds, a bead blank, an Archaic projectile point, lithic debris, and two flake tools. The site is situated on a high dune remnant.

Previous Work

The site was originally recorded by NPS survey personnel in April of 1991 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Monitors recorded in FY96 that both the upstream and downstream boundaries of the site were delineated by the presence of mature arroyos. Because these drainages were inactive, they were not impacting the site. The site exhibited no discernible change since the time it was recorded.

FY99 Recommendations

Monitoring this site will continue every 5 years. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:15:040 Thermal Feature (5-year schedule)

A:15:040 consists of a rock shelter containing ground stone, handtools, and some fire-cracked rock. No ceramics or lithic materials were observed on the surface. Cultural affiliation has not been determined. The site is sheltered between a Muav Limestone overhang and a thick band of Acacia. The site is not visible from the river and access is difficult due to the thick protective cover of vegetation. The fine sediment on which the site rests is highly dissected in both directions up and down the terrace. The runoff is directed by the cliff rising above it.

Previous Work

This site was initially recorded in February of 1991 (Fairley et al. 1994) and was monitored in FY92, FY95, and FY99 (Coder et al. 1994b, 1995b;Kunde 1998a).

Monitoring Data Summary

Mature vegetation on the site has stabilized the gully. No physical impacts were observed.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages, as detailed by Hereford et al. (1993), the inactive schedule will be changed to a 5-year monitoring schedule. This site will be monitored in FY2004. The terrace-based drainage will be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:15:051 Roasting Feature (5-year schedule)

A:15:051 consists of a single roasting feature eroding out of the base of a talus slope. Two obsidian tools and Virgin ceramics were found on the surface. A localized drainage passes through the site causing pedestaling of soil and small gravels.

Previous Work

The site was initially recorded in March of 1991 (Fairley et al. 1994) and was monitored in FY93, FY94, and FY99 (Coder et al. 1994a, 1995a; Hubbard 1999b).

Monitoring Data Summary Status and Recommendation

FY93 monitors recorded the presence of pedestaled soils and gravels due to a drainage on the site. In FY94, cryptogamic soils appeared to be stabilizing the entire site. According to observations made by FY99 archaeologists, this site was observed in stable condition. A mature growth of cryptogamic soil was present. Though no human visitation was observed, there is a trail leading from a small beach to 205 Mile Rapids. (The trail is used for scouting and also leads into the side canyon.) Due to the site's location, there is the potential for this site to be impacted by visitors if river flow regimes change, requiring the rapid to be scouted more regularly. The site should be monitored after a flood of 180,000 cfs or higher.

FY99 Recommendations

Due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. Monitoring is scheduled for FY2004. The terrace-based drainage will be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:16:157 Roaster Complex (5-year schedule)

This site consists of a small rockshelter with two roasting features. Artifacts include ground stone, lithic debris, and a few sherds including corrugated graywares and brownwares. The site is located at the base of a Muav Limestone cliff and an adjacent talus slope.

Previous Work

The site was initially recorded in December of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

In FY96 monitors noted that the rockshelter was highly impacted by animal digging and burrowing, and was used as a carnivore den. Spall from the walls of the shelter was also noted. The two roasting features were viewed in stable condition and threatened only by gravity creep on the talus slope.

FY99 Recommendations

Because the site has only been monitored one time, not enough information has been gathered to warrant taking this site off an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule; monitoring will occur in FY2001. The RCMP staff recommends that the terrace-based drainage be assessed immediately for preservation treatment including headcut documentation and nickpoint counts.

A:16:160 Roasting Feature (5-year schedule)

This site is a cluster of six fire features and an artifact concentration containing lithics, charcoal, bone, a mano, and a slab metate. The site is located on an alluvial terrace adjacent to a major side canyon drainage. Thick vegetation covers the site, deterring erosional processes and human visitation.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). Trail obliteration work was completed in FY96.

Monitoring Data Summary

Overall the site was identified as stable in FY94. However, human trailing was causing adverse impacts to Feature 1. Trail obliteration was recommended in FY94 and completed in FY96. The FY98 monitoring staff noted that the trail work looked good; however, maintenance work was needed, especially where the trail cuts near the mano and metate. It was recommended that trail work be conducted with some transplanting to keep day-hikers off the site. This work would be conducted by the GRCA rehabilitation trail crew in conjunction with the work they do on the boat beach below the site.

FY99 Recommendations

Continue annual trail maintenance by the GRCA rehabilitation crew. Because the site has only been monitored twice, not enough information has been gathered to warrant taking this site off the active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule (monitoring will occur in FY2003). The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:16:161 Small Structure (5-year schedule)

This site consists of two rock alignments, a light lithic scatter, biface fragments, and two bedrock mortars. Feature 1 is a semi-rectangular alignment of small unshaped stones forming a small enclosure approximately 2 m^2 in area. Feature 2 is a straight alignment 2.3 m long. The two Muav Limestone mortars are 25 m south-southwest of Feature 1. The site is situated on a heavily vegetated terrace with some deposition of silty sand.

Previous Work

The site was recorded in December of 1990 by NPS survey personnel (Fairley et al. 1994) and monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Cryptogamic soil covered most of the terrace and the site had not changed since 1990. A brittlebush at Feature 1 died. The site was described as "extremely stable" by the monitoring team.

FY99 Recommendations

Because the site has only been monitored, once not enough information has been gathered to warrant taking this site off an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be monitored in FY2001. The terrace-based drainage should be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:16:171 Roaster Complex (5-year schedule)

A:16:171 consists of two roasting features and a sparse array of artifacts. A single sherd of Polacca Polychrome is located on the site. The sherd could be as early as 1780 and indicates further evidence of Hopi-Pai trade along the river corridor.

Previous Work

This site was initially recorded by NPS survey personnel in January of 1991 (Fairley et al. 1994) and was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998).

Monitoring Data Summary

The site was covered with abundant cryptogamic soils, and no physical or visitor-related impacts were identified. The site was in stable condition and was not threatened by any future disturbances.

FY99 Recommendations

Because the site has only been monitored twice, not enough information has been gathered to warrant taking this site off an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be visited in FY2003. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:16:176 Roasting Feature (5-year schedule)

A:16:176 is an aceramic site with a single roasting feature and scattered lithics. Burned bone is also present. The site is located on a small flattened area at the top of an acacia-covered slope. No gullies or arroyos drain directly into the river from the site. Cultural affiliation is unknown.

Previous Work

This site was initially recorded by NPS survey personnel in January of 1991 (Fairley et al. 1994) and was monitored for the first time in FY94 (Coder et al. 1995a).

Monitoring Data Summary

The site was recorded as very stable in FY94. Access was difficult due to the thick cover of acacia.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages as detailed by Hereford (Hereford et al. 1993), the inactive schedule will be changed to a 5-year monitoring schedule. This site should be monitored in FY2000. The terrace-based drainage will be assessed for preservation treatment including headcut documentation and nickpoint counts.

A:16:184 Thermal Feature (inactive schedule)

This site is a twentieth-century hiking camp consisting of a single fire ring and artifacts including cans and a pickle jar with a note. The note reveals that the camp was used by a Mormon church group out of St. George, Utah and is dated 23 April 1948. The site is located on a sandy terrace.

Previous Work

The site was initially recorded by NPS survey personnel in January of 1991 (Fairley et al. 1994) and it was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

The site was very stable in FY96. The only degradation observed was the partial disintegration of the note inside the jar.

FY99 Recommendations

Information potential at this site is exhausted, therefore it is recommended that the note inside the jar be photographed with a medium-format camera for archival purposes and the site then be placed on the inactive monitoring list.

B:10:111 Roaster Complex (4-year schedule)

The site consists of three roasting features visible on the surface as clusters of fire-cracked sandstone and limestone. These features are eroding down the toe of a terrace ridge. No other artifacts were observed; cultural affiliation is unknown. B:10:111 is associated with a larger habitation site in the same drainage, which is out of the project area.

Previous Work

This site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored in FY93, FY94, and FY96 (Coder et al. 1994a, 1995a; Leap et al. 1996).

Monitoring Data Summary

Extensive arroyo cutting and some animal trailing were noted, although no human impacts were observed at the time the site was recorded. FY93 monitors observed the presence of arroyos and animal-induced erosion. In both FY94 and FY96, monitors mentioned natural slope creep and surface runoff as slowly eroding the features downslope. The FY96 monitoring staff recommended data recovery and stabilization of the shallow gully (Leap et al. 1996); however, in May 1997, no work was warranted due to the relative stability of the on-site drainage.

FY99 Recommendations

The site will be monitored every 4 years. The terrace-based drainage should be assessed for preservation treatment, including headcut documentation and nickpoint counts.

B:10:237 Roaster Complex (5-year schedule)

This site is an open roaster complex with lithic debris and PII sherds. It is situated on a dune-covered debris flow at the mouth of a major side canyon. A route out of the inner canyon originates at this site.

Previous Work

The site was initially recorded by NPS personnel in September of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96. During FY96 monitoring, stabilization and data recovery were recommended (Leap et al. 1996); however, in FY97 the tasks were deemed unnecessary. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY96 archaeologists noted that Feature 1 was perched on the edge of the drainage and was slowly eroding into the side canyon. The rest of the site was covered by a heavier growth of vegetation than in 1990 and was stable overall. The erosion at Feature 1 was the result of side canyon flooding and not increased steepening from changes in base-level elevations of the river channel. An assessment of the area revealed that though there was the potential for future downslope erosion, it was not presently active and no preservation options were warranted.

FY99 Recommendations

This site will be monitored every 5 years. The terrace-based drainage will be assessed for preservation treatment, including headcut documentation and nickpoint counts.

B:11:272 Roasting Feature (biennial schedule)

This site consists of a single isolated roasting feature with no associated artifacts. The feature is situated on a diabase bench with a veneer of eolian sand overlooking the river. Surface runoff, gullying, and active arroyo development exist on half of the site. Two distinct trails pass through the site due to the proximity of and the popularity of the camp at Dubendorf Rapid and the traditional hiking by boaters at Stone and Galloway Canyons.

Previous Work

This site was initially recorded in February of 1991 (Fairley et al. 1994) and it was monitored at least annually FY92–FY96 and once in FY98 (Coder et al. 1994a, 1994b, 1995a, 1995b; Leap et al. 1996, 1998). NPS personnel obliterated the trail west of the roasting feature in February 1995 and this has proven to be very effective. Detailed total station mapping was completed in FY96 (Leap et al. 1996).

Monitoring Data Summary

FY92 and FY93 monitoring staff noted the presence of extensive trailing across the site. It was also noted that erosional scars from gullying and local rains in 1991 and 1992 were stabilizing by naturally occurring vegetation. In FY94, RCMP staff observed an increase in vegetation across the site. No physical or visitor-related disturbances were observed. The trail obliteration work in FY95 successfully deterred human visitation. The monitoring schedule was reduced to biennial visits due to the success of the preservation treatment implemented.

In FY98, the gully adjacent to the feature was inactive, but it had the potential to run in the future, possibly uncovering additional artifacts and threatening site integrity.

FY99 Recommendations

Trail maintenance will continue with the GRCA rehabilitation crews as needed, and RCMP monitoring will occur every 2 years. The terrace-based drainage will be assessed for preservation treatment, including headcut documentation and nickpoint counts.

B:11:277 Thermal Feature (3-year schedule)

B:11:277 is an open site situated on sand dunes adjacent to the Colorado River and consists of a large concentration of fire-cracked rock, ground stone, lithics, and plain gray ware sherds, indicating a formative Puebloan occupation. There is a high potential at this location for more materials to be found buried in the extensive sand dunes.

Previous Work

This site was discovered and initially recorded in January of 1991 (Fairley et al. 1994) and was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b).

Monitoring Data Summary

Observations in FY95 indicated that the site was stable, with only minor surface erosion and wind deflation along the southeast face of the dunes. This was assumed to be a steady-state problem of sediment depletion, correcting itself on a seasonal or annual basis dependent on winds and vegetation. The site was observed as having good grass cover and mature cryptogamic soils.

In FY99, archaeologists found the site to be more active than previously observed. Active rills and a gully were located 5 m northwest of Feature 1. The gully was entrenched 10–20 cm and had several nick points. The headcut of the gully was located next to the northwest artifact and FCR scatter. New rills formed south of the artifact concentration. The rills were entrenched near the headcut, but filtered into the sediment 5 m north of Feature 1. An animal trail was located southeast of Feature 1. The trail led from the side canyon toward the artifact concentration. A large animal burrow, causing downslope erosion of sediment, was discovered southeast of Feature 1.

FY99 Recommendations

Due to the discovery of new, entrenched drainages, this site will be monitored in 3 years. New artifacts were not discovered; however, deepening of the drainages will likely expose new cultural material. Comprehensive photos were taken of the drainages for the next comparisons. The RCMP staff recommends that the terrace-based drainage be assessed immediately for preservation treatment, including headcut documentation and nickpoint counts.

B:11:281 Thermal Feature (biennial schedule)

B:11:281 is an open artifact scatter with sherds, flakes, ground stone, chipped stone tools, and fire-cracked rock. Ceramics indicate a PII Puebloan affiliation. A complete Parowan point was observed at this location, indicating a trade connection to the north.

Previous Work

This site was initially recorded in January of 1991 (Fairley et al. 1994) and was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

The majority of the site was covered in cryptogamic soils, giving it a stable appearance in FY95. However, in FY99 surface erosion was observed adjacent to the gully and throughout the site. Minor sheetwashing was noted within the artifact scatter adjacent to Feature 1. The gully adjacent to Feature 1 had four nick points (10–30 cm deep), whereas the FY95-1 monitoring form mentioned only one nick point. It was recommended in FY99 that if the gully continues to incise rather than fill, the site should be assessed for brush checkdams, or another type of preservation method. A popular camp is located below the site but no visitor impacts were observed.

FY99 Recommendations

Due to an increase in the number of nickpoints in the gully adjacent to Feature 1, the monitoring schedule should be changed to biennial. It is recommended that the active gully be assessed for checkdam installation in FY2000 by the Zuni Conservation Project. The terrace-based drainage will be assessed for preservation treatment, including headcut documentation and nickpoint counts.

B:14:095 Roaster Complex (4-year schedule)

The site contains two loci, A and B, including roasting features, lithics, and sherds representing a Puebloan PI–PII affiliation. The site is located in the dunes near some large debris boulders, which have washed down from a large side canyon. Additional sherds were identified by FY95 monitors in Locus A.

Previous Work

This site was recorded in September of 1990 (Fairley et al. 1994) and monitored in FY93, FY95, and FY99 (Coder et al. 1994a, 1995b; Kunde 1998a).

Monitoring Data Summary

Wind deflation and minor surface erosion have been observed across the surface of the dunes since FY93. Surficial sheet washing, gullying, wind deflation, dune migration, and minor animal trampling were the impacts observed in FY95 and FY99. No human impacts were present. Monitors did note that eolian deposition and erosion will continue in a cyclical manner as the surrounding dunes continue reworking.

FY99 Recommendations

The site will be monitored every 4 years. The terrace-based drainage should be assessed for preservation treatment, including headcut documentation and nickpoint counts.

B:14:107 Thermal Feature (3-year schedule)

B:14:107 is a small rockshelter located in a Tapeats Sandstone overhang and consists of lithics, a cobble mano, a corrugated sherd, and a wall segment. A crescent-shaped concentration of fire-cracked rock and stained soil is eroding out of the slope below the shelter. FY95 monitors recorded a rock cairn and fish skeleton within the site boundary.

Previous Work

This site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY95, FY96, and FY98 (Coder et al. 1995b; Leap et al. 1996, 1998). In April 1997, a water diversion structure was placed above the site to deter runoff through Feature 2. A total station map was also completed in FY97 (Leap et al. 1997). In FY98, Zuni Conservation Project members extended the water diversion bar by 1.5 m to increase its effectiveness; now it extends to a length of 4 m (Leap 1998b). Additional maintenance work was completed in FY99 (Hubbard 1999b). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Between the time the site was recorded and the FY95 monitoring episode, a gully developed adjacent to Feature 2. An assessment for stabilization was conducted in FY97. Placement of the water diversion bar has successfully curtailed further runoff from the talus slope above the site into Feature 2. Figure 15 shows the small gully bisecting Feature 2.

FY99 Recommendations

Annual checkdam maintenance will occur with Zuni Conservation Project personnel and RCMP staff, and archaeological monitoring will continue on a 3-year schedule. The effectiveness of checkdams should be measured by recording volumetric change.

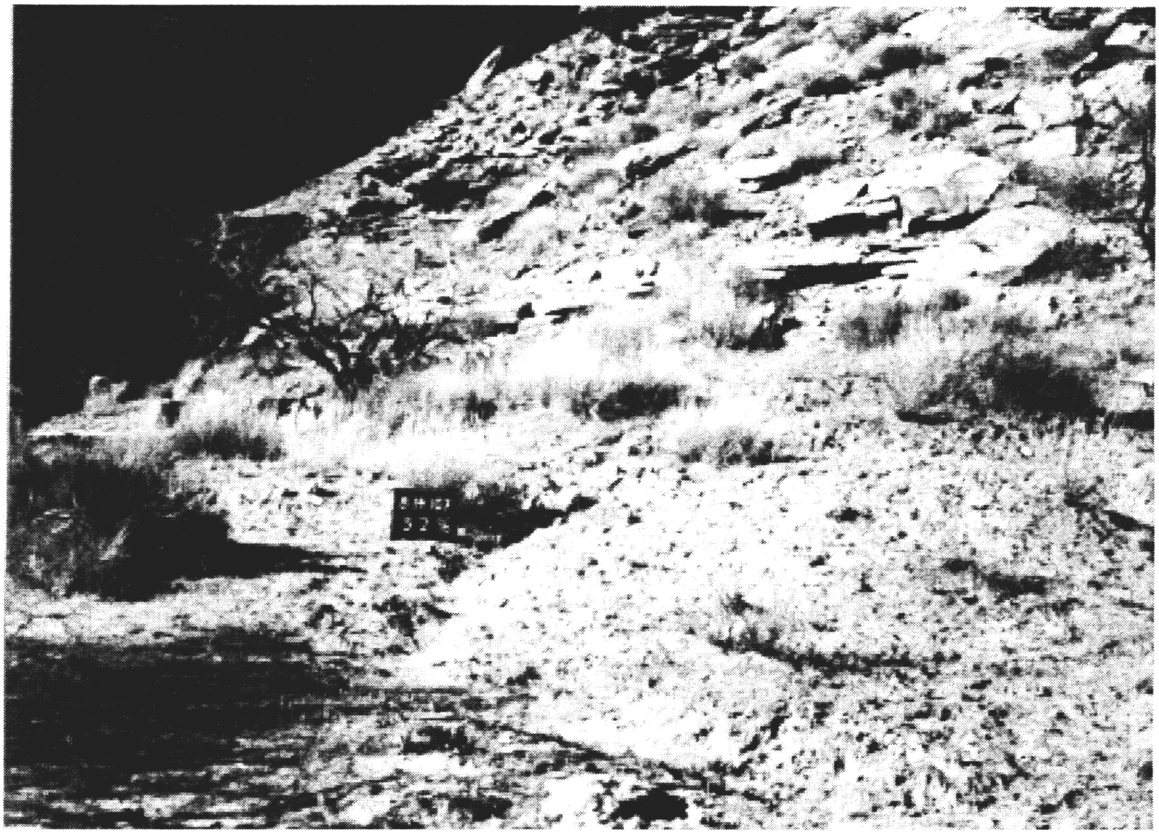


Figure 15. A terrace-based gully bisecting Feature 2 at site B:14:107. Remedial action work completed in FY97 reduced the active gullying at this feature and diverted runoff to a location devoid of cultural materials.

B:15:096 Special Activity Locus (inactive schedule)

This site consists of the celebrated *Ross Wheeler*, a boat constructed by Bert Loper and used in the failed Quist and Tadje film trip of 1915. The boat was abandoned and later moved by members of the Bass Camp (Lavender 1985). In 1984 Kim Crumbo of the National Park Service pulled the boat above the high-water line, where it now rests amongst the boulders, 6.5 m vertically above the 28,000 CFS level. The *Ross Wheeler* has established itself as a physical reminder in the river corridor of the hair-raising trips of the pre-dam era.

Previous Work

This historic period site was initially recorded by Euler in July of 1987 and was mapped in detail by the GRCA survey crew in October of 1990 (Fairley et al. 1994). An excellent sketch of the craft appears in the survey project report. The site was monitored in FY92, FY93, FY94, and FY95 (Coder et al. 1994a, 1994, 1995a, 1995b).

Monitoring Data Summary

Monitoring observations reveal that site B:15:096 has been stable. Due to its proximity to the river and its historical significance, it was recommended that the *Ross Wheeler* be casually observed from the river and officially monitored after flows in excess of 60,000 cfs.

FY99 Recommendations

Medium-format photography should be conducted at this site as a form of archival long-term documentation. After photographic documentation, the information potential will be exhausted and the site will be placed on the inactive list, monitored only by the NPS river patrol for ARPA violations.

C:05:037 Thermal Feature (4-year schedule)

C:05:037 consists of two partially exposed fire features, several flakes, and a few sherds. The sherds indicate Puebloan and Southern Paiute occupations. This site is located on a reworked dune system overlying a talus slope and debris fan. A popular camp is situated less than 100 m downstream from the site. Although the ephemeral nature of the site does not necessarily attract visitation, it is a nice walk from camp so a trail is present and trash is generally found in minor amounts.

Previous Work

This site was initially recorded in October of 1990 (Fairley et al. 1994) and was monitored from FY92 through FY95 and then again in FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b).

Monitoring Data Summary

FY92 and FY93 monitors noted that this site was in poor condition. In FY94 it was noted that Feature 1 exhibited an increase in deflation and gullying across the site. Fire-cracked rock and artifacts were moving downslope near Feature 2. FY99 monitors observed the site in stable condition since last visited in FY95. New photos were taken showing increased vegetation growth. It was suggested that monitoring continue every 4 years due to the gully proximal to Feature 2.

FY99 Recommendations

Monitoring will continue every 4 years. RCMP personnel recommend that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:06:006 Artifact Scatter (4-year schedule)

This is a Pueblo II site consisting of a sparse sherd and lithic scatter on an alluvial terrace. Three corrugated sherds (two from one vessel) and two decortication flakes from coarse-grained cobbles were observed. Other remains may be buried, or have been collected, as the site is at a popular camping area. Based on surface evidence, this was probably a limited activity site associated with C:06:003. In September of 1992, a rock alignment of six boulders was added to the site record and map. This site is located on a sandy alluvial terrace mantled with pea-sized gravels derived from Hermit Shale. The site is bracketed by two arroyos that drain the talus slope behind the site.

Previous Work

This site was re-recorded by NPS survey personnel in 1990 (Fairley et al. 1994), and monitoring occurred in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997). GRCA trail work conducted at this site has successfully decreased visitation. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Runoff occurring between FY92 and FY93 moved a small boulder in a channel running through the feature. Surface and eolian erosion were present, but minor. New surficial erosion was apparent on the site as incipient channeling and dispersed gravels.

FY99 Recommendations

The GRCA rehabilitation crew will continue trail maintenance. The site will be monitored every 4 years. The terrace-based drainage should be assessed for preservation treatment including headcut documentation and nickpoint counts. The Hopi Tribe requested that their cultural advisors inspect the cultural value of the site.

C:09:061 Small Structure (5-year schedule)

This is a habitation site with structures and an extensive artifact assemblage. Ceramic and ground stone evidence indicates an eleventh-century Puebloan occupation. The site is situated on a sediment-covered debris flow at the mouth of a major side canyon.

Previous Work

The site was initially recorded in October of 1990 by NPS survey personnel (Fairley et al. 1994). It was monitored for the first time in FY96 (Leap et al. 1996). This site is included in the Hereford et al. topographic map of the Nankoweap Region (1996a).

Monitoring Data Summary

The site was described by the monitoring team as being "in excellent condition" and "stable." There was more vegetation apparent on the surface and no visitation was discernible since the survey.

FY99 Recommendations

Because the site has been monitored only twice, not enough information has been gathered to warrant taking this site off an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule (monitoring will occur in FY2001). It is also recommended that the terrace-based drainage be assessed immediately for preservation treatment including headcut documentation and nickpoint counts.

C:09:065 Historic Structure (5-year schedule)

This site consists of a number of related features and artifacts associated with testing for a Marble Canyon dam site in the 1950s. There are 16 numbered features. Features 1–11 are on river right, and Features 12–16 are on river left. Features include stakes with guidewires, looped rebar and anchors cemented into the Redwall, adits, cable, masonry platforms, painted inscriptions, and related artifacts. The 97-2 monitors located three additional features.

Previous Work

The site was initially recorded by NPS personnel in 1990 (Fairley et al. 1994), and was monitored for the first time in FY97 (Leap et al. 1997). In FY94 the SHPO concurred with the recommendation of National Register eligibility (Leap 1994c).

Monitoring Data Summary

There was some gullying present near Features 5–8, and 19, but the gully's direction avoided the features. Minor eolian erosion was also present. Human visitation was not observed. The features were extremely stable with only a few areas within the site boundaries exhibiting erosion. Most of the features were cemented into bedrock and boulders, and therefore were not at risk from visitor-related or physical impacts. Many photographs were not available for comparison, and much time was spent photographing features. Now that photographs have been taken and maps have been corrected, monitoring will be much more efficient.

FY99 Recommendations

Monitor the site in 5 years and if it is stable, place the site on the inactive monitoring list.

C:09:067 Small Structure (5-year schedule)

This is a structural habitation site with PII ceramics, a scatter of lithic debris, and a single metate. The site is situated on a sloped alluvial terrace overlaying old debris.

Previous Work

The site was initially recorded in December of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

In FY96 the site appeared unchanged since 1990, still in stable condition. There was no evidence of visitation since the survey, and the site was described by the monitoring team as "difficult to find."

FY99 Recommendations

Because the site has been monitored only one time, not enough information has been gathered to warrant taking this site off of an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993) and other related research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be monitored in FY2001. It is recommended that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:09:068 Artifact Scatter (5-year schedule)

This site consists of an artifact scatter containing sherds and lithics. No obvious architectural features were visible on the surface, but given the nature and depth of alluvial deposits, it is very likely that additional cultural materials are buried beneath the present ground surface. The site surroundings may have offered good agricultural potential. Artifacts suggest a Pueblo II occupation. The site is located along the slope below an alluvial fan.

Previous Work

NPS personnel recorded this site in 1990 (Fairley et al. 1994), and monitoring occurred in FY93 and FY97 (Coder et al. 1994a; Leap et al. 1997).

Monitoring Data Summary

The FY93 monitoring staff observed gullying and animal trampling. Since 1990, vegetation had slightly increased in the artifact concentration area located on the dune slope. This growth added to the stability of the slope and artifact area.

In FY97, overall, the site appeared stable. Trails leading from the upper beach to 50 Mile Canyon came within the vicinity of the site boundary but did not appear to pose any impact to the site. Dense vegetation was protecting it.

FY99 Recommendations

Because the site has been monitored only twice, not enough information has been gathered to warrant taking this site off of an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be monitored in FY2002. It is recommended that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:09:084 Artifact Scatter (3-year schedule)

This site consists of corrugated sherds, manuported cobbles, and a corncob. The FY96 monitoring staff identified several large flakes on the site not recorded during the survey. The site is located at the base of a Bright Angel Shale cliff, resulting in a somewhat sheltered location.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and monitored in FY96 and FY98 (Leap et al. 1996, 1998). In FY98 the site was assessed for checkdam installation. No work was warranted because the ground surface is primarily boulders and colluvium (Hubbard 1999b).

Monitoring Data Summary

In FY96, monitors observed that the sherds had moved 50 cm downslope and the corncob was broken in half. Two additional flakes were found during the FY96 monitoring episode. A small gully also formed along the dripline on the northwest corner of the site. No artifacts or cultural features were exposed or directly impacted by this erosion. In FY96 monitors recommended checkdam construction in one of the gullies. In FY98, upon further monitoring, it was determined that any preservation measures will be put on hold until the site becomes more active.

FY99 Recommendations

Monitoring will continue every 3 years. RCMP staff recommend that the terrace-based drainage be documented, including headcut documentation and nickpoint counts.

C:13:005 Roaster Complex (inactive schedule)

C:13:005 is an extensive site consisting of nine features with associated artifacts. The features include a small rockshelter (Feature 6) and numerous roasting or hearth features. Feature 1 consists of a 2-m-diameter FCR midden of fist-sized sandstone and limestone cobbles. Feature 2 is also an FCR midden of sandstone and limestone cobbles. A well-defined charcoal stain exists at the top of Feature 2. Feature 3, another FCR midden, may be part of Feature 2. Feature 3 is a circular feature, 1 m in diameter. Feature 4 consists of a concentration of fire-cracked rock over the edge of a dune and into the boulders below. The concentration covers roughly 15 m. Feature 5 is a 5-m-diameter cleared area at the top of the dune. The feature is noted as a deflated area within the dune, with a large sandstone boulder acting as a windbreak along the southern edge of the feature. Sandstone slabs and cobbles are present along the surface. Feature 7 consists of a small FCR pile eroding from a sand dune. Feature 8 consists of a fan of fire-cracked rock radiating from a dune area. Some charcoal is present on the surface. Feature 9 consists of more fire-cracked rock adjacent to Red Canyon. Charcoal is present at Feature 9. Two roasting features, recorded in 1988, were also observed. These roasters appeared completely blown out at the time of the river corridor survey. Fire-cracked rock remains are present and are scattered toward the river. Cobble-sized limestone and Hakatai Shale rocks are present. A Deadmans Black-on-red and two Moenkopi corrugated sherds were originally identified at this location. There are few lithics overall, although chert and obsidian are present. Tools include large core scrapers, a hammerstone, a pounding tool, and utilized flakes. A broken sandstone mano was also observed. The 95-5 monitors found a unifacial chert scraper inside Feature 6. Sherds indicate a PII Puebloan affiliation with a later, historic Hopi occupation. The site is situated on riverside dunes and an adjacent structural bench.

Previous Work

The site was originally recorded in 1962 and was revisited by NPS archaeologists in 1976 and 1988. GRCA monitored this site several times before turning over the responsibility to the river corridor project in FY95. The site has been monitored annually since FY95 (Coder et al. 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). Extensive trailing exists on the site due to the location of the roasters along a major rapid scout trail. A toilet paper fire occurred at this location in FY95.

This delta receives heavy use by backpackers and boaters, and the scout trail leads directly through Features 1–4. NPS maintains the trails in this area at least biennially. Three checkdams in the gully near Feature 9 were constructed in February 1996 by the Zuni Conservation Project and NPS trail crew (Leap et al. 1996).

Monitoring Data Summary

Due to the site's location on a large dune, stability has been an ongoing problem. Human traffic through the site continued to be heavy in FY96.

FY97 monitors observed that the fire-cracked rocks that remain at Features 1–4 were stable. The rocks shoring up the trail, adjacent to Features 2 and 3, were dislodged and loose. Feature 5 was stable, although large logs and sticks blocked the entrance and were covering the fire-cracked rocks. Trail work was successful and the only footprints observed were at the scout trail running through Features 1-4. Visitors have used Feature 6 as a shelter, but it did not appear disturbed. The extensive brush piles, rocks, and cacti transplants near Features 7 and 8 were still in place. Feature 9 was difficult to locate, but the checkdams built in FY96 and brush piles have stabilized and obliterated the trail through the feature. No toilet paper was observed in 1996, although it has been during previous monitoring episodes. Trail obliteration seemed to be working.

FY99 monitoring staff observed that the checks were in stable condition with abundant grasses throughout the drainage. However, a minimal amount of sediment was held back. Features 7 and 8 were currently inactive. Overall, the features were in fair condition. Besides active trailing, visitor impacts were minor in nature.

RCMP FY99 monitors noted that river flows have had no impact on the site, due to its location above the 200,000 cfs level, although fluctuating water flows do result in the use of the delta as a scouting location for Hance Rapid. The site should be monitored after flows exceeding 100,000 cfs.

FY99 Recommendations

Trail maintenance and checkdam maintenance will continue by GRCA. The effectiveness of checkdams should be measured by recording volumetric change. Continued impact to this site from backpackers has resulted in destruction of the features. It is recommended that this site be placed on the inactive monitoring list and be turned over to the River Patrol office for annual monitoring for ARPA violations.

C:13:069 Small Structure (annual schedule)

This large site consists of several cists and masonry structures. Feature 1 is a slab-lined cist remnant. Feature 2 may be a masonry room with midden. Feature 3 is a masonry wall. Feature 4 consists of eroding slabs where additional architecture may be present. Feature 5 is a well-preserved cist. Feature 6 is a masonry room. Feature 6B is another masonry room outside of the main dune area. Ceramics suggest a Pueblo II–early Pueblo III affiliation. The site is near the Tanner Trail and a well-used beach camp.

Previous Work

Prescott College personnel originally recorded this site in 1972. NPS personnel re-recorded it in 1990 (Fairley et al. 1994), and monitoring occurred in FY93, FY95, FY96, FY97, and FY99 (Coder et al. 1994a, 1995b; Kunde 1998a; Leap et al. 1996, 1997). As part of the GCES Phase 1 program, Ted Melis took a carbon sample at this location. No information has been disseminated to the RCMP office concerning the results. In 1992, the GRCA Rehabilitation Project conducted trail obliteration, revegetation, and stabilization of minor drainages. Medium-format photos were taken of this site in FY96 (Leap 1996b). Upon completion of a stabilization assessment in FY97, six checkdams were constructed along the drainage bisecting the features. One existing checkdam was reconstructed and five new checkdams were built. A total station map was also completed for this site in FY97. See Hereford (Hereford 1993; Hereford et al. 1993, 1996) for photogrammetric topography mapping of the immediate area. Maintenance work on the checkdams was completed in FY99 (Hubbard 1999b).

Monitoring Data Summary

FY93 monitoring staff observed moderate physical impacts including surficial sheet washing, gullying, active arroyo cutting, burrowing, wind deflation, bank slumpage, and dune migration. Human impacts were high, and included distinct trails, trail-caused erosion, and minimal site camping. This site was at particular risk due to the adjacent river camp that was heavily used, especially during the May to October season. Backpackers throughout the year also used the area and a major trail had cut directly through the site. Retrailing and revegetation work carried out in 1992 has had a positive affect on the site.

FY95 monitoring staff noted that locally active gullying posed an ongoing threat to Features 1 and 2. FY96 monitors recommended additional checkdams.

Physical impacts identified in FY97 included minor bank slump on the upper western half of Feature 1. On the lower western portion there was a log that acted as a sediment catchment device, with an accumulation of at least 20 cm of sediment. This sediment probably came from Feature 1 and possibly from alluvial deposition. Minor surface runoff was noted northeast of Feature 5. Increased animal burrowing was observed at Features 3 and 6.

FY99 monitors recommended further obliteration of the trail through Feature 3 with vegetation and deadfall. It was suggested that large branches be placed in the area to block access. The checkdams appeared stable with minor amounts of sediment accumulating in and around the checkdams. No new nickpoints or headcut advancements were identified.

FY99 Recommendations

Trail maintenance by the GRCA rehabilitation crew will continue, as well as annual checkdam monitoring by Zuni and RCMP personnel. The effectiveness of checkdams should be measured by recording volumetric change. Annual monitoring will continue to identify headcut advancement and the presence of new nickpoints in the gully threatening Features 1 and 2. The site will be assessed for planting vegetation. Finally, it is recommended that an assessment be made for data recovery at Feature 1 if it is determined that checkdams are not effective.

C:13:274 Small Structure (5-year schedule)

This site consists of a series of four rock alignments, one course high of sandstone, and limestone elements. An associated lithic scatter contains primarily Redwall Chert flakes. A single fire feature, measuring 3 m in diameter, also contains charcoal and burned sandstone pieces. No sherds were seen on the surface, and time period and cultural affiliation are unknown.

Previous Work

This site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994) and was monitored in FY95 and FY96 (Coder et al. 1995b; Leap et al. 1996).

Monitoring Data Summary

In FY95 monitors noted that Feature 2 was undercut by an established gully present when the site was recorded in 1990.

FY99 Recommendations

Because the site has been monitored only twice, not enough information has been gathered to warrant taking it off of an active monitoring schedule. Due to the probability of terrace-based drainages becoming river-based drainages (Hereford et al. 1993) and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be monitored in FY2001. The RCMP staff also recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:13:323 Thermal Feature (4-year schedule)

C:13:323 consists of a single eroding hearth and an associated lithic assemblage with three bifacial tools and lithic debitage. The site is located on a west-facing dune at the mouth of a major canyon.

Previous Work

This site was initially recorded by the office of the Park Archeologist in November of 1989. Radiocarbon samples were taken from the hearth, yielding an accelerated date of 390 to 340 B.C., indicating an Archaic occupation. The hearth was also profiled at the time the carbon sample was taken. NPS personnel did more intensive recording and analysis at this location in April and September of 1990 (Fairley et al. 1994). This site was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). It has been included in the topographic map produced by Hereford et al. of the Tanner region (Hereford 1993).

Monitoring Data Summary

FY98 monitoring staff noted increased erosion at the roaster or hearth feature, and two newly exposed charcoal lenses. No visitor-related impacts were observed.

FY99 Recommendations

Eolian activity warrants continued monitoring due to the potential for further surface exposure of archaic remains. RCMP will continue monitoring this site every 4 years. It is recommended that the terrace-based drainage be assessed immediately for preservation treatment, including headcut documentation and nickpoint counts.

C:13:325 Roasting Feature (4-year schedule)

This site consists of a prehistoric roasting feature containing a one-handed mano and ceramics. An historic component is also present, consisting of the historic remains of a small corral. Scattered driftwood planks and poles, plus several upright posts, are arranged in a circular shape. Milk and food cans, cable, and barbed wire are strewn about the site area. FY94 monitoring staff recorded a .30 cal. shotgun shell near one of the upright posts.

Previous Work

This site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994). The site was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998).

Monitoring Data Summary

The site was in stable condition and unchanged since the last monitoring episode in FY94, yet there was a gully west of the structure that appeared active. RCMP monitors suggested that if the gully moved toward the structure, then remedial work should be implemented before it impacts the feature. No visitor-related impacts were observed.

FY99 Recommendations

RCMP staff will continue monitoring this site every 4 years. The site will be monitored in FY2002. The gullies at this site should be assessed for checkdam installation with Zuni Conservation Project personnel. Gully assessments should include headcut documentation and nickpoint counts.

C:13:327 Roasting Feature (biennial schedule)

This is a campsite consisting of several fire features, concentrations of lithic debris, bone, and a single Moenkopi corrugated sherd. The site is situated on the edge of a high alluvial cutbank. It is also adjacent to the Hance-Tanner Trail. A roasting feature, a slab-lined hearth, and charcoal lenses in adjacent arroyo cuts were discovered during geomorphologic research activities on the site.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored in FY96 and FY98 (Leap et al. 1996, 1998). NPS personnel conducted test excavations in conjunction with trail work in 1992. Carbon samples taken at this time date the site from the late Archaic age through the sixteenth century, indicating multiple use of the area. This site is included in the Hereford et al. topographic map of the Tanner region (Hereford 1993). Retrailing took place during FY96 and obliteration of the old trail occurred in FY97. Checkdams were recommended in FY96 and an assessment for stabilization was conducted prior to construction of three checkdams and terrace fortification in FY97 (Leap 1997c). Total station mapping occurred in FY97 upon completion of stabilization work (Leap et al. 1997). In FY99 the Zuni Conservation Project staff performed maintenance on one checkdam (Hubbard 1999b). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY96 monitoring staff observed deflation of surface sand across the site. The headward erosion of a local arroyo since 1992 destroyed Feature 3.

In FY98, the checkdams remained intact. It appeared that minor amounts of water moved through them, depositing new fill. There was moderate vegetation cover above one of the checkdams (Checkdam 1), adding considerable stability. The features also appeared to be in stable condition. Trail obliteration successfully decreased visitor-related impacts to the site. Because there was obvious evidence of water movement on the site, monitors recommended monitoring the site biennially to identify any newly exposed artifacts or features.

FY99 Recommendations

RCMP staff recommend continued trail maintenance by the GRCA rehabilitation crew and continued annual checkdam monitoring and maintenance with the Zuni Conservation Project staff. The effectiveness of checkdams should be measured by recording volumetric change. Biennial monitoring will continue.

C:13:329 Small Structure (biennial schedule)

This is a Pueblo II site consisting of a small rockshelter with a charcoal and bone scatter, an artifact cluster, and a small circular rock feature. Only a small portion of the site may be visible, with the remainder buried under dune deposits. A single Tusayan White Ware sherd is present. This site is located in a shallow overhang and an associated system of reworked dunes.

Previous Work

This site was initially recorded in 1990 (Fairley et al. 1994) and monitored in FY92, FY93, FY95, FY97, and FY99 (Coder et al. 1994a, 1994b, 1995b; Hubbard 1999b; Leap et al. 1997).

Monitoring Data Summary

Monitors noted that Features 2 and 3 were subjected to adverse effects by local gullying. They also noted that Feature 3 could be undercut in a high-water event in excess of 80,000 cfs. The majority of the site was stable; however, a terrace-based gully located in Feature 2 expanded by 6 cm in width since FY93. New artifacts also surfaced at this feature.

FY97 monitors observed that the gullies at Feature 2 were filling in, thus making the feature more stable by eolian deposition. In FY99, Features 1 and 3 were unchanged since the 97-2 visit. The gully impacting Feature 2 was entrenched (25 cm deep).

The sherds previously identified adjacent to Feature 2 were not located in FY99. Previous monitors have observed sediment deposition within the gully, indicating the possibility of cyclical change.

FY99 Recommendations

RCMP staff recommend biennial monitoring. The site will be monitored in FY2001. Feature 2 should be assessed for preservation treatment. If preservation methods are not regarded as an option, data recovery will be considered.

C:13:336 Thermal Feature (3-year schedule)

This site consists of two concentrations of lithics and sherds, a possible hearth, and a roasting feature. A cobble alignment eroding out of a dune may be the remnants of a possible structure. The FY94 monitoring staff recorded a new artifact concentration, Feature 4, not recorded during the survey. C:13:336 is a Puebloan occupation site located within the pre-dam high-water zone adjacent to the Beamer Trail. This site is located in the vicinity of the Palisades Complex on an alluvial terrace proximal (48 m) to the river. A veneer of reworked sand covers the surface of the terrace and the site can be seen in the deflated areas between the low dune crests. The Beamer Trail also transects this site, adding to the adverse impact somewhat.

Previous Work

The site was originally recorded in 1986 and it was mapped in 1990 (Fairley et al. 1994). It has been monitored in FY92, FY94, FY96, and FY98 (Coder et al. 1995a, 1994b; Leap et al. 1996). This site is included in the topographic map produced by Hereford and others for the Palisades Creek region (Hereford et al. 1993). Checkdam installation recommended in FY97 was assessed in FY98. Five checkdams were constructed in FY98 (Hubbard 1999b). Trail obliteration work is ongoing by the GRCA rehabilitation trail crews.

Monitoring Data Summary

The FY92 and FY94 monitoring staff observed incremental downcutting in the gullies at this site. In FY96 and FY98, monitors noted that the gully intersecting the artifact concentration had experienced some increased deflation and widened. There was also slight movement of artifacts along the gully. Continued downcutting of this drainage led to the construction of five checkdams in FY98. All other features appeared stable. Trail eradication looked good. There was even cryptogamic soil development within the former trail.

FY99 Recommendations

The RCMP staff recommends continued trail maintenance by the GRCA rehabilitation crew and continued annual checkdam monitoring with Zuni Conservation personnel. The entire site and the checkdams need to be mapped with a total station instrument. The effectiveness of checkdams should be measured by recording volumetric change. Site monitoring will continue every 3 years. This site is adjacent to C:13:099, Palisades Delta; therefore, the gully has the potential to create more impact because it is adjacent to the active catchment system at C:13:099.

C:13:344 Roasting Feature (inactive schedule)

This is a concentration of fire-cracked rock, approximately 2 x 3 m in diameter. A small scatter of sandstone slabs may be the collapsed remains of a cist. An adjacent lithic concentration contains chert flakes and a biface fragment. The site is located on an eroded terrace at the base of the Dox Sandstone formation.

Previous Work

The site was originally recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994) and it was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

FY96 monitors questioned the integrity of the site. As a result, it was placed on the inactive monitoring list.

FY99 Recommendations

It is recommended that data recovery be conducted to identify whether any intact cultural remains exist. Applicable site management actions will be implemented based on the findings of the excavation. Until data recovery is completed, the site will remain on the inactive list.

C:13:346 Small Structure (3-year schedule)

This is a storage site with an associated artifact scatter consisting of four slab-lined cists, more than a hundred PII sherds, and many lithics. The site is located on an alluvial terrace.

Previous Work

The site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994), and was monitored in FY96 and FY99 (Hubbard 1996b; Leap et al. 1996). The site was assessed for erosion control in FY96 and FY97. In FY97, nine checkdams were constructed by Zuni Conservation personnel and a total station map was completed (Leap 1997b). Minor alteration of four checkdams by the Zuni team occurred in FY99 (Hubbard 1999b).

Monitoring Data Summary

The FY96 monitoring staff observed increased surface erosion at Features 1, 2, and 3, and the artifact scatter since, 1990. A small gully was cutting Feature 3 and affecting the artifact scatter. This erosion was caused by slope runoff. Between FY96 and FY99, grasses and cryptogamic soil stabilized Feature 2. Overall, the site was observed in stable condition.

FY99 Recommendations

RCMP staff will continue monitoring the site every 3 years and Zuni Conservation personnel will aid in annual checkdam maintenance. The RCMP staff recommends determining the effectiveness of the checkdams by measuring change in sediment volume. Lastly, it is suggested that a site map be generated using a total station instrument.

C:13:348 Artifact Scatter (biennial schedule)

The site consists of a moderate- to high-density artifact scatter with jacal fragments, suggesting buried, perhaps burned, structures. An estimated 75–100 sherds and 50–75 lithics are eroding out of alluvial deposits, somewhat concentrated in two main areas. The largest concentration also contains the jacal fragments. Lithics reflect a nonintensive, unstaged reduction strategy, using primarily medium- to coarse-grained materials. A few ground stone items were also noted. A wide variety of sherd types are present, suggesting a Late PII–early PIII occupation. The site was evidently used for habitation.

Previous Work

The site was initially recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored in FY96 and FY98 (Leap et al. 1996, 1998). In FY96 it was recommended that the gullies be stabilized with brush linings to protect the buried remains from eroding down the drainage. Installation of five checkdams was completed in FY97 (Leap 1997b). A total station map was completed for the site in FY97 (Leap et al. 1997). Minor maintenance work was completed on the checkdams in FY99 (Hubbard 1999b).

Monitoring Data Summary

In FY96 it was noted that overall, the site was depleted of surface sediment due to eolian deflation. Northern portions of the site showed increased eolian deposition. A shallow gully running down the eastern border of the site posed the greatest potential threat to stability. As of FY98, checkdams in both drainages were unchanged. No other disturbances were observed.

FY99 Recommendations

Biennial monitoring will continue with RCMP staff and annual checkdam monitoring will continue with Zuni personnel. The effectiveness of checkdams should be measured by recording volumetric change.

C:13:349 Historic Structure (annual schedule)

This multicomponent site consists of an historic cabin or dugout, fire-cracked rock, and artifacts. No artifacts indicating function were found in association with the structure. The prehistoric components are both pre-ceramic and PI–II Puebloan. Charcoal fragments were observed below the structure in a drainage but appear to pre-date the use of the historic structure. There are eight remaining wood pieces to the historic structure. The back of the structure, consisting now of just one foundation pine plank, is banked against a dune. The prehistoric FCR midden or roasting pits have good assemblages of sherds and lithics, but no formal tools were noted. The site is located in mesquite-anchored dunes. New charcoal lenses and fire-cracked rock have been exposed since the initial recording of the site.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it has been monitored annually since FY93 (Coder et al. 1994a, 1995a, 1995b; Kunde 1998a; Leap et al. 1996, 1997). A profile was examined at this site to better understand flood and debris flows along the terrace (Hereford et al. 1993) and was incorporated into the Lower Tanner section of that report. The site was photographed with a medium-format camera in FY96, FY97, and FY98 (Leap 1996b, 1997b, 1998a). A total station map of the site was completed in 1997 and the site was remapped in September 1998. The site was assessed for stabilization by the Zuni Conservation Project in FY97. Stabilization was determined to be inappropriate at this location. Feature 2 was completely excavated in FY99 (Kunde 1998a). The report will be released upon completion of artifact analysis. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 monitors observed sheet wash, gullying, and active arroyo cutting. By FY94, Features 2, 3, 4, and 5 were eroding downslope due to slump and deflation. A complete metate between Features 1 and 2 disappeared under the collapsed bank of an arroyo.

By FY96, Feature 5 was completely lost into the arroyo. After the heavy rains of October 1996, the main arroyo changed dramatically. Bank slump occurred, raising the base of the channel. New artifacts continued to be exposed in FY97, but the previously recorded features appeared stable.

In FY98 the RCMP staff observed some eolian movement and minor bank slump in the headcut of the large arroyo. The more obvious change was the widening of the headcut to the north by approximately 50 cm, threatening Feature 2. Channeling above the headcut also became more defined. Figure 16 shows the headcut and drainage channel direction of this large, terrace-based arroyo.

FY99 monitors noted increased arroyo downcutting and eolian deflation. The battered cobble north of the feature slumped further into the arroyo. Feature 3 had increased deflation throughout the FCR area. New artifacts were expected to erode out of the main arroyo. Minor testing should be conducted to obtain samples and ascertain depth and to consider some form of stabilization, after which monitoring could take place every 3 to 5 years.

Zuni Conservation Project and PA representatives assessed the site in FY97. It was decided that prior to any stabilization effort, the site should be tested to determine its extent.

FY99 Recommendations

Annual monitoring will continue until exploratory data recovery is completed. It is also recommended that measurements be taken of the drainage prior to any data recovery activities to compare drainage size to previous documentation. Measurements of this drainage have been documented since Hereford's studies in the late 1980s (Hereford et al. 1993).

C:13:350 Roasting Feature (inactive schedule)

The site consists of a roasting feature eroding out of a deflating, alluvial deposit. The feature is composed of sandstone, limestone, and basalt rocks mixed with charcoal-stained soil. No artifacts were found in association. Cultural affiliation is unknown. This site is located in a reworked dune field.

Previous Work

NPS survey personnel initially recorded the site in 1990 (Fairley et al. 1994), and it was monitored in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997). A radiocarbon date from a charcoal sample was secured by Hereford (USGS) of 1610 ± 70 B.P. (A.D. 240–585; Hereford et al. 1993). The sample was collected to supplement the alluvial sequence of the lower Tanner Delta.

Monitoring Data Summary

This site has been stable since it was originally recorded. FY97 monitoring staff noted that cryptogamic soils were moderately spreading throughout the area. No erosion was present and human visitation was not observed. No further work was recommended.

FY99 Recommendations

The site should be tested for intact, subsurface cultural material prior to any additional site management efforts. Until then, the site will remain on the inactive list.

C:13:352 Artifact Scatter (5-year schedule)

This is a Puebloan habitation and special activity site with a dense assemblage of sherds, several manos, a grinding slab, and a light scatter of lithic debris. Locus A contains more than a hundred sherds, several manos, a light lithic scatter, and a grinding slab. Locus B consists of a light-density sherd and lithic scatter. Sandstone slabs have collapsed within a concentration of corrugated sherds and may represent a storage cist. Locus C consists of a small sherd concentration. Charcoal and bone are present on the site. Lithics are of obsidian, chert, rhyolite, and quartzite. A Bull Creek projectile point was collected while recording the site. Several one- and two-handed manos were observed. Ceramics were

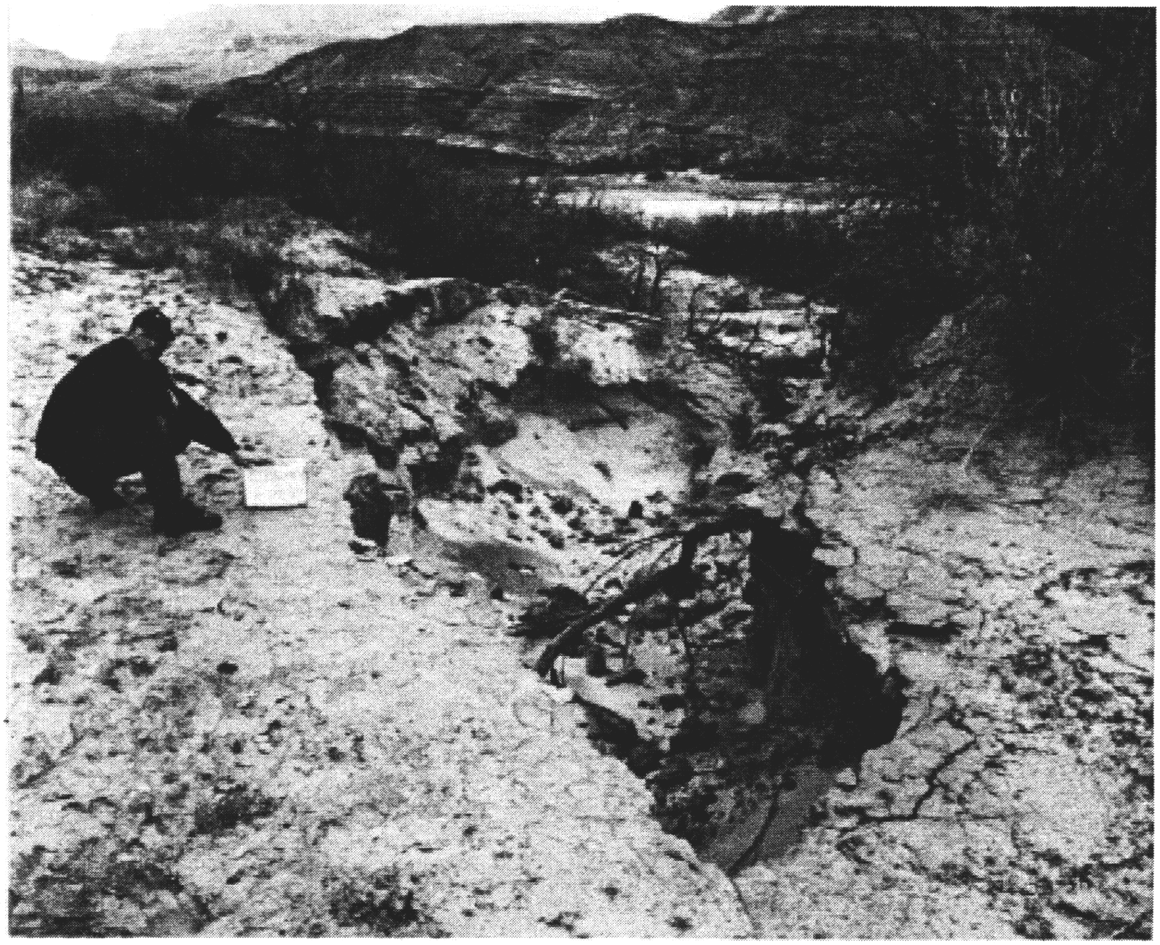


Figure 16. A terrace-based arroyo cutting through C:13:349. The arroyo continues to widen and lengthen, and has been active since it was recorded in 1990. Stabilization by checkdams has been deemed unrealistic given the mature stage of this drainage.

Tusayan gray and corrugated wares, Tusayan White Wares, and Tesgi Orange Wares. The site is located in an open dune field cut and rearranged by wide shallow runoff channels and low-volume debris flows originating in the cliffs abutting the dunes to the south.

Previous Work

The site was initially recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

In FY96 monitors noted minor movement of sand and some pedestaling of smaller artifacts at Locus A. There were still palm-sized sherds and decorated wares on the surface, indicating either that visitation during the twentieth century was virtually nonexistent or that the artifacts were uncovered recently due to the lack of available sand in the system. Monitors determined that Locus C was situated in a small debris flow and was not a contiguous part of the site, retaining none of its original integrity. They suggested that Locus C no longer be monitored.

FY99 Recommendations

Because the site has been monitored only one time, not enough information has been gathered to warrant taking this site off of an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:13:358 Roasting Feature (inactive schedule)

This is a fire feature with several complete and partial sandstone slabs. Three PII sherds were also observed. The site is located in a very dense stand of old growth mesquite.

Previous Work

The site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994). It was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Monitors noted that the site was subjected to flooding prior to construction of the dam and was situated on the margins of a backwater overflow channel from the Colorado River. Waters from floods in excess of 100,000 cfs could reach this zone and probably did so in the 1880s and possibly the 1920s and 1950s. There was no change to this site since 1990.

FY99 Recommendations

The site should first be tested for intact, subsurface cultural materials. Future site management will be based on the findings. The site will remain on the inactive list until results are obtained.

C:13:365 Small Structure (5-year schedule)

This site is located on a sand-covered debris fan. It consists of two highly deflated fire features. The few lithics in the debris fan represent the only artifacts. Cultural affiliation is unknown. In FY96 an additional hearth feature was identified eroding from the alluvial terrace.

Previous Work

This site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and it was monitored in FY92, FY93, FY94, and FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b). The site was mapped in detail in FY96, and was tested to determine the effects of the 1996 research flood (Balsom and Larralde 1996). This site was also part of a flood mitigation project in FY96 using medium-format photography (Balsom and Larralde 1996).

Monitoring Data Summary

The site was stable through FY93. FY94 monitors noted the development of a small drainage rill located on the dune surface adjacent to Feature 2. The rill may have been a result of trailing created while recording the site. FY95 monitors recommended monitoring only after flows in excess of 50,000 cfs, although it was noted that the surface runoff at Feature 2 might become channelized in the future and impact the feature..

FY99 Recommendations

Due to the vulnerability of terrace-based drainages as detailed by Hereford (Hereford et al. 1993), the inactive schedule will be changed to a 5-year monitoring schedule. This site should be monitored in FY2000. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts.

C:13:370 Small Structure (5-year schedule)

This site consists of a small rockshelter containing a wall enclosure 3 x 2 m in size. The wall is one to two courses high. A trough metate, a metate blank, and a cobble mano are present in the shelter area. Though no hearth feature was identified, smoke blackening on the shelter ceiling suggests that a hearth may be buried in the fill.

Previous Work

The site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994). It was monitored for the first time in February of 1996 (Leap et al. 1996). In FY99 the site was assessed for stabilization or erosion control work (Kunde 1998a). The terrace-based gully recommended for stabilization is created by the dripline. The gully cuts into colluvial and debris flow that goes down approximately 50 cm before reaching Tapeats Sandstone bedrock. No stabilization or erosion control was recommended because the current path of the gully will not impact any exposed archaeological features.

Monitoring Data Summary

Minor amounts of runoff are directed through the porous travertine and channeled across the floor of the shelter, causing surface rills. Sediment brought into the shelter by the runoff covered an exposed area noted during the survey. There was also wall deterioration and basal erosion on the exterior north wall. Minor wall repair was advised.

On the 96-2 monitoring trip, archaeologists observed the movement of artifacts within the shelter area but saw no signs of human visitation. It was determined that runoff may have been contributing to the movement of artifacts. During further investigations of the site, runoff was beginning to channel adjacent to the overhang floor. Upon further assessment, no stabilization was warranted. The most prevalent form of impact to the site was from small animals: packrats, ringtails, mice, and lion ants.

FY99 Recommendations

Monitor this site on a 5-year schedule, watching the pattern of the gully. Upon visiting the site, another assessment may be recommended.

C:13:379 Small Structure (5-year schedule)

C:13:379 is an extensive Puebloan habitation site composed of five features and an extensive assemblage of artifacts including Pueblo II ceramics, chipped stone tools, complete ground stone, shell, and charcoal. Feature 1 consists of a Dox Sandstone slab-lined cist. Features 2, 3, and 4 may be the remains of structures. Charcoal and a metate blank are located at Feature 4. Feature 5 is a coursed wall with trough metate fragments. Ceramics include Tusayan Gray Wares, Tusayan White Wares, and San Francisco Mountain Gray Wares. This site is located on a dune-blanketed alluvial terrace and arroyos are exposing the artifacts and structures.

Previous Work

Although this site had been known about for several years, it was not officially recorded until March of 1991 (Fairley et al. 1994). It was monitored in FY92, FY93, FY94, and FY96 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1996). An assessment for stabilization was conducted in FY99, and no work was recommended due to the mature stage of the drainage (Kunde 1998a).

Monitoring Data Summary

Survey personnel recorded extensive natural impacts, including surficial sheet washing, gullying, active arroyo cutting, wind deflation, and bank slump. FY92 and FY93 monitoring staff observed extensive physical impacts including sheet wash, gullying, active arroyo cutting, deflation, and bank slump. FY94 monitors noted that the site was stable, although extensive gullying made it prone to radical erosion. Feature 3 experienced some downcutting between FY94 and FY96. A very active terrace-based drainage cut through the site. It was at least 1 m deep at the headcut and got progressively shallower.

An assessment conducted in FY99 determined that there was no efficient way to stabilize the area; the system was too mature and extensive. Several gullies emptied into the drainage system on the site. No structures are currently exposed, but the potential is there due to the abundant amount of surface artifacts. If identifiable structures are exposed, excavation is recommended.

FY99 Recommendations

RCMP staff will continue monitoring the site every 5 years. The site will be monitored in FY2001. The RCMP staff recommends that the terrace-based drainage be documented, including headcut documentation and nickpoint counts. A preservation assessment is also suggested.

C:13:385 Small Structure (biennial schedule)

C:13:385 is a twelfth-century Puebloan habitation site consisting of two slab-lined features and associated artifacts, dominated by Kayenta ceramics with chipped stone and handtools, ground stone, and shaped slabs. The site is located on an alluvial terrace with an eolian component present on the surface.

Previous Work

This site was initially recorded in April of 1991 (Fairley et al. 1994). It was monitored in FY93, FY94, FY95, and FY99 (Coder et al. 1994a, 1995a, 1995b; Hubbard 1999b). A surface analysis unit was placed at this site in FY94; however, these units were discontinued by the project in FY96 (Leap 1996a).

Monitoring Data Summary

Survey personnel recorded surficial sheet washing, active arroyo cutting, wind deflation, bank slumpage, and dune migration. No human impacts were observed at the time of the survey. FY93 monitors observed sheet wash, active arroyo cutting, deflation, bank slump, and dune migration. FY94 monitors noted that continued incremental erosion was occurring. Although the two features appeared stable, artifacts were moving downslope. The local drainage network across the entire terrace continued to expand and downcut.

Features 1 through 3 were unchanged since the 95-5 visit. However, there was downslope sheet-washing of artifacts in the artifact scatter. An arroyo upstream of the site drained into a low river terrace. The local drainage network across the entire terrace was expanding and downcutting, including other sites as well (C:13:386 and C:13:070). The collection pile recorded on the 95-5 trip no longer existed. No signs of human visitation were recorded. High river flows could compromise the dune area, adding to the deterioration of the site. If data recovery is warranted in the future, the variety of artifacts could give extensive cultural data.

FY99 Recommendations

The RCMP staff will continue biennial monitoring. It is also desirable to assess the terrace-based drainage for preservation treatment including headcut documentation and nickpoint counts. The entire site should be assessed for preservation treatment with vegetation. If revegetation work is not possible, data recovery should be considered.

C:13:386 Small Structure (biennial schedule)

The site consists of a single isolated slab-lined cist. No artifacts were observed and cultural affiliation is unknown. The site is on a dune slope just above the mesquite and driftwood zone. Wind-blown sands may still cover extensive materials.

Previous Work

This site was originally recorded in 1991 (Fairley et al. 1994) and it was monitored in FY93, FY94, FY96, and FY98 (Coder et al. 1994a, 1995a; Leap et al. 1996, 1998).

Monitoring Data Summary

Physical impacts recorded during the survey included sheet washing and minor erosion. FY93 monitors observed active sheet wash and surface erosion. In FY94, vegetation began growing beneath the feature, pushing out one of the slabs. Slight movement of the downslope slab was observed in FY96. Minor animal burrowing was observed during FY98 monitoring at the cist, yet cryptogamic soils and vegetation were present and stabilizing the feature. No sign of human disturbance was observed.

FY99 Recommendations

RCMP personnel will continue biennial monitoring. Exploratory data recovery is recommended. If the cist is the only feature remaining, data recovery should ensue and monitoring will be discontinued.

G:02:009 Historic Structure (5-year schedule)

G:02:009 is an historic structure consisting of two stone rooms and a fire hearth with no indication of a site date. The rooms are incorporated into a natural rock outcrop.

Previous Work

Euler and Jones initially recorded this site in 1978. It was mapped in greater detail in March of 1992 by NPS survey personnel accompanied by members of the Hualapai Tribe. The site was monitored in FY95 (Coder et al. 1995b). In FY99, Hualapai archaeologists and tribal members visited this site.

Monitoring Data Summary

In FY95 monitors considered the walls at G:02:009 in stable condition, except the support beams in Room 2 were precariously perched. Hualapai archaeologists and tribal members in FY99 observed no new changes.

FY99 Recommendations

Site monitoring will continue every 5 years. This site will be monitored in FY2004. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts. The Hualapai tribe may consider monitoring at this location. Trail obliteration should be conducted by the GRCA.

G:02:103 Rock Art (inactive schedule)

G:02:103 consists solely of the commemorative plaque located at Separation Canyon that pays tribute to the location and solemn event of the parting of the ways of three men from Major Powell's first expedition down the river in 1869. The three men were killed days later on the North Rim by either a local Paiute band or hostile Mormon militia.

Previous Work

This popular site, known officially as "the cenotaph," was recorded as an historic site in April of 1991 (Fairley et al. 1994). The site was monitored in FY95 (Coder et al. 1995b).

Monitoring Data Summary

The plaque was securely bolted into the face of a granite cliff and was found in very stable condition in FY95. The only threat to its integrity is if someone were to remove it. Several trails were formed to visit the cenotaph; therefore, it was recommended that the GRCA rehabilitation trail crews create one trail leading to the plaque. The remaining trails should be obliterated.

FY99 Recommendations

The site will remain on the inactive monitoring list; however, the cenotaph should be documented with a medium-format camera. The GCRA River Patrol should then monitor the site for ARPA violations. The GRCA rehabilitation crew should maintain trails annually.

G:02:105 Historic Structure (5-year schedule)

G:02:105 is an historic site pertaining to engineering projects in the west end of the Grand Canyon. It consists of three rock walls defining three cleared areas probably used as tent platforms. A pile of trash includes food cans, tobacco tins, broken glass, a metal buckle, and parts of a leather boot, indicating a short-term habitation in the 1920s or 1930s.

Previous Work

This site was recorded in April of 1991 (Fairley et al. 1994) and was monitored for the first time in FY95 (Coder et al. 1995b).

Monitoring Data Summary

The site was observed in stable condition in FY95.

FY99 Recommendations

Due to the vulnerability of terrace-based drainages as detailed by Hereford (Hereford et al. 1993), the inactive schedule will be changed to a 5-year monitoring schedule. This site should be monitored in FY2000. The RCMP recommends that the terrace-based drainage be assessed for preservation treatment including headcut documentation and nickpoint counts. GRCA and the Hualapai Tribe should be consulted regarding retrailing at this location.

G:03:029 Roaster Complex (5-year schedule)

G:03:029 consists of two overlapping roasting features, several flakes, and a single Cerbat Brown Ware sherd. The site is located on dune-covered Tapeats Sandstone ledges and it is protected by vegetation.

Previous Work

This site was located and recorded in February of 1991 (Fairley et al. 1994) and was monitored for the first time in FY95 (Coder et al. 1995b).

Monitoring Data Summary

The roasting features appeared to be stable in FY95.

FY99 Recommendations

Because the site has been monitored only one time, not enough information has been gathered to warrant taking this site off of an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. The site will be monitored in FY2000. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment, including headcut documentation and nickpoint counts.

G:03:030 Roaster Complex (biennial schedule)

This is a roasting complex with seven roasting or hearth features and flakes. Locus A contains three features. Feature 1 is a conical-shaped roaster with fire-cracked rock. Feature 2 is a hearth feature of limestone filled with fire-cracked rock. Feature 3 a low, circular wall built up along the base of a large boulder. Locus B has four features. Feature 4 consists of a fan of fire-cracked rock with lithics. Feature 5 contains two adjacent piles of fire-cracked rock. Feature 6 is a concentration of fire-cracked rock and Feature 7 is a 2-m cluster of fire-cracked rock. A possible Feature 8 consists of another cluster of fire-cracked rock. The site is located on a dune-covered terrace split by a side canyon drainage.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY96 and FY98 (Leap et al. 1996, 1998). It was mapped with a total station in FY97. In FY96 checkdams were recommended and an assessment for stabilization was completed in FY99 (Hubbard 1999b). Checkdams are currently recommended for this site.

Monitoring Data Summary

FY96 and FY98 monitors observed that all features looked the same since 1991, and vegetation increased around the structure. Gullying and surface erosion were present but inactive. There was some minor rock movement at the structure that appeared to be caused by humans. Only Locus A was monitored due to the presence of the terrace-based drainage system.

FY99 Recommendations

The RCMP staff will continue monitoring the site biennially and Zuni Conservation Project and RCMP personnel will construct checkdams as time permits.

G:03:032 Roaster Complex (3-year schedule)

G:03:032 is a roaster complex with artifacts. Feature 1 is a large roasting area with fire-cracked rock. Feature 2 consists of fire-cracked rock along the toe of an alluvial terrace. Feature 3 is a 3-m-diameter circular depression, dug 40–50 cm into the terrace. Feature 4 is a large flat area with an associated area of fire-cracked rock. Feature 5 is a circular, hearth-like accumulation of heat-altered rock. Several flakes, two ground stone tools, an old metal button, and a small wire cotter pin were noted. A circular shell bead was also observed. The site is probably a late historic Hualapai occupation.

Previous Work

This site was initially recorded in February of 1991 (Fairley et al. 1994) and was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b).

Monitoring Data Summary

The FY95 monitoring staff observed the presence of arroyos and a network of inactive gullies. FY99 monitors noted that Feature 1 was stable, with minor pedestaling of fire-cracked rock and microbiotic crust. Features 2 through 5 were stable since the 95-1 monitoring trip. Minor sheetwashing was detected in the gully between Features 1 and 2. The main arroyo that drains the site area was active. However, none of the features were directly impacted by the arroyo. The arroyo was widening and deepening in the lower dune terrace, located 30–40 m below Feature 1. The arroyo filters into the dune field before reaching the river.

FY99 Recommendations

The site will be monitored every 3 years. The site will be monitored in FY2002. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment, including headcut documentation and nickpoint counts.

G:03:042 Special Activity Locus (inactive schedule)

G:03:042 is a unique processing site adjacent to the Colorado River that consists of at least three deeply ground bedrock mortars in Tapeats Sandstone. Ethnographic evidence indicates seasonal use (August-September) of these features by Hualapai and Paiute people to process mesquite into flour.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored annually from FY92 through FY94 and again in FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998). In FY96 this site was investigated for effects from the research flood (Balsom and Larralde 1996).

Monitoring Data Summary

No physical or visitor-related impacts were detected. These features were thought to be in no danger of impact, and all archaeological information was documented.

FY99 Recommendations

This site should remain on the inactive list. All archaeological information has been obtained.

G:03:044 Structure–Thermal Feature Complex (biennial schedule)

This site is a large activity area divided into two loci. Locus A contains five dry-laid walls and a lithic scatter. Locus B contains three roasting features below the activity area. FY94 monitoring staff identified a .44 cal. cartridge (nineteenth century) and two large utility ware sherds below the activity area.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored the site annually from FY92 through FY98 (Coder et al. 1994a, 1994b, 1995a, 1995b; Leap et al. 1996, 1997, 1998). FY96 monitoring staff recommended checkdam installation in the Locus B drainages. An assessment for checkdam installation was completed in FY97. Because the drainages appeared stable, no stabilization work was necessary.

Monitoring Data Summary

Monitors have consistently recorded active surface erosion, gullying, arroyo cutting, and eolian-alluvial activity prior to FY97. From FY93 through FY96 arroyo cutting increased at Locus B each time the site was monitored.

FY97 monitoring staff recorded the arroyo cutting as present but not increased since FY96. One nickpoint was present in the drainage.

FY99 Recommendations

RCMP will continue biennial monitoring. The RCMP staff recommends that the terrace-based drainage be assessed by Zuni Conservation Project personnel for preservation treatment including head-cut documentation and nickpoint counts. If preservation treatment is not an option, the three roasting features at Locus B should be considered for data recovery.

G:03:056 Roaster Complex (5-year schedule)

G:03:056 is a group of three to four roasting features with chipped stone and ground stone tools. Feature 1 consists of a dispersed scatter of fire-cracked rock with lithics, a polishing stone, and a side-notched projectile point in association with the feature. Feature 2 is another dispersed scatter of fire-cracked rock with a laterally ground mano in association. Feature 3 is a very dispersed FCR scatter. It is possible that the projectile point is a reworked Archaic dart point base. No ceramics were observed.

Previous Work

This site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and it was monitored in FY94 (Coder et al. 1995a).

Monitoring Data Summary

In FY94 monitors recorded arroyo expansion affecting Feature 1 and surface movement of the artifacts and Features 2 and 3. Cryptogamic soils were acting as a stabilizing force to some degree. Game trailing was noted. No human visitation was evident since the site's initial recording in 1991.

FY99 Recommendations

Because the site has been monitored only twice, not enough information has been gathered to warrant taking this site off an active monitoring schedule. Furthermore, due to the likelihood of terrace-based drainages becoming river-based drainages (Hereford et al. 1993), and other related geomorphic research (Thompson et al. 1998; USDI 1995), this site will be monitored on a 5-year schedule. Site monitoring will occur in FY2000. The RCMP staff recommends that the terrace-based drainage be assessed for preservation treatment. This will include headcut documentation and nickpoint counts.

G:03:057 Thermal Feature (annual schedule)

The site consists of a Tapeats Sandstone rockshelter containing a large, eroding RCR feature, a charcoal scatter, an ash stain, and a scatter of lithics, sherds, and ground stone. Lithics are densely concentrated along the front edge of the shelter floor, with some eroding downslope. No formal chipped-stone tools were seen. Two pecked and ground slabs, one of Tapeats Sandstone and one of Muav Limestone, were observed near the center of the site. The sherds are found in the north half of the shelter. Ceramics suggest a multicomponent occupation of the site: possibly early Basketmaker III–Pueblo I Formative and late prehistoric–early historic Paiute. The FCR feature is composed of angular, cobble-size rocks of sandstone and limestone. The site appears as a limited lithic manufacturing and food processing area based on the artifacts present.

Previous Work

The site was initially recorded in 1991 by NPS survey personnel (Fairley et al. 1994). It was monitored in FY97 and FY99 (Hubbard 1999b; Leap et al. 1997).

Monitoring Data Summary

FY97 monitoring staff observed a minor increase in surface erosion that appeared to be fairly recent, but not impacting the artifact concentration. Animal burrowing exposed new artifacts on the surface. Minor sheet washing occurred behind the fire-cracked rock, toward the cliff and washed into a shallow rill. The FCR debris slope was stable with cryptogamic soils and moss growing. The collection pile recorded during the survey was still present on the grinding slab, although the artifacts had been moved. Lithics were placed on the large boulder in the center of the site. No trails were present.

In FY99, monitors observed increased surface erosion and gullying under the overhang within the FCR, artifact, and ash concentration areas. Gully activity was moderately moving fire-cracked rock, lithic, and sherd debris downslope of the overhang. The gully in the shelter area had significantly changed since the FY96 monitoring episode, exposing new lithics and sherds. Monitors noted that the gullies on the site had the potential to cause extensive damage. The gullies died out in the terraces below the site and did not drain to the river. The RCMP staff recommended monitoring the site annually due to the recent physical impacts caused by gullies in the site area. The RCMP staff also suggested assessment for data recovery due to active erosion.

FY99 Recommendations

Annual monitoring will continue and an assessment for preservation treatment, including headcut documentation and nickpoint counts, will be completed. Data recovery of the thermal feature may be considered.

G:03:058 Roasting Feature (3-year schedule)

G:03:058 consists of a single roasting feature 7 x 10 m in diameter and an associated fragmented mano. The site is located on a lightly dune covered terrace.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY94, FY96, and FY98 (Coder et al. 1995a; Leap et al. 1996, 1998). Checkdams were recommended and an assessment was conducted in FY96. Two rock and brush checkdams were built in FY97 in conjunction with minor trail obliteration and vegetation planting (Leap 1997b). A total station map was completed in FY98 (Leap et al. 1998). Four new checkdams were constructed in FY99 by the Zuni Conservation Project and RCMP staff (Hubbard 1999b).

Monitoring Data Summary

In FY94 and FY96 monitors noted that the site was impacted by the growth of an arroyo into the feature. They recorded in general that arroyos and erosional channels bound the site. A river camp is located below the site and trails lead directly to the site. These trails were obliterated and vegetation planted to discourage further visitation in conjunction with checkdam construction in FY97. FY98 monitors observed no physical impacts at the feature. Minor deposition was noted at one checkdam (#1).

Overall, the site was viewed as stable. Monitors suggested planting vegetation to deter trailing in addition to routine trail maintenance.

FY99 Recommendations

The GRCA rehabilitation crew will continue trail maintenance, and the Zuni Conservation Project staff will continue annual checkdam monitoring. The RCMP staff recommends determining the effectiveness of the checkdams by measuring change in sediment volume. Site monitoring will occur in 3-year intervals.

G:03:059 Thermal Feature (inactive schedule)

G:03:059 is the remains of dispersed fragments of fire-cracked rock, a few chert flakes, and four manuported river cobbles showing expedient use. This site appears to be well covered by river sediment, but it may also be the scant remains of a little-used temporary camp. No ceramics were observed and cultural or temporal affiliation is not known.

Previous Work

This site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and monitored in FY94 (Coder et al. 1995a). A total station map was completed at this location in FY96 (Leap et al. 1996). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Surface runoff and deflation were impacting the site. Due to the dispersed nature of the site and its location, no further monitoring was warranted.

FY99 Recommendations

The RCMP recommends testing the FCR feature for intact, subsurface cultural remains. The site will remain on the inactive monitoring schedule until the results of the testing are determined.

G:03:062 Artifact Scatter (inactive schedule)

This is an historic artifact scatter that includes square and wire nails, a Levi button, a fork, wire, a clothes-pin spring, a can, a metal ring, a comb, a piece of a 1932 newspaper, and wooden slats probably from a wooden box or crate. The site is located on a granite bedrock bench.

Previous Work

The site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and monitored in FY96 and FY99 (Hubbard 1999b; Leap et al. 1996).

Monitoring Data Summary

The only impact noted to the site was minor artifact movement occurring between the time the site was recorded and FY96. This was presumed to be caused by humans due to the nearby trail. Monitors did not anticipate future visitor-related or physical impacts, but suggested visiting the site after floods over 100,000 cfs.

FY99 Recommendations

The RCMP staff will contact the GRCA rehabilitation crew regarding trail obliteration work. The staff also recommends that the terrace-based drainage be assessed for preservation treatment, including headcut documentation and nickpoint counts. If no work is warranted, the site will remain on the inactive schedule.

G:03:063 Thermal Feature (inactive schedule)

G:03:063 consists solely of a highly eroded roasting feature. The feature is dispersed across and 10 x 3 m area. No artifacts have been observed on the surface since the survey. The site is located on a highly eroded dune-covered terrace.

Previous Work

This site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and monitored in FY94 and FY95 (Coder et al. 1995a, 1995b).

Monitoring Data Summary

FY94 and FY95 monitors noted ongoing erosion in the form of gullying, arroyo encroachment, deflation, and gravity creep. Due to the dispersed nature of the site, monitors placed the site on the inactive monitoring list.

FY99 Recommendations

The site should be tested for intact, subsurface cultural materials and reassessed regarding the monitoring schedule upon completion of testing. The terrace-based drainage should be assessed for preservation treatment, including headcut documentation and nickpoint counts. Until testing has been completed, this site will remain on the inactive schedule.

SITES WITH TERRACE AND SIDE CANYON DRAINAGES

Five sites contain terrace- and side canyon-based drainages. Monitoring data show that all five sites with these drainages exhibit active arroyo and gully erosion.

A:16:004 Structure–Thermal Feature Complex (biennial schedule)

The site consists of numerous roasting pits, shelters with alignments and a diverse and dense scatter of artifacts. Three possible components are indicated: Late Archaic, PI–III Formative, and late prehistoric–early historic Pai and Paiute. Features include a shelter with lithics, bone, and several manos; a shelter with lithics, a few ceramics, and a grinding slab; a shelter with an extensive roasting pit and abundant sherds, lithics, and some ground stone; a faint basalt wall on top of a limestone cliff; a shelter with 2-m-long rock alignments with lithics, sherds, manos, and a burned beam; a large donut-shaped roasting pit about 15 m in diameter; a roasting pit measuring 5 x 10 m; a roasting pit 10 m in diameter; a horseshoe-shaped pit eroding at the base; and a smaller pit eroding into a gully. The site is located on a variety of landforms, including stabilized dunes, Tapeats rock ledges, and a flattened basalt outcrop.

Previous Work

The site was originally recorded by Euler in 1975 and was recorded and mapped in more detail by NPS survey personnel in January of 1991 (Fairley et al. 1994). The site was monitored in FY92, FY93, FY94, FY96 and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1996, 1998). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

In FY92 and FY93 minor trailing was observed but there was no real threat to the site. Rilling and channeling was also occurring; however, the activity was minimal. It was not until FY94 that RCMP monitors noted a gully near Feature 10. At that time, no preservation treatment was recommended, only continued monitoring.

By FY96 the gully at Feature 10 appeared to be stabilizing and it was recommended that only Features 7–10 be monitored biennially because the other features are located outside the APE. FY98 is the most recent assessment of the site. Archaeologists noted that human trails went through Features 7 and 10. Feature 7 appeared to be eroding downslope, into the side canyon, and the trail near Feature 10 would likely become a gully. It appeared that the gully observed in FY94 functions as an area for water runoff and human trailing. Continued trailing only enhanced the gully; therefore archaeologists recommended that trail obliteration and some transplanting occur prior to an assessment for building checkdams.

Although Features 1–6 were not scheduled for monitoring, archaeologists noted that human disturbance was observed in the shelter/midden areas. Several collection piles were present with impressive artifacts (i.e., diagnostic points and decorated pottery sherds). It was recommended in FY98 that Features 7–10 continue to be monitored biennially due to an active gully-trail near Feature 10.

FY99 Recommendations

GRCA will consider vegetation work and trail obliteration prior to checkdam installation at the gully-trail. The Hualapai Nation will be involved with all visitor-related impacts due to the site's location adjacent to the reservation. A biennial schedule will continue for the entire site based on the activity observed. If mitigation efforts prove to be successful, monitoring will decrease. The Hopi Tribe suggests closing the site to visitors.

C:13:006 Small Structure (annual schedule)

The site is eroding out of a reworked dune at the mouth of a major side canyon. It consists of a Pueblo II Kayenta ceramic and lithic scatter eroding from a dune face with a fire-cracked rock and cobble-strewn, ashy midden. Survey personnel identified four to five possible rooms present but in fair to poor condition (RCMP staff questioned this observation even after mapping the site in detail with a total station instrument). Due to active erosion in the dune area, several additional features have been recorded since the river corridor survey. In FY95 monitors made several additions to the site map, including walls eroding out of gullies, an additional roasting pit, an artifact concentration, and several new drainage channels. Ground stone is present but no formal tools have been observed.

Previous Work

The site was recorded in the early 1960s, in 1965, in 1984, and again in 1990 (Fairley et al. 1994). River corridor archaeologists monitored this site annually in FY92 and FY93, semiannually in FY94 and FY95, and back to annually from FY95 to FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). In FY95 a stationary camera was placed across from the site (Coder et al. 1995b), but it was removed after FY96 because the photographs showed only stochastic changes (Leap et al. 1996). In FY95 Zuni Conservation personnel assessed the site for checkdam installation. In FY96 a GRCA recreational specialist and revegetation employee assessed the site for planting vegetation and placing jute mat on the deflated areas. The site was mapped with a total station in FY96 (Leap et al. 1996), and medium format photographs were taken prior to the 1996 research flow. Twelve checkdams were built in the two active gully systems and jute mat was laid in the deflated dune areas (Leap 1996f; Leap et al. 1996, 1997). Additional vegetation work was completed at this site in FY97. In FY97 and FY99 Zuni Conservation personnel conducted minor maintenance on some of the original checks. The increased sediment deposition at this site is a result of checkdam construction. This area was researched by Thompson and others in 1998 and 1999 (Thompson et al. 1998).

Monitoring Data Summary

From FY92 through FY96 project staff continued to express concerns regarding the loss of cultural information at features being subjected to constant gullying and arroyo downcutting. In FY97 archaeologists noted increased surface erosion and bank slump along the site's southern boundary. However, there was no increase in gullying. The gullies with the checkdams on the west end showed considerable sediment deposition and the checkdams near the east boundary showed no sediment increase. A new channel north of the site had a few new nick points and demonstrated moderate runoff.

In FY98 the site appeared stable with the exception of Feature 9. Sixty-mile Canyon flashed in the summer of FY98 and cut the bank back into the site by roughly a meter. The checkdams held up very well, but downslope movement increased, Feature 9 was recorded as eroding from the slope adjacent to the side canyon.

In FY99, archaeologists found the site to be fairly stable, with only minor runoff and downslope movement. Feature 9 was examined for a possible carbon sample by RCMP staff and Hopi representative Mike Yeatts; a sample could not be taken without causing considerable damage to the entire slope. They recommended that additional jute mat and grass seedlings be placed along the slope in the dune areas that are not vegetated. Another management recommendation was to update checkdam placement using a total station instrument.

FY99 Recommendations

Annual monitoring will continue. Vegetation work on the slopes will be implemented and checkdam maintenance will continue annually. To determine the effectiveness of the checkdams, changes in sediment volume should be measured above and below the checkdams. The new channel north of the site should be assessed for preservation treatment.

G:03:026 Roaster Complex (3-year schedule)

This site consists of seven roasting pits and two activity areas exhibiting several different phases of use and existing in various stages of deflation, from pristine to nearly eroded to their original base-level. The sherds (and other artifacts) indicate late prehistoric–early historic and mid-historic (1850–1900) Pai use. Some flakes and tools were observed, including two biface items and an obsidian point. Ground stone was also located. The two fragments of pressed purple glass observed near activity area A are perhaps pieces of a small candy or relish dish.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and has been monitored at least annually since FY92 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b; Leap et al. 1996, 1997, 1998). Carbon samples for Hereford's geomorphological research were collected from Features 2, 3, and 8 prior to the RCMP. Dates range from 190 ± 50 to 520 ± 50 B.P. Trail obliteration, retrailing, and vegetation work was conducted in FY96 and FY97 by NPS and RCMP staff. Upon completion of the trailwork, the Hualapai and RCMP staff submitted a letter to the *Boatman's Quarterly* requesting no more visitation by commercial passengers and a decrease in the research conducted at Granite Park (Jackson and Leap 1996). In FY96 the features were plotted using a total station instrument and overlain onto a topographic map created by Thompson and others (Leap et al. 1996; Thompson et al. 1996). The site was assessed in FY96 and as a result, five checkdams were constructed in the side canyon-based drainage (Leap 1996f; Leap et al. 1996). In FY99 four of these checks were slightly altered and one new check was built. In FY99 personnel from the Natural Resources Conservation Services conducted some soil sieving and wrote a small report on the findings (Lindsey 1999). This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

Visitor-related impacts (by river-runners and researchers) have been recorded consistently since FY92. Trailing from tourists and researchers has been evident everywhere, and the problem is compounded by bighorn sheep living in the area. FY93 monitors initiated the recommendation for retrailing and trail obliteration. This recommendation continued until FY98 when only trail maintenance was warranted.

It was not until FY94 that any type of physical impacts were mentioned. Archaeologists noted incipient gullying present across the site but only encroaching cultural materials on the west side of Feature 3. Monitors recommended that the site be placed on a semiannual schedule due to the gully activities recorded in FY94. However, in FY95 the monitoring schedule reverted back to annual based on the inactivity noted during the FY95 visit.

Gullying was minimal from FY95 through FY99. In FY99 it was recorded that checkdams were successful in collecting sediment. Impacts from visitors and researchers continued to come and go; therefore, trail maintenance was recommended as needed.

FY99 Recommendations

Based on the evidence presented above, the site should be monitored by RCMP every 3 years. The physical activity observed at the site appears minimal, as seen from FY95 through FY99. Checkdam maintenance will continue annually by Zuni Conservation personnel and RCMP staff. The effectiveness of checkdams should be measured by recording volumetric change. While doing so, the site should be remapped with a total station showing checkdam alterations that have occurred since their original placement. GRCA will continue trail maintenance with Hualapai consultation and participation.

G:03:040 Roaster Complex (biennial schedule)

The site consists of two loci (A and B) of activity that represent at least two and six to seven roasting features, with associated debitage and many formal tools. Locus A may be one large roasting feature that has been eroded by a wash, or more than one feature with elements eroding together. Fire-cracked rock elements at both loci are of predominantly limestone cobbles, with a variety of Kaibab or Redwall Chert flakes in association. At least part of Locus A (the fire-cracked rock on the southern edge of the locus) forms a semicircle that is half blown out by the wash. Locus B contains a much more obvious circular FCR feature with additional, smaller FCR concentrations around it. The main feature is slightly mounded and has a clear center. Many tertiary flakes, including bifacial thinning flakes, were observed. Tools include a sandstone slab metate fragment and flakes with retouch and use wear—some possibly used as scrapers, biface-preforms, and cores. Cultural affiliation and site chronology are unknown.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and have monitored it at least annually from FY94 to FY98 (Coder et al. 1995a, 1995b; Leap et al. 1996, 1997, 1998). In FY98, RCMP monitors changed the schedule to biennial. FY95 monitors recommended total station mapping at this site. In FY96 monitors recommended installing checkdams and data recovery at Locus B. Surveyors mapped the site with a total station instrument in FY96 (Leap et al. 1996), but no data recovery was performed. Zuni conservators constructed four checkdams near Locus B in FY97 (Leap et al. 1997). A large side-canyon flood completely took out one checkdam in FY99. The other three checkdams (one adjacent to the side canyon and two in a terrace-based drainage) were unaffected. Figures 17 and 18 exhibit the two types of drainage systems present at G:03:040. Figure 17 is a photo of the terrace-based drainage after remedial actions and Figure 18 shows the side canyon-based gully prior to checkdam work.

Monitoring Data Summary

In FY94, FY95, and FY96 the site was in stable condition. General surface erosion and wind deflation were present. Archaeological monitors noted the potential for major physical impacts due to localized rain or side canyon flooding. In FY97 RCMP monitors noted two narrow and deep gullies situated west of the site (Locus B), which drained into the main side channel. The southernmost gully was new, and the older gully showed evidence of sediment deposition due to checkdam installation.

Upon monitoring the checkdams in FY99 the RCMP staff recorded that approximately 5 m of bank slope was cut away due to side canyon flooding. This activity destroyed one checkdam and cut approximately 1 m of sediment back from the original bank. The slope was recorded as a vertical wall 25 m long with a depth of 3 m. The location of activity, only 5 m upstream from Locus B, prompted monitors to recommend data recovery for Locus B. The terrace-based gully near Locus B with two brush checks survived the heavy rains and flash flood; no alterations were noted. Human disturbances have never been observed at this site.

FY99 Recommendations

Biennial monitoring will continue. Limited excavation should be conducted at Locus B because it is an intact roasting feature with the potential to yield much information. It is one of the smaller sites, compared to areas in the vicinity such as Arroyo Grande and Granite Park. Because the RCMP is considering more excavations, data recovery at this site can begin defining the chronological period, morphology, subsistence, and possibly cultural affiliation for this geographical area within the Canyon. Excavation of this feature supplemented by other limited excavations can aid in the refinement of property types within the corridor regarding thermal or roasting features. Checkdam maintenance will continue annually. The effectiveness of checkdams should be measured by recording volumetric change.

G:03:052 Roaster Complex (3-year schedule)

The site is situated on a dune-covered sandstone bench. It has three roasting pit features, one large area of fire-cracked rock, and an associated lithic scatter. A single sherd of Moapa Brown ware was also observed on the surface, suggesting a late PI–early PII Virgin association. FY96 monitors identified an additional FCR area only 7 m from one of the originally recorded features.

Figure 17. The terrace-based drainage at G:03:040; checkdam construction was completed in FY97. Since then, these brush checkdams have proven to be effective in collecting sediment.

Figure 18. The side canyon-based gully dissecting Locus B, a roasting feature, at G:03:040. In FY97 the Zuni Conservation Project personnel lined the gullies with small cobbles and gravel. After a flash flood in FY99 this entire bank was defaced about a meter back, completely destroying one of the checkdams.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and the RCMP staff monitored the site in FY96 and FY98 (Leap et al. 1996, 1998). FY96 monitors recommended trail obliteration and gully stabilization. After an assessment in FY97, only minor trail obliteration was completed.

Monitoring Data Summary

Project monitors noted trailing, minor surface erosion, extensive burrowing, and the formation of a gully in FY96. By FY98, the site reflected no changes since FY96.

FY99 Recommendations

A 3-year schedule will suffice; however, the gully should be assessed by Zuni personnel for preservation treatment. Trail maintenance should also continue as needed by NPS.

CHAPTER 7. SITES WITH SIDE CANYON-BASED DRAINAGES

Duane C. Hubbard

In the beginning of the RCMP, monitors identified drainages as river or terrace based. The RCMP staff classified streams that drained into a side canyon as river based. Approximately 2 years ago K. Thompson (a geomorphologist) began identifying streams that drained directly into side canyons as "side canyon-based." These drainages presumably follow a similar drainage development pattern as river-based drainages, for the following reason.

The side canyon base-level is controlled by the Colorado River, as is the base-level of a side canyon-based drainage. Side canyons are extremely variable drainages that are shaped by high energy, catastrophic changes. For example, when side canyons flood, cutbanks are often vertically truncated and the channel lowered. If the side canyon truncates a side canyon-based drainage, the drainage will respond by adjusting to its new lowered base-level. This response is often in the form of channel initiation and active headcuts. For this reason, sites with side canyon-based drainages should be monitored closely after side canyon flooding.

Monitors have recorded the effects of large tributary floods on archaeological sites since 1992. Most tributary floods and debris flows occur during July to October due to localized convective thunderstorms with rainfall intensities up to 40 mm per hr (Griffiths et al. 1997). Researchers have identified at least 600 tributaries in the Grand Canyon from Lees Ferry to Surprise Canyon where debris flows occur (Griffiths et al. 1997; Melis et al. 1997).

Upon re-evaluation of the RCMP data, archaeologists identified 21 sites with side canyon-based drainages (see Appendix G). Six of the 21 sites have only side canyon-based drainages (see Table 5 for property types). Two sites have river-, terrace- and side canyon-based drainages, eight sites have river- and side canyon-based drainages, and five sites have terrace- and side canyon-based drainages.

Monitoring schedules for these sites vary from inactive to semi-annual. Two of the sites are monitored every 5 years, and the remaining four are biennial, annual, semi-annual, and inactive.

The RCMP staff monitoring observations (FY92 to FY99) regarding sites with side canyon-based drainages indicates a wide range of site conditions and drainage activity. The RCMP staff has not made conclusions or even arrived at credible patterns regarding expected drainage behavior due to the small size of this data set. However, the RCMP management staff's reaction to this group of sites is consistent with RCMP site prioritization. Sites that are actively eroding (C:13:371, C:13:343, C:13:007) received recommendations for preservation or recovery options and work was completed. Sites that are stable (A:15:029, G:03:078) received no remedial actions. Sixty-seven percent of the sites with only side canyon-based drainages are experiencing active physical erosion, versus 33 percent experiencing visitor-related impacts.

Monitors recorded physical erosional activity at four of the six sites (A:15:025, C:13:007, C:13:343, C:13:371). The most physically active sites, C:13:371, C:13:007 and C:13:343, received a preservation option, recovery option, or both. Monitors recorded active visitor impacts at two of the six sites (A:15:025, C:13:007). Site C:13:007 received revegetation and trail obliteration work in FY93. C:13:371, the only site with checkdams, received checkdam maintenance in FY99. Overall, 50 percent of the sites received preservation treatments, and 33 percent received recovery treatments.

A:15:025 Special Activity Locus (5-year schedule)

A:15:025 is a hematite mine that was the site of prehistoric and late historic mineral procurement. The Hualapai and Paiute most likely traded the pigment, obtained and processed at this location, all over the region. GRCA archaeologists also recorded a Pueblo I-early Pueblo II Virgin component. Although Native Americans visited the site into late historic times, it has remained dormant for most of the twentieth century. Presently, PA members (tribes) obtain small amounts of the pigment for ceremonial use.

Table 5. Site Count and Property Types of Sites with Only Side Canyon-Based Drainages (n = 6)

Site Counts	Property Types
2	Small Structures
1	Thermal Feature
1	Structure-Thermal Feature Complex
1	Special Activity Locus
1	Artifact Scatter

Previous Work

Archaeologists officially recorded A:15:025 in November of 1990 (Fairley et al. 1994). The RCMP staff monitored the site in FY93, FY94, and FY95 (Coder et al. 1994a, 1995a, 1995b). No remedial actions were recommended for the site. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 monitors recorded minor gullying, active arroyo cutting, and erosion within the side canyon drainage. Monitors identified a cigarette in the upper hematite mine. FY94 monitors noted increases in gullying, surface erosion, side-canyon erosion, and spalling. They also noted increased trailing, minor movement of artifacts, and the return of a digging stick discovered on the 1990–91 survey. Also, crushed turquoise was noted, most likely left by tribal monitors.

FY95 monitors observed no increases in erosion since the 1994 visit. They confirmed that surface runoff does reach the river through the side-canyon. Monitors consistently recorded the presence of a trail developing due to visitation to the hematite mine. Tribal representatives have requested that this site be monitored by the RCMP staff.

FY99 Recommendations

The RCMP staff changed the site schedule from inactive to every 5 years due to physical and visitor-related activity and also due to tribal requests.

A:15:029 Thermal Feature (5-year schedule)

This site consists of a single roasting feature perched on the cutbank of a side canyon drainage. The feature is eroded on the side facing the river and a game trail skirts its eastern edge. Archaeologists observed no artifacts on the surface and cultural affiliation is unknown.

Previous Work

The site was initially recorded by NPS survey personnel in February 1991 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). No remedial actions were recommended for this site.

Monitoring Data Summary

FY96 monitors recorded increased surface erosion and the presence of game trails. The site has remained relatively stable since its initial recording, with only minor movement of rock down the cutbank. It appears that the feature has been eroding away in incremental amounts for many years. Due to thick vegetation and steeply inclined banks, site access is difficult and monitors have recorded no visitor-related impacts.

FY99 Recommendations

RCMP staff recommend monitoring the site on a 5-year schedule due to the precarious location of the feature near a side canyon cutbank.

C:13:007 Small Structure (biennial schedule)

This is a mid-late Pueblo II–early Pueblo III occupation consisting of three or four structural outlines (Features 1–4). Feature 1 is an L-shaped structure open to the east. Feature 2 consists of the remains of a rectangular structure outline, also open toward the east. Feature 3 is another L-shaped structure. Feature 4 is the remnant corner of a single-course structure. Before 1993, campers used the structural elements to hold down tents, and the site has apparently gone through a phase of deterioration since its original recording. Many sherds and Features 3 and 4 have disappeared since originally recorded. Some fire-cracked rock is present, along with some sherds, a few flakes, some ashy soil, and rodent bones of questionable affinity. Archaeologists have not recorded any formal tools.

Previous Work

This site was discovered in the early 1960s and was recorded in 1965 by Prescott College. GRCA archaeologists recorded the site in 1990 (Fairley et al. 1994). RCMP staff monitored the site in FY93, FY94, FY95, FY97, and FY98 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1997, 1998). In 1992 the GRCA trail crew stabilized a portion of the site by constructing a retaining wall and placing jute mat and grass seed across the site's surface. Heavy rains in 1993 obliterated the retaining wall, but the GRCA trail crew repaired the wall in 1994 (Coder et al. 1995a). No other remedial actions were recommended after the trail project except for maintaining the stabilization work completed in FY92. Hereford (1993) completed a photogrammetric map in 1993 that includes this site area. It was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY93 monitors recorded moderate surface erosion, gullying, and arroyo cutting. Erosion had decreased since the stabilization and revegetation efforts. Monitors noted distinct trails and minimal on-site camping. FY94 monitors recorded increased arroyo cutting and bank slump. They noted that the stabilization wall had collapsed due to heavy rain. A decrease in on-site camping, trailing, and overall visitor-related disturbance was recorded.

FY95 monitors recorded increased surface erosion near Features 1 and 2. Revegetation efforts appeared to curtail the active gullying at this site. Minor human disturbance at Feature 1 was recorded. FY97 monitors recorded increased bank slump, side canyon erosion, and the presence of surface erosion, gullying, alluvial erosion, and animal disturbance. Monitors confirmed that the drainage impacting Feature 5 reaches the side canyon. The side canyon had recently flashed, causing active bank slump. Monitors noted that the revegetation work was keeping visitors off the site.

FY98 monitors recorded active arroyo cutting, surface erosion, gullying, and animal burrowing. The features were in stable condition and revegetation efforts looked good. No visitation was recorded.

Monitors (FY93 to FY98) recorded the continued success of the FY92 trail obliteration and revegetation work. The trail obliteration work has prevented further visitor-related impacts from river-runners camping below the site.

FY99 Recommendations

The RCMP staff recommends watching the side canyon-based arroyos for exposure of new materials and continued monitoring on a biennial schedule. The GRCA trail and revegetation crews will perform trail maintenance, stabilization, and revegetation during annual resource river trips.

C:13:343 Small Structure (annual schedule)

This is a Pueblo II Kayenta-Virgin limited activity area with three slab-lined features, a small artifact scatter, a FCR scatter, and a rock alignment. After testing Features 1 and 2 in FY99, archaeologists determined that they are not cultural features. Feature 3 is a small, circular, Dox Sandstone slab-lined feature. At the top of a dune are two rock alignments; one measures 4 m long and the other consists of two Dox Sandstone slabs. Artifacts consist of sherds, lithics, and fire-cracked rock; one chert scraper was noted on the survey. FY98 monitors identified Dogozshi and Sosi Black-on-white sherds in the active side canyon cutbank.

Previous Work

Archaeologists recorded the site in 1990 (Fairley et al. 1994) and the RCMP staff monitored it in FY92, FY93, FY95, FY97, FY98, and FY99 (Coder et al. 1994a, 1994b, 1995a; Hubbard 1999b; Leap et al. 1997, 1998). Surveyors completed a total station map in FY97 (Leap et al. 1997). FY95, FY97, and FY99 monitors recommended testing at this site. The RCMP staff tested Features 1 and 2 in FY99 and confirmed that the "probable cists" were actually naturally formed during a debris flow. The RCMP staff performed a complete surface collection of a 5 x 18 m area on the site. This site was also included in the studies conducted by Thompson and Potochnik (Thompson et al. 1998).

Monitoring Data Summary

FY92 and FY93 monitors recorded moderate surface erosion, gullying, and arroyo cutting. FY92 monitors questioned whether Feature 1 was cultural. FY93 monitors noted that sediment from the large 1993 Little Colorado flood was deposited below the site, along the shoreline. The site appeared more stable to FY93 monitors than in FY92.

FY94 monitors discovered increased arroyo cutting and the presence of surface erosion. They noted that Feature 1 was showing signs of slope erosion. However, the artifact concentration, 4 m north of Feature 1 and adjacent to the arroyo, had new charcoal exposed. Monitors also questioned whether Features 1 and 2 were cultural.

FY97 monitors recorded increased surface erosion, gullying, eolian activity and the presence of arroyo cutting. A gully had developed on the site that fed into the large drainage below (side canyon). Monitors also noted that Feature 3 was actively moving downslope.

FY98 monitors documented active surface erosion and inactive gullying and arroyo cutting. There was increased eolian activity at Feature 3 and artifacts on the slope had moved down into the side canyon drainage below. Footprints noted on the site were attributed to the last monitoring visit.

FY99 monitors recorded active bank slump caused by the side canyon. Inactive surface erosion was also recorded. Features 1, 2, and 3, the artifact concentration, and the rock alignments were all in stable condition. The only physical change was on the west slope of the dune. No sign of human visitation was observed due to the absence of camps or attraction sites in the area.

Monitors have recorded surface erosion, bank slump, gullying, arroyo cutting, eolian activity, and side canyon erosion at this site since 1990. A small gully bisects the site and drains into the side canyon (see Figure 19). Surface erosion consistently moves artifacts down into the drainage. Monitors have recorded new ceramic and lithic artifacts eroding from this site since 1990. Monitors have consistently recorded no visitor impacts at this site. Future visitation could be attributed to backpackers that travel the Cardenas-Tanner Trail above the site.

Several members of the PA, including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff, stopped at C:13:343 on the April 1999 river trip. The group decided that ground-penetrating radar (GPR) would be beneficial prior to any subsurface disturbance. After the GPR information was generated, a mitigation plan could be developed. The site has great research potential due to the variety of artifacts and possible buried structures (Leap 1999).

FY99 Recommendations

The RCMP will continue annual monitoring due to the active on-site erosion and past discovery of new artifacts. The site is recommended for data recovery within the FY00–FY05 budget (Leap 1999).

C:13:371 Structure–Thermal Feature Complex (semi-annual schedule)

This is a mid-late Pueblo II habitation area situated on a debris fan and on both sides of an unnamed side canyon. It consists of several rockshelter overhangs, some with dry-laid masonry walls, possible room rubble, several FCR concentrations, and a lithic-ceramic scatter. Feature 1 consists of two small rock overhangs, each with 2–3 course, dry-laid masonry walls, possibly the remains of storage features. Features 2, 3, and 4 are fire-cracked rock concentrations. Feature 5 is an architectural unit consisting of two rooms. Feature 6 consists of two FCR concentrations, one 3 m in diameter and the other 3 x 5 m with artifacts. Feature 7 is a FCR scatter with a few artifacts. In general, each fire-cracked rock area has at least some artifacts associated with it. FY97 monitors found a Tapeats Sandstone mano below Feature 6.

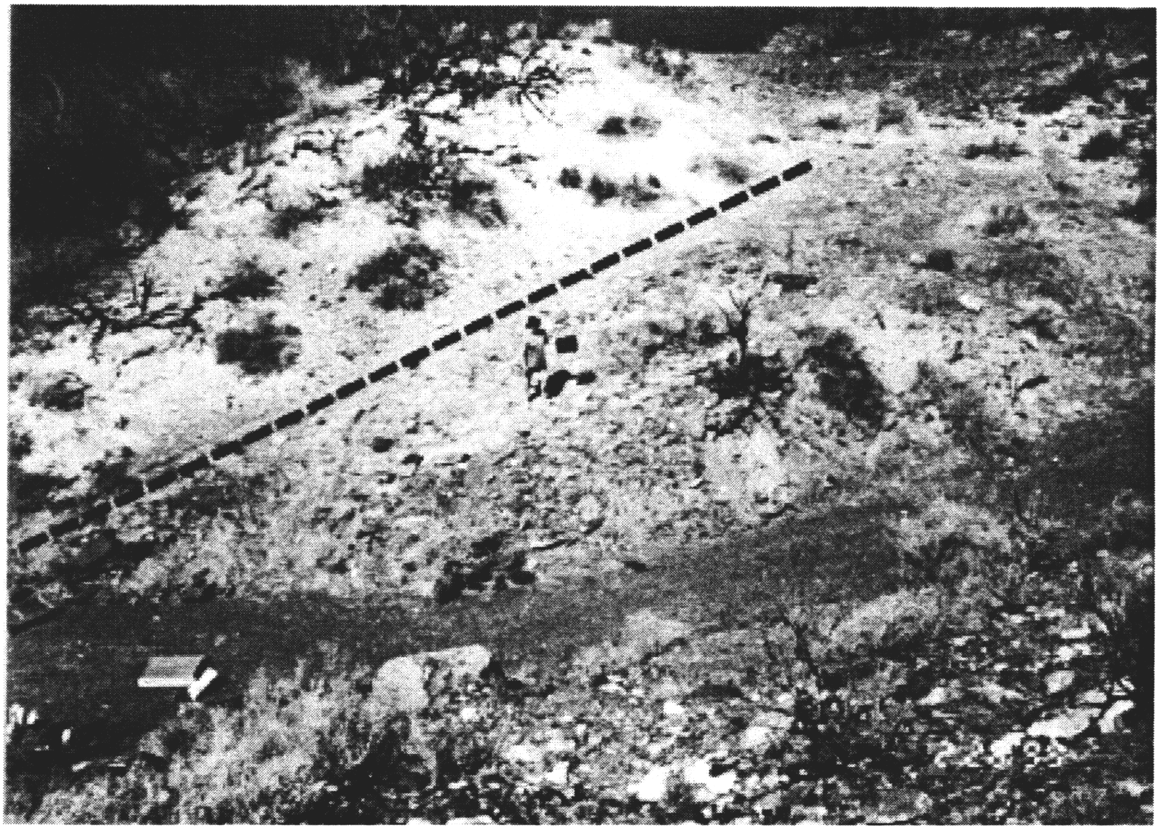


Figure 19. Overview of C:13:343 in relation to an active side canyon (foreground); the side canyon-based drainage is demarcated in photo-center. The drainage bisects the site and feeds directly into the side canyon.

Previous Work

Archaeologists recorded the site in 1990 (Fairley et al. 1994) and the RCMP staff has monitored it semi-annually since FY92 (Coder et al. 1994a, 1994b, 1995a; Hubbard 1999a; Kunde 1998a; Leap et al. 1996, 1997, 1998). Monitors have recommended a combination of data recovery, testing, planting vegetation, and installing checkdams since FY94 (Coder et al. 1995b; Leap et al. 1996, 1997, 1998). FY94 monitors recommended total station mapping and collecting charcoal. In FY95 monitors recommended checkdams. In FY96 Zuni Conservation personnel, the GRCA trail crew, and RCMP personnel constructed three checkdams adjacent to Features 3 and 5 (Leap 1996f). FY95 monitors also recommended planting vegetation. FY96 monitors assessed the site for planting vegetation and decided that none would be planted. FY96 monitors collected charcoal from Features 2 and 4. Radiocarbon dates with a 2 sigma, 95% probability indicate new Feature 2 dates ranging between A.D. 1665 and 1950 and a Feature 4 age range between A.D. 1445 and 1655 (Leap et al. 1998).

Prior to the research flow of 1996, Feature 8 was tested for subsurface deposits. The results showed that Feature 8 was the remains of a debris flow (Balsom and Larralde 1996). In FY96 the site was mapped with a total station instrument and medium format photos were taken before and after the research flow (Leap 1996b, 1996d; Leap et al. 1996). FY98 monitors recommended testing Feature 6 and 7, collecting a charcoal sample at Feature 3, and full data recovery of Feature 2. FY98 monitors also recommended obtaining a charcoal sample from Feature 3. FY98 monitors replicated medium-format photos taken during the 1996 research flow. Zuni Conservation personnel completed checkdam maintenance at Checkdam 2 in FY99. FY99 monitors noted that Checkdams 1 and 3 were in stable condition.

Monitoring Data Summary

FY92 and FY93 monitors recorded extensive surface erosion, gullying, and moderate arroyo cutting. Monitors also recorded slump at Feature 4 and high-water impacts to Feature 7. Monitors noted that the on-site impacts were attributed more to post-dam high water than side canyon impacts.

FY94 monitors observed increased surface erosion, gullying, arroyo cutting, animal trailing, and side canyon erosion. Increased gullying was identified at Feature 2 (see Figure 20), increased bank slump at Feature 4, and surface erosion at Features 5, 6, and 7. Trailing was attribute to research activities.

FY95 monitors noted increased surface erosion, gullying, alluvial erosion, and the presence of bank slump and side canyon erosion. The gully north of Feature 5 had widened, Feature 3 had fire-cracked rock eroding downslope due to a gully, Feature 4 had alluvial deposition, and no change was observed at Feature 5. Increased vegetation and cryptogamic soil was noted throughout the site.

FY96 monitors recorded increased surface erosion, gullying, eolian-alluvial erosion, and the presence of bank slump, side canyon erosion, animal-caused erosion, and root impacts. Physical impacts were affecting all features except 1, 6, and 7. Monitors attributed the erosion to the loss of abundant pre-dam sediment (beach sand) that once covered the cultural material.

FY97 monitors observed increased surface erosion and bank slump and the presence of gullying and side canyon erosion. Features 4, 6, and 7 showed signs of increased slumping and no changes were noted at the other features. The newly installed checkdams were stable with no noticeable change.

FY98 monitors noted active surface erosion, gullying, side canyon erosion, animal trailing, eolian-alluvial activity, and bank slump. Monitors noted that Feature 1 had active surface erosion, gullying, and animal trailing that impacted the feature's east side. Feature 3 had inactive erosion but was termed in "poor condition." Evidence of rilling was also noted at Features 2 and 3. Feature 4 again showed signs of active bank slump and Feature 5 had increased slump and deepening and widening of a gully.

FY99 monitors recorded active surface erosion and inactive gullying, and eolian-alluvial and side canyon erosion. Feature 2 had minor flow in the rills bisecting the feature. Features 1 and 4–7 were unchanged. The features were stable but in poor condition. Checkdam 2 had increased slump along the east side. Footprints were observed at Feature 3.

The RCMP staff consistently recorded surface erosion, gullying, eolian-alluvial activity, bank slump, and animal disturbance at this site. The RCMP staff reevaluated the "river-based drainage" at this site and concluded that it is a side canyon-based drainage. The small side canyon, which drains to

Figure 20. Overview of a side canyon-based drainage impacting Feature 2 at C:13:371.

the river, was plugged by the 1996 research flow (Balsom and Larralde 1996). However, the side canyon has reached the river again and continues to cut through the 45,000 cfs terrace deposited in 1996.

Several members of the PA, including representatives from AZSHPO, GRCA, WAPA, the Hopi Tribe, and RCMP staff, stopped at C:13:371 on the April 1999 river trip. The group decided that the site should be tested for subsurface materials by PA staff archaeologists. The potential for cultural material in the dune above Features 6 and 7 is high. Testing is needed to determine the lateral and vertical extent of the site. Archaeologists could use testing information to develop an appropriate research design and excavation strategy. A testing phase at this site would take 3–5 days (Leap 1999).

FY99 Recommendations

RCMP staff will continue semi-annual monitoring at C:13:371. The RCMP staff recommends data recovery at C:13:371 from FY03 to FY07 (Leap 1999). Monitors recommend determining the effectiveness of the checkdams by measuring change in sediment volume. Zuni Conservation personnel and RCMP staff will continue annual checkdam monitoring and maintenance.

G:03:078 Artifact Scatter (inactive schedule)

This is an open-air lithic scatter of 1,000+ flakes, several sherds, and some circular rock alignments that may represent wickiup outlines. The site is on a level expanse of Tapeats Sandstone, adjacent the Colorado River, and on the south side of a popular side canyon. The lithic debitage is almost entirely heat-treated tertiary thinning flakes, dominated by white-cream-pink Kaibab Chert, but including some other (yellow-red-brown) cherts, black rhyolite, and possible Partridge Creek Obsidian. Archaeologists observed several cores, but no bifaces, formalized flake tools, or groundstone implements. The three sherds suggest a late prehistoric–early historic Pai cultural affiliation.

Previous Work

Archaeologists recorded the site in 1991 (Fairley et al. 1994) and RCMP staff monitored it for the first time in FY97 (Leap et al. 1997). Monitors have not recommended remedial actions at this site.

Monitoring Data Summary

The site is in excellent condition with cryptogamic soils covering the entire area. A faint trail crosses through the site, but judging from the growth of the cryptogamic soils, there has been no recent use. FY97 monitors observed a shallow gully on the eastern side of the site that drains into the side canyon. They noted that the gully does not appear to be impacting the site.

FY99 Recommendations

The site will remain on an inactive monitoring schedule due to its physical and visitor-related stability. The drainage has reached bedrock and it is probable that no additional downcutting will occur.

CHAPTER 8. SITES WITH UNDEVELOPED DRAINAGES

Nancy B. Andrews

Sites with undeveloped drainages comprise forty percent of the entire group of archaeological sites for which the RCMP establishes drainage type. These sites do not, at the present time, have a drainage that reaches a terrace, a side canyon, or the Colorado River. Instead, water drains into dunes or shallow, ephemeral channels that do not empty onto an alluvial terrace. Although these sites do not at present exhibit gullying or arroyo cutting, they have that potential if their current drainage network transitions from surface runoff to a downcutting process.

There are currently 118 sites in the undeveloped drainage category. Most are on an inactive monitoring schedule, or are monitored only every 3 to 5 years. Three sites in the undeveloped drainage group are monitored biennially and one site is monitored on a semiannual basis. See Appendix H for additional information about undeveloped drainage sites.

Table 6 shows the property type frequencies for these undeveloped drainage sites. Prehistoric structures, artifact scatters, and thermal or roasting features comprise 70 percent of this group. Eight percent are historic structures, and the remaining 22 percent include prehistoric rock art, structure and roasting feature complexes, special activity loci, or (rarely) pueblo sites.

REMEDIAL ACTIONS

Most of the sites with undeveloped drainages are currently stable; only 20 of the 118 sites (17%) are experiencing active physical erosion, in the form of surface erosion (rilling, slope wash, sheet wash), eolian erosion or deposition (dune migration, wind deflation), bank slump, or animal-caused erosion (burrowing, trailing). Twenty five sites (21%) are experiencing active visitor-related impacts, mainly in the form of on-site trails or artifact collection and displacement.

Remedial actions conducted at undeveloped drainage sites in the last 8 years have been primarily preservation treatments, with only limited data recovery. Preservation treatments include medium-format photography (16 sites), trail work or trail maintenance (10 sites), graffiti removal (1 site), artifact inventory or additional documentation (3 sites), construction of a water diversion bar (1 site), and planting vegetation (1 site). In all, 45 preservation actions have been completed at 28 undeveloped drainage sites (see Appendix H).

Twelve data recovery actions have been completed at 10 undeveloped drainage sites, including testing for site significance or integrity (3 sites), feature excavation (2 sites), carbon sampling (4 sites), and artifact collection (2 sites). Therefore, remedial actions (both preservation and recovery) have been completed at 34 of the 118 undeveloped drainage sites (29%). Of these 34 sites, 24 percent have received preservation treatments, and 8 percent have received recovery treatments.

A:15:018 Rock Art (inactive schedule)

This is a rockshelter with ground stone, fire-cracked rock (FCR), flakes, and several associated pictograph panels. No ceramics are present on the surface. The pictograph panels are executed in hematite and limonite pigment and charcoal. The pigments were procured locally, possibly at site A:15:025 located 2 miles downstream from. An additional element was executed in charcoal. The Southern Paiute Consortium has visited this site and conducted in-depth interviews that establish it as Paiute.

Previous Work

The site was initially recorded by NPS survey personnel in November of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

FY96 monitors noted that Panel 1 was very faint, probably due to greater exposure than the other panels, which were in relatively good condition. No human visitation was apparent at the time.

Table 6. Count and Property Types of Sites with Undeveloped Drainages (n = 118)

Site Counts	Property Types
36	Small Structures
23	Artifact Scatters
13	Roasting Features
11	Thermal Features
10	Historic Structures
9	Rock Art
5	Structure-Thermal Feature Complex
5	Special Activity Locus
4	Roaster Complex
2	Pueblo

Consequently, the FY96 monitors placed the site on a 5-year monitoring schedule. In FY97, RCMP archaeologists photographed the pictographs in detail using a medium-format camera (Leap 1997b). In FY99, RCMP staff placed the site on an inactive monitor schedule because all archaeological information has been retrieved from the site and there is no subsurface material present.

FY99 Recommendations

The inactive monitoring schedule will continue. It is recommended that the GRCA River Patrol periodically visit the site for ARPA violations.

A:15:021 Roasting Feature (3-year schedule)

A:15:021 is a late prehistoric–early historic Paiute site, with a later historic component, consisting of an 80 percent intact slab or block-lined fire feature with most of its fill still remaining. In association or nearby are a finely worked obsidian Desert Side-notched point, several sherds from a single Paiute Brown Ware jar, and a recent historic can scatter. The cans are from the latter end of the 1920-1950 period and possibly have a Hualapai affinity. A single bone shirt button is also present. The prehistoric component is centered on the top of a stabilized dune; the cans and sherds are scattered over a limestone bench area adjacent the upstream terminus of the dune.

Previous Work

The site was initially recorded in November of 1990 by NPS survey personnel (Fairley et al. 1994). It was monitored by the RCMP staff in FY94, FY95, and FY99 (Coder et al. 1995a, 1995b; Hubbard 1999b). Bureau of Reclamation archaeologist W. Hurley mapped the site with a total station in FY95 (Coder et al. 1995b). Further detailed mapping is needed to complete the Hurley map.

Monitoring Data Summary

In FY94, monitors noted the site's overall stability, but indicated that the fire feature was deteriorating due to exposure. They recommended data recovery at the fire feature. FY95 monitors discovered additional features and artifacts not previously recorded during the survey, including a roasting feature, RCR scatters and a collection pile, and more cans and charcoal. Initially an annual, then a 3-year monitoring schedule was implemented. A total station map of the site, recommended in FY94, was initiated in FY95 by Hurley, but it was never completed. The site is currently in stable condition, although artifacts continue to be uncovered or exposed. FY99 monitors found burnt bone on the northeast perimeter of the slab-lined feature, and the basal half of a projectile point (perhaps Elko Corner-notched) on the Muav Limestone ledges above the site. Minor sheetwashing is occurring around both features, but currently does not affect their stability. Future increases in sheetwashing around the base of the slab-lined feature could expose more of the feature and new artifacts. This site is located within the APE and would receive impacts from high-water fluctuations.

FY99 Recommendations

A 3-year schedule is appropriate for A:15:021. The GRCA revegetation crew should conduct an assessment for stabilizing the dune below the slab-lined feature.

A:15:026 Roaster Complex (5-year schedule)

This site consists of two roasting features (Features 1 and 2), a few lithics, and a sherd that indicates late prehistoric–early historic Pai use. Feature 1 is a 7-m-diameter donut-shaped roasting pit with limestone and sandstone fire-cracked rock, abundant charcoal, and the Pai sherd. Feature 2 is a smaller, highly deflated and eroded FCR and ashy soil concentration about 50 m north-northwest of Feature 1. It is currently 3 x 6 m in size. A few (< 10) Redwall Chert flakes were observed in the area.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998).

Monitoring Data Summary

The 1991 NPS archaeologists recorded natural erosion of the sand dune, including deflation and sheetwashing. Animal trails were evident. They noted that the dune was visited irregularly by river-runners, and that a high-water flow (75,000 cfs) might prompt river parties to camp at the base of the dune. The site was visited over the next several years with no indications of serious impacts. The FY92–FY94 monitors mentioned the thick cover of grass that blankets the site, the presence of bighorn sheep trails, and the lack of human visitation. The monitoring schedule was set for every 3 to 5 years. When monitored again in FY98, the site was very stable and in good condition. The only observations recorded included bighorn sheep trails, minor rodent burrowing, and increased vegetation. Therefore, the site was placed on a 5-year monitoring schedule.

FY99 Recommendations

A 5-year monitoring schedule is appropriate for A:15:026. No preservation treatments are recommended at this time. If the site is in stable condition in 5 years, then it will be placed on the inactive monitoring list.

A:15:027 Roasting Feature (5-year schedule)

A:15:027 consists of at least one fairly large roasting feature (Feature 1) and a smaller FCR mound (Feature 2), with several possible discard scatters around Feature 1. There is also a relatively extensive lithic scatter and a dozen sherds, including a single Jeddito plainware. This may be a multi-component site with both Late Pueblo I–Early Pueblo II Virgin and late prehistoric–early historic Pai occupations. Debitage at the site indicates that a variety of lithic reduction tasks were performed, including biface reduction and projectile point manufacture. Several ground stone items suggest that plant food processing was also an important activity. The site is located on a dissected terrace remnant adjacent to the river.

Previous Work

The site was first recorded in November of 1990 (Fairley et al. 1994). It was monitored once a year in FY92 and FY94, and semiannually in FY93 and FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b). In FY95, the site was placed on a 3 to 5 year monitoring schedule. It was monitored in FY99 (Hubbard 1999b).

Monitoring Data Summary

In the early years, from its recording in FY91 through FY95, monitors kept watch on several off-site drainages that had the potential to threaten the site. One of these was at the northern end of the site, and another was near Feature 1 on the southern end. After repeated monitoring visits, it became apparent that the drainages were stable, and that monitoring was creating the most impact on the site. Consequently, the monitoring schedule was changed to every 3 to 5 years. Bighorn sheep trails and rodent burrows were the only other physical impacts mentioned. The only sign of human visitation in FY95 was a mano placed on a rock. FY99 monitors noted that Feature 1 was covered in abundant cryptogamic soils and grasses. Feature 2 was unchanged and also stable. A faint game trail led from the river to the site. There were no signs of human visitation, nor any camping or hiking trails in the vicinity. RCMP archaeologists recommended that the site be examined after a flood exceeding 100,000 cfs.

FY99 Recommendations

The site should remain on a 5-year monitoring schedule. If the site is stable in 5 years, it can be moved to the inactive monitoring list.

A:15:036 Thermal Feature (inactive schedule)

A single concentration of fire-cracked rock and an associated discard pile defines this site. A sandstone cobble mano was the only artifact observed on the surface. Cultural affiliation is unknown.

Previous Work

The site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

When monitored in FY96, the site was stable. It is not being impacted by channeled runoff or directly threatened by dam operations. It is currently on the inactive monitoring list.

FY99 Recommendations

The site should be tested for intact subsurface remains. The monitoring schedule should be re-evaluated after testing.

A:15:042 Thermal Feature (inactive schedule)

This is an Early-Middle Pueblo II Virgin and late prehistoric–early historic Pai or Paiute site that consists of five shelters and artifact scatters. Feature 1 is an overhang shelter with a sandstone grinding slab and three slightly ground basalt cobble stones. The shelter is dry and no additional deposits appear to remain in the shallow fill. Feature 2 is a boulder overhang with charcoal fragments, a few sherds, and a core. A square nail was also found (this area may be related to the historic use at site A:15:001A). Feature 3 is a large artifact scatter associated with a small rockshelter. The shelter contains lithics, ceramics, fire-cracked rock, and ground stone. Feature 4 is a downslope slump of ceramics and lithics; this area was chosen for placement of a ceramic analysis unit during the survey due to its diversity and density of sherds. Feature 5 is a FCR scatter that contains a couple of ground stone fragments.

Previous Work

The site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and it was monitored in FY92, FY93, FY94, FY95, and FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b).

Monitoring Data Summary

The 1991 surveyors noted mostly physical impacts at this site. Sheetwashing and rilling near Feature 4 were carrying artifacts downslope. A burrow trail led to the site and along the cliff base. The 1983 flood levels could have inundated the sand terraces at the site. Additionally, flash flooding from the adjacent canyon appeared to have washed some artifacts away. By FY95, the majority of the site was stable. However, Feature 2 was still eroding with annual side canyon flooding. An additional feature, newly exposed, was recorded during FY95. Trailing had developed from visitors hiking to the Kolb inscription, so trail work was completed in FY95. The FY99 monitors noted that the site was in poor but stable condition.

FY99 Recommendations

This site will remain on the inactive monitoring list.

A:15:047 Artifact Scatter (5-year schedule)

This site consists of a small isolated rockshelter 16 m from the river containing ground stone and lithic debris. No ceramics are present and cultural affiliation is unknown. The site is situated at the contact of a basalt flow and an older consolidated river channel. The channel deposit consists of river cobbles in a clastic matrix. In 1994, seventeen bedrock mortars were found on scoured ledges just below the site adjacent to the river. These mortars make use of natural concavities in the Muav Limestone.

Previous Work

The site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and it was monitored for the first time in FY96 (Leap et al. 1996). The mortars were mapped and incorporated into the site file in October 1994.

Monitoring Data Summary

There is no evidence of erosion occurring on the floor of the rockshelter since it was recorded. River cobbles periodically dislodge from the roof of the shelter and fall onto the surface. The research flow of March 1996 deposited sand on the lower ledges just upstream from the site. In FY96, the site was placed on a 5-year monitoring schedule.

FY99 Recommendations

A:15:047 should be tested for intact subsurface cultural material and then the monitoring schedule should be reevaluated.

A:16:148 Roasting Feature (inactive schedule)

This aceramic site consists of a fire-cracked rock or roasting pit activity area of unknown cultural affiliation. The site covers a broad area (100 x 60 m), and contains three FCR or charcoal lens areas and a small number of lithics. Area 1 consists of FCR concentrations, charcoal, a widespread ash lens, a diffuse bone scatter, and a few flakes. Area 2 contains fire-cracked rock and charcoal. Area 3 contains two FCR concentrations, some charcoal, and sparse lithics. No ground stone, ceramics, or architecture is present on the surface, although one biface fragment was observed. The site is on an alluvial terrace where soil deposition is extensive. For this reason the site probably has good overall integrity and additional cultural material may be buried below the surface.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it has been monitored in FY94, FY96, and FY98 (Coder et al. 1995a; Leap et al. 1996, 1998).

Monitoring Data Summary

Animal trampling and an article of clothing were the only disturbances noted at the site by the FY94 and FY96 monitors, who placed the site on a biennial monitoring schedule due to the presence of an upstream camp. The site remained stable in FY98, with lush grasses and cryptogamic soils growing throughout the terrace. There continued to be no additional signs of human visitation, so the site was placed on a 4-year monitoring schedule in FY98.

FY99 Recommendations

The site should be placed on an inactive monitoring schedule due to its stability since initial recording in 1990. Because there are no ceramics at this site, it would be useful to obtain a radiocarbon sample to provide temporal affiliation.

A:16:150 Roasting Feature (inactive schedule)

The site represents a prehistoric site of unknown cultural affiliation. FY91 monitors found a semicircular feature constructed of fire-cracked limestone cobbles and charcoal on the southern slope of a sandy alluvial terrace. The semicircular portion of the feature represents the only exposed section and no artifacts were found in association with the site.

Previous Work

The site was initially recorded in November of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored by the RCMP staff for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

The site shows no change. FY96 monitors noted local runoff filtering through the feature and funneling out through the wall of an adjacent drainage. Recommendations were made to place rocks in the piping to decrease erosion and place the site on the inactive list (Leap et al. 1996).

FY99 Recommendations

The site should remain on an inactive schedule. Stabilization work is recommended to fill in the holes or piping at the site.

A:16:151 Roasting Feature (5-year schedule)

This site consists of two loci that may reflect a late prehistoric–early historic Pai occupation with later historic (late nineteenth century) use. Locus A contains several features. Feature 1 is a large roasting feature and its associated discard pile, ash midden, and debris, plus a ground cobble. Feature 2 is a very highly deflated and much smaller fire feature. Between Features 1 and 2 are a lithic debitage concentration, a ground slick, a Pai sherd, and a battering device. A worked piece of brass horsetack and a soldered, reclosable lid can were also associated with Feature 1. Locus B, on the downstream side of the canyon mouth, consists of several lithics, a single Pai sherd, and a charcoal-rich midden associated with a shallow overhang.

Previous Work

Archaeologists originally recorded the site in 1990 (Fairley et al. 1994). The RCMP monitored the site semiannually in FY93 and FY94 (Coder et al. 1994a, 1995a). In FY95, the RCMP changed the monitoring schedule to every 3 to 5 years and the site was monitored last in FY98 (Coder et al. 1995b; Leap et al. 1998). FY94 monitors recommended trail obliteration work, which the RCMP staff completed in FY97 (Leap et al. 1997).

Monitoring Data Summary

The 1990 surveyors noted that the site was experiencing deflation and visitation by river-runners. In FY93 and FY94, collection piles, additional trailing, and movement of artifacts were recorded. The FY95 monitors stated that the site should be watched for side canyon flooding and continued trailing by visitors. The trail obliteration work conducted in FY97 (north of Feature 1 and at Locus B) was successful. The site is located on the same delta as a very popular boat beach. The site appeared in stable condition when last monitored in FY98.

FY99 Recommendations

If the site remains stable in 5 years, it should be put on an inactive schedule. Trail maintenance by GRCA revegetation personnel should continue upon completion of a preservation treatment assessment.

A:16:154 Structure–Thermal Feature Complex (5-year schedule)

This site contains a large southeast-facing rockshelter situated in the Bright Angel Shale. Two distinct fire features and associated activity areas are present. Artifacts include Paiute indented and a single Jeddito Plainware sherd, a sandstone grinding slab, lithic debris, and an abundance of cracked bone. Ceramics indicate that this is a late prehistoric–early historic Paiute site.

Previous Work

This site was initially recorded by NPS survey personnel in November of 1990 (Fairley et al. 1994) and it was monitored in FY96 (Leap et al. 1996).

Monitoring Data Summary

The site has remained stable since the survey. Some minor small-mammal burrowing was noted in the back of the rockshelter. The Jeddito sherd could not be relocated in FY96.

FY99 Recommendations

If this site is stable in 5 years, place it on the inactive monitoring list.

A:16:155 Small Structure (inactive schedule)

A:16:155 is a small rockshelter with a few brownware sherds, probably of Pai affinity. The shelter is situated at the base of the Bright Angel Shale.

Previous Work

The site was initially recorded in 1990 (Fairley et al. 1994) and was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). In FY94, A. Gellis (USGS) assessed the drainage located on the upstream side of the site (Gellis 1994). He noted that the gully had tributaries working upgradient to the sandstone ledge, but the channel had boulders and probably would not deepen any further. The channel could be treated, but RCMP archaeologists decided that no work was necessary. In FY98 monitors recorded that the gully was not impacting the features and continued to move away from the site boundary.

Monitoring Data Summary

During both monitoring episodes archaeologists noted small rodent and insect disturbance. But overall, the site was in stable condition. The river-based gully present on the upstream side of the overhang was determined to be outside the site boundary, and therefore not a threat to the site. Because the site is well protected by the overhang and no activity has occurred in the past 4 years, the FY98 monitors recommended that the site be placed on the inactive monitoring list.

FY99 Recommendations

This site will remain on the inactive monitoring list.

A:16:159 Artifact Scatter (3-year schedule)

This site consists of an overhang with sherds, lithics, tools, and pictographs. The shelter has experienced post-occupational wall and ledge fall. The only discernible pictograph elements are two hematite anthropomorphs located 3 m above the shelter floor. Other elements that were once present have deteriorated, leaving only traces of red pigment. The ceramics indicate a multicomponent site, with Pueblo II Virgin and late prehistoric–early historic Pai occupations.

Previous Work

The site was originally recorded in 1990 when a ceramic spindle whorl was identified (Fairley et al. 1994). The site was monitored annually in FY92 and FY93 and the spindle whorl was never relocated (Coder et al. 1994a, 1994b). In FY94 the site was monitored three times and closure to visitors was recommended (Coder et al. 1994b). Site closure never occurred, and beginning in FY95 semiannual monitoring was conducted, which demonstrated fewer to no impacts; annual monitoring was recommended for FY96 (Coder et al. 1995b). In FY97 medium-format photographs were taken of the hematite images (Leap et al. 1997). The site was last monitored in FY98 (Leap et al. 1998).

Monitoring Data Summary

The RCMP staff has monitored this site annually since FY92, with semiannual visits in FY94 and FY95. Physical impacts include minor animal trailing, cliff spall, and surface erosion. Visitor-related impacts include rearrangement of artifacts and camper trash (boaters know of the site and there is a popular campsite just across the river). A projectile point was found in an area of exfoliated rock by the FY95 monitors.

FY99 Recommendations

The RCMP will continue monitoring this site every 3 years. Surface erosion recorded at the site has the potential to expose additional cultural materials.

A:16:162 Small Structure (inactive schedule)

This aceramic site is located in Bright Angel Shale under a shallow overhang. It contains three distinct, flat, possible activity areas with Bright Angel shale slabs "defining" each area. It is not known whether these alignments are man-made or simply debris from the eroding overhang. Features A and C both have scattered charcoal associated with their alignments. One of the features contains a battered cobble of solidified sandstone. It may be the result of a Paiute occupation.

Previous Work

An NPS survey crew recorded this site in 1990 (Fairley et al. 1994) and it was monitored in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997).

Monitoring Data Summary

The FY92 monitors recorded wall fall and spalling at the site, and noted that the site had been inundated at least once since the 1900s. No physical or visitor-related impacts were recorded in FY93 and the site was not visited again until FY97. FY97 monitors noted the high potential for spalling, but placed the site on the inactive list due to its stability.

FY99 Recommendations

This site will remain on the inactive monitoring list, but limited data recovery should occur to identify whether or not intact cultural materials remain. The monitoring schedule will be reevaluated upon completion of testing.

A:16:163 Small Structure (5-year schedule)

A:16:163 is a large multicomponent site with five loci. Locus A is located along the base of a Bright Angel Shale cliff and contains several structural elements and pictographs. Locus B consists solely of pictographs along a rock overhang. Locus C is a lithic scatter. Loci D and E are both rock-outlined structures. The rock structure at Locus E is modern, according to the FY98 RCMP monitors. The "supposed" structure rocks look recently moved, unlike other rocks which have been cemented in cryptogamic soils. Together, these five loci combine to form a habitation and activity area along a major side canyon drainage. Virgin Puebloan and Pai or Paiute occupation is suggested by the artifact assemblage of flakes, sherds, bifacial tools, and ground stone.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). Medium-format photographs were taken of Locus B in FY97 (Leap 1997b).

Monitoring Data Summary

FY94 monitors observed that the site was stable, although visitation had increased since 1991. They recommended that Loci D and E, which are situated in the potential high-water zone, be monitored annually. The rest of the site could be spot-checked with an eye kept open for increased foot traffic from the boat beach to Locus A. When monitored again in FY98, the site was still stable, with no physical or visitor-related impacts present. A 5-year monitoring schedule was recommended.

FY99 Recommendations

This site should be monitored in 5 years. If the site remains stable, place it on the inactive list. It is recommended that the GRCA revegetation crew maintain the trail work.

A:16:167 Roaster Complex (3-year schedule)

This site consists of five roasting features (Features 1–5) and a small, partially collapsed, scoured rockshelter with a few artifacts (Feature 6). The artifacts suggest that this is a multicomponent site, with both Pueblo I to Pueblo III Virgin and late prehistoric–early historic Pai or Paiute occupations. The roasting features are spread over about half an acre of stabilized dune surface. Archaeologists identified flakes, a ground slab, and one cobble hand tool. Buried materials are probably present.

Previous Work

The site was initially recorded in 1990 (Fairley et al. 1994) and was monitored in FY93, FY94, FY96, and FY98 (Coder et al. 1994a, 1995a; Leap et al. 1996, 1998).

Monitoring Data Summary

When initially recorded in 1990, the site was experiencing some surface erosion and animal trailing. There was no evidence of human disturbances. The FY93 monitors noted the general trampling and trailing by animals and the presence of off-site gullies. Physical impacts were present in FY94 and FY96, but not active. In FY98, monitors recorded that the impacts in Features 3 and 4 were caused by animal trailing and campers using the trail to go to the downstream side canyon drainage. Most features were stable, with healthy vegetation growth. FY98 monitors recommended retrailing the area around Features 3 and 4, and continuation of a biennial monitoring schedule.

FY99 Recommendations

Due to the site's overall stability in the past 3 years, it will be placed on a 3-year monitoring schedule. The GRCA trail crew should complete an assessment for trail work.

A:16:172 Rock Art (inactive schedule)

This site consists of two components: a prehistoric petroglyph panel (Locus A) and historic inscriptions (initials and dates) with artifacts dating to the 1930s (Locus B). The site is under adjacent overhangs. The prehistoric locus contains a panel with three pecked figures and an associated pecked sandstone grinding slab. Locus B is a boulder with three historic inscriptions: "F.I. Dec. 17, 1933," "E.B. Jan. 1, 1934," and "D.B. Jan. 1, 1934." Associated with this locus is a Carnation milk can that dates to the 1930s with crimped seams, and a can that has been modified with a wire handle and is burned at the bottom from cooking or boiling water. "Canco" is stamped on the bottom. A few pieces of milled lumber with nails and burned wood or charcoal fragments make up the rest of the component. The Locus A rock art may have a Western Puebloan stylistic association; however, diagnostic artifacts are lacking and cultural affiliation is tentative.

Previous Work

The site was initially recorded by NPS personnel in December of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

The site is very stable. No changes in natural impacts have been noted since 1990. The site is visited by river-runners, but this visitation has not affected the integrity of the panels or the surface. The prehistoric panel was photographed in black-and-white and color film using medium-format photography in FY97, at the request of the Southern Paiute Consortium (Leap 1997b).

FY99 Recommendations

This site will remain on the inactive monitoring list.

A:16:185 Special Activity Locus (3-year schedule)

A:16:185 is a probable human burial consisting of numerous shell beads from the Pacific coast, a finely worked rhyolite Desert Side-notched projectile point, a few flakes, some Moapa Gray Ware sherds, and a single human metatarsal. The site is located in a stabilized set of riverside dunes. Ceramics suggest a Pueblo II Virgin association, but the Desert Side-notched point indicates a Pai or Paiute affiliation.

Previous Work

This site was recorded in February of 1991 (Fairley et al. 1994), and was monitored in FY93, FY95, and FY99 (Coder et al. 1994a, 1995b; Hubbard 1999b).

Monitoring Data Summary

The FY93 monitors found minor trampling by animals and some dune migration, but overall the site was stable and well covered with vegetation. In FY95, minor burrowing and trailing through the site were noted. Dense vegetation covered the site. They mentioned that the nearby canyon is sometimes used for a lunch stop by boaters, who hike up the canyon. Due to the sensitive nature of sites containing human remains, the Hualapai Tribe requested minimal monitoring at this site, and that a tribal member be present during any scheduled visit (Coder et al. 1995b). When RCMP archaeologists monitored the site in FY99, it was in stable condition with no active physical or visitor-related impacts. River flows over 100,000 cfs, a large side canyon flood, or visitors from the camp below could potentially impact the site. Monitors placed dead brush next to the cleared area, blocking access to the site. The brush will discourage potential visitation due to the natural pathway leading from the side canyon to the site. The RCMP staff recommended a monitoring schedule of 3 years, to assess exposure of new artifacts caused by physical or visitor-related disturbances.

FY99 Recommendations

Continue monitoring this site on a 3-year schedule. After the next visit in FY02, the site could be placed on the inactive list if it remains stable.

B:09:314 Small Structure (5-year schedule)

This aceramic site consists of a single structure built against the base of a cliff face with a high overhang. Two masonry walls extend from the cliff face to two large boulders, which are incorporated into the walls, forming an enclosure about 3 x 2.5 m in size. The masonry has apparently fallen to grade. Currently one course remains on the west wall, and the east wall is simply a line of stone elements. The cliff wall has no marks to indicate original wall height, but remaining debris suggests that the walls were low to begin with. The floor of the structure is sandy with limestone gravels. A core, two flakes of limestone, and some charcoal are scattered across the site area. The FY98 monitors found additional flakes in the northernmost charcoal scatter and noted that charcoal is present within the room. Cultural and temporal affiliation is unknown.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored for the first time in FY98 (Leap et al. 1998).

Monitoring Data Summary

This is a very stable site with no new signs of physical impact. The FY98 monitors found additional flakes in the northernmost charcoal scatter, and noted that charcoal was present within the room. No visitor-related impacts were observed.

FY99 Recommendations

The FY98 recommendations for monitoring are appropriate (5-year schedule). Because cultural and temporal affiliation are unknown, and no ceramics are present, it is recommended that a radiocarbon sample be collected.

B:09:316 Small Structure (4-year schedule)

This is a possible Pueblo I–Early Pueblo II Formative habitation area that extends for 17 m along the base of a Muav cliff. The site consists of five rooms defined by several one-course high rock alignments. In association are two metates, a few charcoal fragments, a sparse number of lithics and ceramics, and a cluster of burned rock. Room 1 contains a charcoal scatter (possibly a hearth). Room 2 has two trough metates, burned rocks, and charcoal fragments that may represent a hearth. Rooms 3 and 4 each contain a flake. Room 5 has two flakes and a sherd. No formal tools are present. Subsequently, RCMP monitors have found additional sherds and lithics. The site is within the 1983 flood zone and was probably flooded during that time.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and has been monitored in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998).

Monitoring Data Summary

Post-occupational inundation by high-water flows, cliff spall, and the presence of ant lion holes were the primary physical impacts noted in FY92. The site appeared stable when monitored in FY93 and FY94. In FY98, monitors noted the overall stability of the site, with only minor bighorn sheep tracks and ant lions. Additional artifacts were exposed on the surface, including a Tusayan corrugated sherd and flakes. Although the site is easily accessible to visitors, there is no sign of visitor impact. Due to its proximity to the water, the site should be checked after flows of greater than 90,000 cfs.

FY99 Recommendations

The site will continue to be monitored on a 4-year schedule.

B:09:317 Roasting Feature (biennial schedule)

This site consists of two loci. Locus A is located on the upstream side of a major side canyon drainage overlooking the river and includes a large roasting pit with flakes and a complete projectile point. Locus B, located downstream of the drainage, is a thermal feature at the base of a Muav Limestone cliff. Cultural affiliation is Pai or Paiute. This site is significant to the Hualapai as it is associated with individuals who have living descendants at Peach Springs today.

Previous Work

Balsom originally recorded the site in 1986, and it was re-recorded by NPS personnel in 1990. The site has been monitored in FY93, FY94, FY95, FY96, and FY98 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1996, 1998). Trail work completed in FY97 has successfully deterred visitation.

Monitoring Data Summary

When monitored in FY92, the main concern was with visitor-related impacts (trailing and artifact movement). The site is less than 100 m away from a highly used camping beach. Physical impacts included surface erosion and animal burrowing. The site was monitored twice in FY94 and FY95. Physical impacts continued to be present, but not significantly impacting the site. Visitors continued to be the main concern, with artifact movement, trailing, collection piles, and littering observed. One visitor had unearthed a perfectly preserved pair of bent twig prickly pear tongs and left them on the surface. The tongs were subsequently collected by RCMP archaeologists.

The only access route to Locus A was obliterated in FY97. Since then, there has been no sign of visitation. Biennial monitoring will continue to assure that the trail obliteration is successful. B:09:317 is located on Hualapai Tribal lands and therefore management actions need to be determined by the Hualapai Historic Preservation office.

FY99 Recommendations

Biennial monitoring will continue at B:09:317. Because visitors are the main impact to the site, GRCA will conduct trail maintenance as needed in a joint effort with the Hualapai Tribe.

B:10:224 Thermal Feature (4-year schedule)

B:10:224 consists of two fire features adjacent to a major side canyon. Archaeologists observed artifacts on the surface during the survey. Feature 1 is a 1.5-m-diameter mounded roaster in pristine condition, rising 40+ cm above the surface. Feature 2 is the remnants of a burned sandstone slab cist eroding out of the edge of the cutbank into the main drainage. Cultural affiliation is unknown.

Previous Work

Archaeologists recorded the site in September of 1990 (Fairley et al. 1994) and the RCMP monitored it in FY92, FY93, FY94, FY95, and FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Hubbard 1999b).

Monitoring Data Summary

Initial monitoring visits to the site revealed the presence of extensive bighorn sheep trailing and trampling, active arroyo cutting adjacent to the site, wind deflation, and dune migration. No signs of visitors were recorded. The cist feature (Feature 2) was half gone as a result of cutbank erosion from the drainage. FY94 and FY95 monitors continued to note the demise of Feature 2, and recorded the relative stability of Feature 1. Bighorn sheep continued to use the area extensively, trailing and feeding through the site on a daily basis. Although data recovery should be carried out at Feature 2, the FY99 monitors recommended monitoring every 4 years due to the site's location within the APE and the potential for dam-related physical erosion.

FY99 Recommendations

The site will continue to be monitored every 4 years. Excavation of Feature 2 is recommended. The Hopi Tribe wishes to participate in the research design, data recovery, and interpretation phases of the project. After excavation, the site should be placed on the inactive monitoring list.

B:10:225 Small Structure (5-year schedule)

This site is located under a shallow overhang and on the slip face of a steep dune. It consists of two small structures along an overhang wall. A midden associated with the structures contains ground stone fragments, sherds, and lithics. Ceramics indicate a Pueblo II occupation.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored in FY93, FY94, and FY98 (Coder et al. 1994a, 1995a; Leap et al. 1998).

Monitoring Data Summary

The FY93 monitors noted considerable surface erosion, wind deflation, animal trailing, and the presence of an off-site gully, but none of it significantly impacting the site. By FY94, the site looked more stable, with dune migration having the most potential impact to the site. The site was not monitored again until FY98 because of the damage that monitoring could cause to fragile soils. When visited in FY98, monitors recorded minor rock movement and eolian activity, but no signs of visitors. The site was placed on a 5-year monitoring schedule.

FY99 Recommendations

A 5-year monitoring schedule will continue at this site due to the potential for additional artifacts to be exposed.

B:10:227 Artifact Scatter (inactive schedule)

This site is in an obscure overhang adjacent to the river. It consists of a pristine late nineteenth-century gold miner's camp and operation belonging to the Powell era of exploration. The site is historically documented and is attributed to the prospectors Riley and Stewart in 1872. They were packers for Major Powell in Kanab, Utah. Many of the artifacts are in excellent condition. As such, the site's importance cannot be underestimated. Accordingly, confidentiality and discretion regarding this very significant property is critical.

Previous Work

This site was initially recorded by NPS survey personnel in December of 1990 (Fairley et al. 1994). It was, however, observed and commented on by Edwin McKee, Grand Canyon Park Naturalist, during a river trip in 1937 (personal communication, R. Quartaroli 1994). B:10:227 was monitored in FY92 and FY94 (Coder et al. 1994b, 1995a).

Monitoring Data Summary

FY92 monitors recorded surface erosion and runoff from the cliff face as having minor impact on the site. Also in that year, footprints and movement of artifacts was observed. Those impacts probably resulted from a site visit by GRCA employees and Department of the Interior personnel. The site was stable in FY94, with only minor physical impacts. It continues to be at risk due to the materials present on the surface; FY94 monitors noted a recent set of footprints and minor movement of the artifacts. The constructed walls and gold-washing features exist in the historic high-water zone and these should be checked periodically.

FY99 Recommendations

It is recommended that the site remain on an inactive schedule, with annual visits by the GRCA River Patrol for ARPA violations.

B:10:260 Thermal Feature (inactive schedule)

B:10:260 is situated on a ridge that runs east-west adjacent to the edge of a short, unnamed side drainage. The site represents a small, limited activity area with a FCR feature and a lithic scatter. The sparse lithic scatter (10–25 items) remains well concentrated with mostly tertiary flakes. Materials include Redwall, Kaibab, and other local cherts, and Government Mountain–R.S. Hill obsidian. No tools were noted and cultural affiliation remains unknown. Monitors found a few fragments of fire-cracked limestone clustered at the west end of the site along with a few flaked items, but no charcoal staining. About 100 m separates the thermal feature and the lithic scatter.

Previous Work

This site was originally recorded in October of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored for the first time during FY95 by RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

The FY95 monitors noted the site's overall stability and the fact that there was no sign of visitors. The site is within the APE and was placed on an inactive monitoring schedule.

FY99 Recommendations

An inactive schedule remains appropriate for this site.

B:10:262 Small Structure (inactive schedule)

This site contains a few courses of partially buried masonry, with some movement of wall fall by campers. The structure also has two or three courses of masonry under the sand deposits. Six or seven lithic items were found, including a bidirectionally worked limestone tool. Materials include Redwall and other cherts, as well as limestone. In addition, monitors found one Tusayan Gray Ware sherd of Pueblo I to Pueblo III Kayenta affiliation.

Previous Work

This site was initially recorded by NPS survey personnel in November of 1990 (Fairley et al. 1994). It was monitored in FY95 by RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

FY95 monitors noted that visitation and camping had heavily impacted the site. There were no physical impacts observed. No artifacts were relocated during the monitoring visit and, due to the lack of artifacts or additional information, the site was placed on an inactive schedule.

FY99 Recommendations

The poor condition of the site and the lack of further information supports an inactive schedule.

B:11:278 Small Structure (5-year schedule)

The site consists of two features. Feature 1 is an overhang where a single metate is located. No other artifacts are present. Feature 2 is a single semicircular wall set against a Bass Limestone outcrop. It is one to two courses high and averages 50 cm in height. The wall is partially protected by an overhanging rock. There is an entryway in the northeast portion of the structure. The structure diameter (taken at its widest where it contacts the cliff wall) is 3.6 m. The distance between the "floor" and the shelter ceiling is 1.4 m. Cultural affiliation is unknown, although a single Deadmans Gray Ware sherd (which dates from A.D. 700 to 1175) was discovered during testing by RCMP staff in FY94.

Previous Work

The site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994). It was tested for significance by the RCMP staff in March 1994 (Coder and Leap 1994; Leap 1994c) and deemed eligible for the National Register by SHPO. B:11:278 was monitored for the first time in FY96 (Leap et al. 1996).

Significance testing included the placement of two 1 x 1 m test units at Features 1 and 2, which were excavated to bedrock at approximately 20 cm below present ground surface. The excavated sediment was screened through 1/4-inch mesh. The test unit at Feature 1 contained two tertiary chert flakes, charcoal flecks, and three sherds (a local corrugated, a local plainware, and a Deadmans Gray Ware). No artifacts were found in test unit 2 at Feature 2. Based upon the findings of intact subsurface cultural materials, the NPS recommended National Register eligibility for this site under Criterion D and the Arizona State Historic Preservation Officer (SHPO) concurred (Calhoun 1994; Leap 1994c)

Monitoring Data Summary

The only change noted by the FY96 monitors was animal burrowing on the back side of the structure and minor surface erosion along the dripline. There was no sign of visitors, so the site was placed on a 5-year monitoring schedule.

FY99 Recommendations

B:11:278 will continue to be monitored every 5 years.

B:11:280 Small Structure (inactive schedule)

This site is situated within a rockshelter at the base of a Tapeats boulder outcrop on the northern edge of a colluvial debris flow. Lithic remains include a broken granite "anvil" stone, a cobble hammer-stone, and a Tapeats Sandstone slab that may represent ground stone. Charcoal and burned wood were also present in the shelter, as well as the remains of a possible wall. Cultural affiliation is unknown.

Previous Work

The site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored by the RCMP staff in FY95 (Coder et al. 1995b).

Monitoring Data Summary

FY95 monitors noted no changes in the site and its stable condition supported an inactive monitoring schedule (Coder et al. 1995b).

FY99 Recommendations

The stability of the site warrants an inactive status.

B:11:282 Structure–Thermal Feature Complex (4-year schedule)

The site consists of an eroding roasting feature located at the top of a sand dune at the mouth of a small canyon, with a partial circular rock outline adjacent to the arroyo. Feature 1 is a probable wicki-up or brush structure. The organic superstructure is gone; all that remains is a cobble surface alignment. Feature 1 lies between two sheep trails and could be easily destroyed in a single flash flood. Lithics are present. This may be a late prehistoric–early historic Paiute or Pai site.

Previous Work

This site was initially recorded by NPS surveyors in 1990 (Fairley et al. 1994) and it was monitored in FY92, FY93, FY94, FY95, FY97, and FY99 (Coder et al. 1994a, 1994b, 1995a, 1995b; Kunde 1998a; Leap et al. 1997).

Monitoring Data Summary

The 1991 surveyors recorded a sheep trail adjacent to Feature 1 and a trail made by visitors between Features 1 and 2. In FY92 and FY93, monitors noted minor surface erosion, gullying and arroyo cutting (off-site), and wind deflation. No visitor-related impacts were present. In FY94 and FY95, monitors continued to stress the proximity of the feature adjacent to the side canyon, and recommended mapping with a total station. Trash left by visitors was apparent in FY95. The features remained unchanged in FY97 and FY99, so the site was placed on a 4-year monitoring schedule.

FY99 Recommendations

A 4-year monitoring schedule is appropriate for B:11:282. After the next visit, reevaluate the schedule and perhaps place the site on the inactive list if no physical impacts are observed.

B:11:283 Small Structure (inactive schedule)

This site, located at a point where the talus slope meets a schist cliff base, features two wall fragments and a few charcoal pieces. The walls, 30 m apart, are constructed of dry-laid Tapeats Sandstone. The talus may contain additional cultural materials, but a lack of artifacts prevents designating cultural affiliation.

Previous Work

The site was originally recorded by NPS survey personnel in February 1991 (Fairley et al. 1994) and it was monitored by the RCMP staff in FY94 (Coder et al. 1995a).

Monitoring Data Summary

FY94 monitors found the site in stable condition and recommended it for an inactive schedule.

FY99 Recommendations

The site should remain on an inactive schedule because of its stability.

B:11:284 Small Structure (inactive schedule)

This site consists of a pictograph and two stacked rock walls in a pour-over, situated in a shallow alcove at the top of a talus slope and at the base of a limestone cliff. No artifacts are present and cultural affiliation is unknown. The site is moderately stable and protected from the elements.

Previous Work

The site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored in FY93 (Coder et al. 1994a). Testing for significance was carried out in March 1994, and additional testing requested by the SHPO was completed in May of 1996 (Coder et al. 1995a; Leap et al. 1996). Archival medium-format photographs were taken of the pictograph in FY97 (Leap 1997b).

Monitoring Data Summary

FY93 monitors noted that the site was being impacted by runoff from the pour-over above the site, but there were no visitor impacts. They recommended that the site be tested to determine its significance. In March of 1994, two 0.5 x 0.5 m test units were placed between the rock walls and excavated to a depth of 33 cm and 25 cm respectively (Leap 1994c). The fill was screened through 1/4-inch mesh, and two quarter-sized charcoal flecks were found. Because it was not possible to reach sterile soil in the time allotted for testing, the SHPO requested that archaeologists return to the site at a later date and excavate a test unit to sterile soil. The RCMP staff returned to the site in May of 1996 and excavated a 0.5-m test unit to sterile soil (Leap 1996c). No cultural material was found. However, a red pictograph in the form of a zoomorph was discovered on the Bass Limestone above the unit. RCMP archaeologists recommended that B:11:284 be considered eligible for National Register listing under Criterion D and the SHPO concurred.

FY99 Recommendations

An inactive monitoring schedule is appropriate for B:11:284. It is suggested that the GRCA River Patrol make annual routine visits to the site to check for ARPA violations.

B:13:001 Small Structure (4-year schedule)

This is a small multicomponent site consisting of remnant wall features dividing probable activity areas against a Bright Angel Shale cliff. Both walls are dry-laid and only one to two courses high. Associated with the walls is a small hearth or roasting feature with bone, charcoal, and a couple of slabs. Other prehistoric artifacts include a few Redwall Chert and river cobble flakes, a mano, and a polished cobble. The site's historic component includes a small trash pile of glass and tin cans dating from the 1940s and 1950s. Cultural or temporal association for the prehistoric component is unknown.

Previous Work

The site was originally recorded in 1969, was re-recorded by NPS survey personnel in 1990 (Fairley et al. 1994), and was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

FY97 monitors noted that a small but active talus slope adjacent to the northwest wall of Feature 1 was affecting the feature by filling debris behind the wall and moving slabs downslope. Increased rodent activity and minor FCR movement were also mentioned. Visitor impacts included a trail from the main drainage to just below the site, and movement of rocks. The glass jar in the historic debris area was moved but remained in the vicinity. For these reasons, trail obliteration was recommended in FY97. In FY99, the RCMP staff assessed the site for trail obliteration, but did not perform the work due to heavy vegetation growth and fragility of the soils (Kunde 1999b).

FY99 Recommendations

A 4-year monitoring schedule is appropriate due to the activity described above. Reassess the schedule in 4 years and possibly place the site on the inactive list if it appears stable.

B:14:093 Thermal Feature (3-year schedule)

This aceramic site is a limited activity area of unknown cultural affiliation. It consists of two fire features and a single lithic. The site is situated on highly deflated overlying Tapeats Sandstone ledges adjacent to a side canyon drainage.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998).

Monitoring Data Summary

The FY90 survey crew recorded surface erosion, off-site gullying, and minor animal disturbance impacting the site. FY92 and FY93 monitors noted the same natural erosion, with the addition of dune migration and wind deflation. No visitor-related impacts were recorded. The site was stable in FY94, although monitors noted that Feature 2 could be impacted by major side canyon flooding. There was no evidence of gullying. Feature 1 showed increased eolian erosion in FY98, exposing up to 50 percent more rock. Data recovery may be necessary at Feature 1 in the future.

FY99 Recommendations

Monitor this site every 3 years. It is recommended that GRCA assess the site for planting vegetation to stabilize the dunes.

B:14:108 Artifact Scatter (5-year schedule)

This aceramic site consists of a relatively long, but shallow Tapeats Sandstone rockshelter with several grinding tools. It is located along a flat narrow ledge caused by spalling of the local cliff face. Of the observed ground stone, two large Tapeats Sandstone slabs show obvious grinding wear, with pecking on a single surface and shaped margins. Two other Tapeats slab fragments appear smooth on one surface, but may not be grinding tools. Two sandstone river cobble manos are also present. Locus B contains one of the manos and a grinding slab; all of the other artifacts are at Locus A. The site was probably occupied on a transient basis, possibly focused on plant food gathering and processing. Cultural affiliation is unknown.

Previous Work

The site was initially recorded in 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997).

Monitoring Data Summary

Monitors in FY92 and FY93 recorded animal trailing and rock spall. No signs of human visitation were observed. The FY97 monitors noted that Locus B showed minor exfoliation on some slabs along the wall, but impacts were minor. The artifacts were well protected, but spalling posed a threat. They found a pecked stone between the dripline and the shelter wall. No remedial actions were warranted at the time, and a 5-year monitoring schedule was recommended.

FY99 Recommendations

Continue monitoring this site on a 5-year schedule. The site may be reevaluated for the inactive list if it is found to be stable during the next monitoring episode.

B:15:097 Artifact Scatter (5-year schedule)

This site consists of the remains of the William Bass cable car system. The cables (cut by Park officials on the right bank in 1971) extend from the river upslope 30 m to a schist outcrop. The cable car is located 7 m downslope from the outcrop. Locus A includes several cables of varying widths and the cable car. Locus B consists of related historic artifacts, campfire remnants, rock features, a platform, and a constructed trail. The cable system was used during the early decades of the twentieth century.

Previous Work

Euler and Jones initially recorded the site in July of 1978. NPS archaeologists re-recorded the site in 1990 (Fairley et al. 1994). Monitoring occurred in FY97 and FY99 (Hubbard 1999b; Leap et al. 1997).

Monitoring Data Summary

FY97 monitors noted the overall stable condition of the site, although eolian processes and surface erosion were at work. Cryptogamic soils were abundant. Visitors, however, continued to trail through and around the site, rearranging historic artifacts and creating collection piles. The site is well known to river-runners due to its historic significance. A popular hiking trail is located within view of the site. The FY97 monitors recommended that a complete inventory of all artifacts be conducted in FY98. The artifact inventory was completed in FY99. The monitors noted that visitation is dependent on river fluctuations due to limited camps in this stretch of the Colorado River.

FY99 Recommendations

The RCMP should monitor the site in 5 years due to the minor physical impacts noted. It is recommended that the GRCA River Patrol periodically visit the site to check for ARPA violations.

B:15:119 Artifact Scatter (5-year schedule)

This site consists of a sparse scatter of Redwall Chert lithic tools and debitage, ceramics, and charcoal. The artifacts are concentrated along the dripline of a shallow, sheltered area at the base of the Tapeats Sandstone. The ceramics indicate a Basketmaker III–Pueblo I presence.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998).

Monitoring Data Summary

In 1990, archaeologists recorded sheet washing along the dripline of the shelter, and a small drainage forming off-site to the north. RCMP monitors visited the site in FY94, noting an animal trail and surface erosion downslope of the tool 1–5 area. The small drainage noted in 1990 had apparently filled in. There continued to be no sign of visitors, so the RCMP staff placed the site on a 4-year monitoring schedule. FY98 monitors commented on the site's stability, deciding to monitor the site again in 5 years. The potential exists for surface erosion and animal trailing, which could expose additional artifacts.

FY99 Recommendations

A 5-year monitoring schedule will continue.

B:15:120 Small Structure (3-year schedule)

The site consists of a small "platform," jutting from a rocky slope. This enigmatic flat space is surrounded by broken and rocky terrain. The slopes of the feature are covered with what could be construed as fire-cracked rock, and are rimmed by some larger flattened boulders; apparently these were intentionally placed to keep the flat surface from eroding away. The site is circumvented by two game trails. Several crew members brainstormed the nature of this feature; possible functions include a large, eroding mescal pit, a tent platform, a helicopter pad, a hunting blind, or a photographer's or surveyor's platform. No artifacts are present and cultural affiliation is unknown.

Previous Work

The site was first recorded by NPS surveyors in 1990 (Fairley et al. 1994), and it was monitored in FY92, FY93, and FY97 (Coder et al. 1994a, 1994b; Leap et al. 1997).

Monitoring Data Summary

FY92 monitors noticed the imprint of a helicopter on the surface of the site. There were no other impacts. Vegetation had increased on the surface by FY93, stabilizing the area. Monitors continued to speculate about the feature's function. Perhaps it was an older, eroding FCR pile with historic use on top. The site was not monitored again until FY97. The FY97 monitors recorded the presence of an animal or human trail running from the beach, west of the feature, and above the site heading north. Signs of coyote and deer were present. A golf ball was found just below the feature and collected as trash. Due to the trail and recent trash, the monitoring schedule was changed to every 3 years to determine how frequently the trail is used, and who is using it. The RCMP staff also recommended testing for subsurface deposits.

FY99 Recommendations

The RCMP staff recommends limited subsurface testing for site integrity. Upon completion and dissemination of testing results, the monitoring schedule will be reevaluated.

B:15:122 Small Structure (inactive schedule)

The site consists of three partial walls located among large boulders 50 m downstream from the lower Bass Camp. The walls appear crude and expedient and reach a maximum height of 40 cm. They are well hidden and generally protected from the elements. The site is construed as historic because the only observed artifact was a piece of saw-cut animal bone.

Previous Work

This site was first recorded in 1991 by NPS survey personnel (Fairley et al. 1994) and it was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

The FY91 surveyors noticed the human-made trails from Bass Camp and commented that visitors may have collected any previous artifacts. When visited in FY97, monitors observed that one rock from the east wall had fallen from the structure. The west and south walls were stable with no evidence of change. The trail that leads to Bass Camp is nearby, as are spur trails that branch off and lead to scenic overlooks. There is trailing in the direct vicinity of the site, adjacent to the large boulders in the historic shelter area. A cigarette butt was found and collected. The sawed bone could not be located. The RCMP staff decided to monitor the site in 3 years for additional changes. Impacts were most likely visitor related because of the site's proximity to Bass Camp.

FY99 Recommendations

This site should be on an inactive schedule with periodic monitoring by the GRCA River Patrol for ARPA violations. Testing for site integrity is recommended. The Hopi Tribe has requested that their cultural advisors visit the site to determine whether it has any cultural value for the Hopi people.

B:15:124 Rock Art (inactive schedule)

This site consists solely of the historic inscription: George W. Parkins Washington, D.C. 1903. The name is carved into water-polished granite at an old ferry crossing. This inscription is one of the most beautifully executed works along the entire river corridor. This is also the location of the W.W. Bass ferry crossing prior to 1904. Photographs dating back to 1900 exist for this particular beach.

Previous Work

This site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored annually by the RCMP staff from FY92 to FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b). RCMP archaeologists photographed the inscription with a medium-format camera before the research flow of 1996 (Balsom and Larralde 1996). Aerial surveillance was also conducted of the historic beach.

Monitoring Data Summary

FY92–FY95 monitors recorded the overall stability of the inscription, but noted that surficial weathering will continue. Potential threats were high-water flows and vandalism. B:15:124 was monitored in September of 1998 by the GRCA River Patrol, who observed recent footprints on the beach but no impacts to the inscription.

FY99 Recommendations

B:15:124 will remain on an inactive monitoring schedule. The GRCA River Patrol Office should monitor this site for ARPA violations.

B:15:127 Roasting Feature (5-year schedule)

B:15:127 is a Pueblo II site consisting of a shelter beneath a Tapeats Sandstone overhang at the base of a cliff. It is situated on a sand bench with two features: a roughly circular stone alignment that may be the remains of a granary and a roasting feature eroding out of the western slope of the terrace. A single flake, three North Creek Gray Ware sherds, some scattered charcoal, and some animal bone complete the site. Buried artifacts or features could be present, and datable materials are present.

Previous Work

This site was discovered and recorded in October of 1990 (Fairley et al. 1994), and was monitored in FY95 and FY99 (Coder et al. 1995b; Kunde 1998a).

Monitoring Data Summary

The site is well protected by the Tapeats Sandstone overhang and not easily discernible from the river. FY95 monitors noted minimal downslope movement of the stone alignment, burial or removal of a sherd, and downslope movement of fire-cracked rock. A faint sheep trail intersected the roaster on the south side and minor rodent burrowing was evident. There were no signs of human visitation. The site was placed on a 3-year monitoring schedule. In FY99, the features appeared stable with only minor evidence of animals passing through.

FY99 Recommendations

Continue monitoring this site every 5 years due to the likelihood of newly exposed artifacts as a result of sediment depletion.

B:15:128 Artifact Scatter (5-year schedule)

This is a multicomponent site with a prehistoric (possibly Archaic) lithic scatter and a turn-of-the-century historic trash scatter. The prehistoric scatter is composed of three projectile points, 100+ flakes, a broken graver, and a couple of biface fragments. Two of the points were Elko items and the third was a Gypsum-like point, but with a wider than usual base. Debitage reflects biface thinning; no ground stone, ceramics, or tools suggestive of core reduction are present. The historic camp includes a drill jack, cartridges, two cans, a black pepper tin, and a railroad spike. The multiple use of this area suggests that it was a favorable location for various cultures and activities.

Previous Work
Original recording of this site was in 1990 by NPS archaeological surveyors (Fairley et al. 1994). The site was monitored in FY97 (Leap et al. 1997).

Monitoring Data Summary
The FY97 monitors noted that the site was very stable with only minor surface erosion in the low areas. The vegetation appeared unchanged except for noticeable growth in the prickly pear cacti. A trail along the bench showed use, but the site appeared unvisited. Monitors were unable to relocate the spike, drill bit, or projectile points. It is unclear if they were "collected" by a visitor or not. The RCMP staff recommended monitoring every 5 years because the site is fairly stable with the exception of minor visitor disturbance.

FY99 Recommendations
Monitor this site in 5 years. If the site is found in good, stable condition during the next monitoring episode, the site will be placed on the inactive schedule.

B:15:134 Small Structure (inactive schedule)

B:15:134 consists of a crude, single-course wall constructed of unshaped travertine boulders with a large piece of charcoal in front of the wall. The wall is situated under a large travertine boulder that provides shelter, ranges from one to three courses high, and measures 2.4 m long. A possible second alignment of five boulders roughly parallels the main alignment. Cultural affiliation is unknown.

Previous Work
The site was originally recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and was monitored by RCMP staff in FY97 (Leap et al. 1997).

Monitoring Data Summary
FY97 monitors recommended an inactive schedule for the site due to its stable condition and lack of threats from physical or visitor-related impacts (Leap et al. 1997).

FY99 Recommendations
Due to its stable condition, an inactive schedule remains appropriate for this site.

B:15:135 Small Structure (5-year schedule)

This site is located on the west side of a drainage at the base of the Tapeats Formation. It consists of a rockshelter with upright sandstone slab walls outlining a habitation area. The associated artifacts (a few flakes, several lithic tools, and a sherd) suggest a late prehistoric–early historic Pai association. The site contains possible buried artifacts and architectural features.

Previous Work
This site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored in FY93, FY94, FY95, and FY96 (Coder et al. 1994a; 1995a, 1995b; Leap et al. 1996).

Monitoring Data Summary
When recorded in FY91, the site was experiencing sheet wash, deflation, and defoliation. The FY93 monitors recorded continued deflation and deterioration, and noted that sheep sometimes traversed the feature. The nearby trail and footprints were probably from river-runners going to the so-called Powell steps. The site remained stable when observed in FY94 and FY95. Eolian deposition and spalling of the Tapeats Sandstone were noted, but these processes were not impacting the site to a great degree. Bighorn sheep continued to utilize the area. In FY96 the site was placed on a 5-year monitoring schedule because of its stability and lack of visitation. The greatest potential impact to the site was spalling from the overhang.

FY99 Recommendations
Monitor this site in 5 years. If it is found in stable and good condition, the site will be placed on the inactive monitoring schedule.

B:15:139 Artifact Scatter (4-year schedule)

The site consists of two flat areas sheltered by shallow overhangs at the base of a cliff with historic and prehistoric artifacts. Two components are indicated: Pueblo II and early twentieth century (1900–1930) Euro-American. Shelter A is a small area with historic cans, one sherd, a granite cobble mano, and a large mammal bone, possibly a burro. Shelter B contains a schist rock alignment, two metal plates, and one metal can. The historic artifacts may be related to trail building or mining activities by Bass.

Previous Work

The site was originally recorded by NPS personnel in 1990 (Fairley et al. 1994) and it was monitored in FY97 (Leap et al. 1997).

Monitoring Data Summary

Archaeologists recording the site noticed scattered pockets of silty, tan-colored sand that may have been deposited by flood waters in the distant past. There were no discernible erosional impacts to the site. By FY97, Shelter A had experienced animal burrowing near the base of the schist wall. The cans had been scattered throughout the shelter, apparently by animals. Shelter B was stable. Minimal bighorn sheep and packrat activities were evident throughout the site. No visitor-related impacts were observed. A 4-year monitoring schedule was selected for this site, due to the chance that new artifacts might be exposed.

FY99 Recommendations

Monitor this site in 4 years. If the site is in stable condition, the monitoring schedule may be re-evaluated and the site placed on the inactive monitoring schedule.

B:16:003 Small Structures (inactive schedule)

The site consists of five well-defined masonry structures aligned along the base of a schist slope. The structures are all multicoursed of tabular schist. Sherds and lithics are lightly dispersed on the terrace, but are definitely concentrated in front of Feature 3 at the present time. Any other prehistoric remains, such as trash deposits, have been eroded away or taken by visitors. The 1990–91 surveyors reported an Elko Corner-notched projectile point and a mano. Ceramics indicate a Pueblo II affiliation.

Previous Work

Archaeologists initially recorded the site in 1978 and NPS survey personnel re-recorded it in 1991 (Fairley et al. 1994). GRCA crews conducted trail obliteration work here prior to 1993. The RCMP monitored B:16:003 in FY93, FY95, FY97, FY99 (Coder et al. 1994a, 1995b; Kunde 1998a; Leap et al. 1997). Monitors have not recommended any remedial actions for this site.

Monitoring Data Summary

Archaeologists recording this site observed that the 1983 high water eroded and slumped the cut at the edge of the terrace upon which the site was located. The 1983 high water also prompted increased visitation by river-runners walking passengers around the rapid. Well-used river camps were known in the area. Visitation continued to occur from FY93 through FY97 as observed by the RCMP monitors. Trailing and collection piles were recorded, but the features themselves remained stable.

FY99 monitors observed recent sheep tracks, rock movement, and currently inactive off-site gullies that may cause impacts in the future. The trail, now entrenched, was visible below the site. The site is monitored at least once a year by several tribes, so FY99 monitors recommended that the RCMP staff discontinue biennial monitoring and conduct appropriate preservation actions based upon the results gathered by tribal monitoring.

FY99 Recommendations

An inactive monitoring schedule is appropriate for this site. The GRCA trail crew should maintain single-trail access to the site because many tribal groups stop here. The RCMP will implement remedial mitigation upon the request of the tribes.

B:16:257 Small Structure (inactive schedule)

B:16:257 consists of a rock wall with two sherds and a scatter of historic trash. The sherds are oddly unrelated: a brownware and Tsegi Orange Ware. They were found more than 30 m apart and may have been carried onto the site by tourists.

Previous Work

This site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored in 1994 (Coder et al. 1995a).

Monitoring Data Summary

The site is presently stable. It is located near a major trail, but is not likely to be impacted by visitors. The probability of physical impacts is also low. This site is very obscure and is situated on Schist gravels.

FY99 Recommendations

This site will remain on the inactive monitoring schedule.

B:16:258 Small Structure (inactive schedule)

B:16:258 consists of two historic masonry features. Feature 1 represents an L-shaped alignment of limestone, schist, and granite elements measuring 3.2 x 2.1 m. This feature is adjacent to a trail and one to two courses remain. Feature 2 consists of a leveled spot with schist walls of 7–12 courses. Two other rock alignments are situated above Feature 2, as well as two possible tent platforms. Artifacts include a friable piece of saw-cut wood, bailing wire, and rubber fragments. The site may date to the turn of the century.

Previous Work

The site was originally noted by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored by RCMP staff in FY97 (Leap et al. 1997).

Monitoring Data Summary

The two historic structures remain from the Bright Angel suspension bridge. Phantom Ranch staff maintains these structures, so they have been placed on the inactive list.

FY99 Recommendations

The site should remain on the inactive schedule per monitoring by Phantom Ranch staff.

B:16:259 Roasting Feature (5-year schedule)

The site is composed of one FCR midden or roasting pit with an associated scatter of lithics and sherds. The flakes are of white-tan Redwall Chert; less than a dozen were observed. No tools were noted. The roasting pit is 2 m in diameter, with fire-cracked rock distributed down the slope for about 7 m. Elements are of schist and granite, within a matrix of charcoal-stained soil. This appears to be a Pueblo I–III Formative site. It is on a sand-covered talus slope adjacent to a well-used hiking trail.

Previous Work

This site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored annually from FY92 to FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b).

Monitoring Data Summary

The 1991 surveyors recorded deflation, sheetwashing, and gullying. A trail cut through the edge of the roasting feature, connecting the nearby hiking trail with the beach. In FY92, surficial sheet washing and moderately active arroyo cutting were noted, along with wind deflation, bank slump, and dune migration. It was noted that the arroyo adjacent to the feature was causing instability. A trail was still present. By FY93 the arroyo had become vegetated. Fire-cracked rock continued to erode down the slope. There was no sign of trail use. Minor surface erosion was recorded in FY94, as well as the presence of the hiking trail above the site. The gully or arroyo (mentioned in previous monitoring visits) was stable when visited in FY95, with heavy growth of cryptogamic soil and vegetation. The site was placed on a 5-year monitoring schedule due to its stability. Future threats included the location of the roaster on a moderately steep dune, and the site's location adjacent to a hiking trail.

FY99 Recommendations

Continue a 5-year monitoring schedule. If gullies and arroyos remain stable, consider putting the site on the inactive monitoring schedule.

B:16:261 Small Structure (inactive schedule)

The site consists of a dry-laid masonry room abutting a schist outcrop and an associated scatter of lithics and ground stone. The site is situated on a terrace adjacent a creek. Just south of the room is a possible sheep midden or artifact concentration with an ashy oil stain, flakes, and biface fragments. Nearby is a boulder with a smoothed, circular surface and, lying adjacent, a unifacially ground cobble. No sherds were found, although the site has probably been picked over. This site may be associated with the Puebloan structures across the creek, such as B:16:003. The site was originally recorded as part of B:16:003.

Previous Work

This site was initially recorded by NPS survey personnel in February of 1991 (Fairley et al. 1994) and it was monitored in FY93 and FY94 (Coder et al. 1994a, 1995a).

Monitoring Data Summary

The FY91 archaeologists noted that the site was above a major rapid on a terrace overlook that is probably visited by every trip that comes down the river. A trail was present immediately south of the site, with a path leading to the room. None of the trails had begun gullying, except on the terrace slope. Physical impacts included spalling, deflation, and sheet erosion of the midden.

In FY93, sheet washing, animal-caused erosion, and wind deflation were noted. Visitor impacts included trailing and soil compaction. By FY94 the site was stable, with only minor trailing in the vicinity. The FY94 monitors indicated that the site was not affected by flows in the main channel of the river, was outside the parameters defining the current project, and should be discontinued. The site is currently on an inactive monitoring schedule.

FY99 Recommendations

Keep this site on the inactive monitoring schedule. The site is situated on Schist cliffs and is not prone to deep arroyo or gully cutting.

B:16:262 Historic Structure (inactive schedule)

B:16:262 is the USGS gauging station located 300 m above the Kaibab suspension bridge. The station was constructed in the early 1920s and is clearly visible from the river.

Previous Work

The gauging station, which has been a landmark in the central river corridor for more than 70 years was officially recorded in September of 1992 (Fairley et al. 1994). The structure was monitored in FY92, FY93, and FY94 (Coder et al. 1994a, 1994b, 1995a).

Monitoring Data Summary

The site is presently stable. Unusually high water is the greatest threat to the structure. It is recommended that a small interpretive sign be placed on the footpath at B:16:262.

FY99 Recommendations

B:16:262 will remain on the inactive monitoring schedule.

B:16:364 Artifact Scatter (inactive schedule)

This is a marginal site consisting entirely of a sparse and somewhat dispersed scatter of lithics in an area measuring 15 x 20 m. The site is within an alluvial-colluvial debris flow or fan at the mouth of Bright Angel Creek. All of the artifacts are of the same material: white or gray Redwall Chert. The flakes appear to be the result of unintensive core reduction. No formal tools were observed, but one flake with a battered dorsal surface was noted. Visitors have trampled much of the area, and the site is part of a GRCA revegetation project. It may also have been impacted by creek or high river flows. Cultural affiliation is unknown, though the site may be affiliated with the Bright Angel site nearby.

Previous Work

This site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY93 and FY97 (Coder et al. 1994a; Leap et al. 1997).

Monitoring Data Summary

The 1991 archaeologists noted that the site had received considerable impacts from both physical and visitor-related processes. The site is close to the main trail to Phantom Ranch, so there are trails throughout. In addition, GRCA staff performed major revegetation work here. High water flows from the creek and river may have impacted the site in the past. The site was stable when visited in FY93 and FY97, and is currently on the inactive list.

FY99 Recommendations

The site will remain on the inactive list, and GRCA will continue trail maintenance.

C:02:094 Historic Structure Biennial Schedule

The recorded portions of this site consist of a dugway that accessed the lower ferry on the left bank, numerous historic inscriptions associated with the dugway and ferry crossing, and large wooden posts on the right bank that were also associated with the crossing. These are thought to be mooring posts. The ferry was established in 1873 and used until 1898; it was built as a means of avoiding the Lee's Backbone road. There are many historic names and dates written in axle grease or tar on a rock surface, plus four carved initials at the base of the dugway. Other inscriptions are located at the top of the dugway, but were not re-recorded by the 1990–91 survey crews. Most of the names belong to Mormon immigrants traveling on the Honeymoon Trail between the outposts on the Little Colorado River and the temple in St. George, Utah. Dated names cluster from 1890 to 1898 and were executed in grease and charcoal on a rock while passengers waited for a ride across the river. There is a rock wall at the panel between the upstream and downstream portions of the panel, plus modern graffiti. RCMP monitors found two Tusayan corrugated sherds and several secondary flakes eroding from the surface approximately 4 m below the panel in FY98. This new information changes the site class to both historic and prehistoric.

Previous Work

Portions of the site were originally recorded as part of the Lees Ferry Historic District by Geib in the 1980s under site number C:02:011. The 1990–91 survey crew, after recording both right and left bank areas, decided to isolate the lower ferry crossing as a separate site, which was designated C:02:094 (Fairley et al. 1994). The site was monitored in FY92, FY93, FY96, FY97, FY98, and FY99 (Coder et al. 1994a, 1994b; Kunde 1998a; Leap et al. 1996, 1997, 1998). GRCA and RCMP staff removed graffiti associated with the panel in 1996 and documented the inscriptions with a medium-format camera in FY97 (Leap et al. 1997).

Monitoring Data Summary

The 1991 archaeological surveyors recorded that the upstream portion of the panel with the inscriptions was beginning to bleed, and other portions were suffering from wind abrasion. There was heavy modern use of the area, with trash littering the site and a modern fire ring under the overhang. Numerous recent etchings, scratched or written in charcoal, were on the panel, detracting from and in some cases obliterating the historic inscriptions. From FY92 through FY99, the site continued to experience primarily visitor-related impacts, due to fishermen and hikers using the established trail. Monitors frequently removed trash from the shelter and surrounding area. Vandalism in the form of graffiti continued to be a problem, prompting the RCMP staff to remove some of it in FY96. The FY98 monitors commented that it might be beneficial to place a sign at the top of the trailhead, but prior to that the RCMP staff would have to consult the Navajo Nation.

The FY99 monitors indicated that the site would continue to be impacted by anglers, who hike down to the river and through the site. In addition to the RCMP staff, GRCA River Patrol and Science Center personnel also monitor the site. The FY99 monitors recommended bulk sampling of the subsurface prehistoric deposits due to the recent identification of prehistoric sherds found within the site.

FY99 Recommendations

RCMP personnel will monitor the site biennially. The GRCA River Patrol will stop here during the summer months to check for ARPA violations. The recommendation is for GRCA to remove graffiti and place an interpretive sign at the trailhead, after consultation with the Navajo Nation. In addition, the prehistoric component should be tested for any intact, subsurface remains.

C:05:004 Artifact Scatter (inactive schedule)

This site is the equipment cache of a nineteenth-century trapper or prospector located inside a small cave. The site contains a handful of historic artifacts, such as traps, tools, and kitchen objects.

Previous Work

Members of a USGS trip took the first photograph of this site in 1923. This photograph, taken by Lewis R. Freeman, was published in *National Geographic* in 1924 (Freeman 1924). Euler (GRCA) assigned a site number and recorded a list of artifacts in 1975. The site was re-recorded by the 1990–91 survey (Fairley et al. 1994). The RCMP staff monitored the site in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998). In FY98, the RCMP staff completed an inventory of the artifacts and the site was monitored by GRCA River Patrol rangers for ARPA violations.

Monitoring Data Summary

In 1990, archaeologists commented that the site had been frequently visited by river trips. Artifacts have disappeared since the site was first recorded, plus scouring by river floods has taken a toll. When the USGS expedition visited this site in 1923 there was considerably more sand in the cave than at present. There have been no physical changes to the site from FY92 through FY98. Modern visitors occasionally leave "offerings" such as a wood carving or a candle. The FY98 monitors noted that the artifacts had been moved to the southeast side of the cave. The current recommendation is to keep the site on an inactive schedule and monitor it only before and after experimental flows over 45,000 cfs. The archaeological information at this site is exhausted due to the complete artifact inventory in FY98, and the lack of subsurface deposition.

FY99 Recommendations

C:05:004 will be kept on the inactive monitoring list, with annual visits by the GRCA River Patrol for ARPA violations.

C:05:007 Rock Art (inactive schedule)

C:05:007 represents an historic inscription of Harry McDonald's initials ("H Mc") on the trunk of a juniper tree in Marble Canyon. McDonald was a member of the Stanton expedition during the lower half of Stanton's first trip in 1889 and during the upper half of Stanton's second trip in 1890.

Previous Work

The site was originally recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored by the RCMP staff in FY95 (Coder et al. 1995b). Medium-format photography of the rock image was completed in FY97 (Leap 1997b).

Monitoring Data Summary

The site has remained stable since the original survey.

FY99 Recommendations

The stability of the site warrants its continued inactive schedule.

C:05:009 Small Structure (inactive schedule)

C:05:009 is a small, temporary-use rockshelter of Formative affiliation that contains a collapsed dry-laid wall, a sparse lithic scatter, a concentration of charcoal, and three sherds. Flakes are made of Redwall Chert and chalcedony. No tools are present. Surveyors noted one low-fired, sand-tempered brownware sherd and two Tusayan Gray Ware sherds.

Previous Work

This site was first recorded in October of 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored during FY95 by the RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

Monitors observed no signs of visitation or visitor-related impacts and noted the site's overall stability. This site was kept on an inactive schedule.

FY99 Recommendations

An inactive schedule for the site remains appropriate due to its stability.

C:05:039 Special Activity Locus (inactive schedule)

The site consists of a single North Creek Corrugated jar cached in a 1-m-high Redwall Limestone "cavern." The jar was toppled and broken by a large chunk of fallen limestone so that the vessel is now in four large pieces, currently nested alongside each other on their sides. The 1990–91 survey crew made no attempt to move either the sherds or the rock to see what might be underneath them. The ceramic type indicates a Pueblo II Virgin affiliation.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored by RCMP archaeologists in FY97 and FY98 (Leap et al. 1997, 1998). The GRCA River Patrol monitored the site in June of 1998, and will continue periodic visits to the site.

Monitoring Data Summary

No physical impacts have been observed at this site since it was first photographed in 1990. FY97 monitors noted the presence of footprints leading up the dune toward the site, and collected a 1981 dime 4 m in front of the pot. The pot itself appeared unchanged. The FY98 recommendation was to have the GRCA River Patrol monitor the site for ARPA violations during the summer months because it is easily accessible to human visitation. The pot is properly documented and the archaeological information potential is exhausted. It will be monitored by RCMP archaeologists before and after experimental flows of over 45,000 cfs.

FY99 Recommendations

C:05:039 will remain on the inactive monitor list, with periodic monitoring for ARPA violations by GRCA River Patrol rangers. A medium-format photograph of the vessel would really complete documentation at this location.

C:06:002 Rock Art (inactive schedule)

C:06:002 consists of an inscription documenting the time and place of the death of Frank Brown. Mr. Brown drowned during the Stanton railroad survey expedition of 1890. Boatman Peter Hansbrough, who drowned several days later, completed the inscription. The inscription was placed on the water-worn surface of the Coconino Sandstone. Paint from boats that parked directly on the inscription during the high water of 1983 is still present.

Previous Work

This site was initially recorded as an historic property by Euler in 1972, and was recorded by the GCRC survey crew in 1990 (Fairley et al. 1994). The site was monitored annually by the RCMP in FY92–FY95 (Coder et al. 1994a, 1994b, 1995a, 1995b). The RCMP staff completed medium-format photography at this site prior to the research flow in 1996 (Balsom and Larralde 1996; Leap 1996d).

Monitoring Data Summary

The 1990 survey crew noted that the inscription had been greatly impacted by high-water flows and was now faint. Observation by GRCA personnel since 1982 corroborated this trend. RCMP monitors from FY92 through FY95 commented that the site was stable, but visitation was high. The greatest threats to the site included high-water flows in excess of 70,000 cfs and vandalism.

FY99 Recommendations

The site will remain on the inactive monitoring list.

C:06:004 Rock Art (inactive schedule)

C:06:004 is situated on the back wall of a small alcove in the Supai Formation. The site features an historic petroglyph, depicting a geologist's rock hammer and the letters "U.S.G.S.," constructed during a 1923 survey expedition.

Previous Work

The site was originally recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994). The site was also monitored during FY92, FY93, and FY94 because of its potential for inundation when flows exceed 50,000 cfs (Coder et al. 1994a, 1994b, 1995a).

Monitoring Data Summary

Innundation during high flows, weathering, and potential visitor impact prompted FY94 monitors to place the site on an annual schedule (Coder et al. 1995a). When monitored in FY95, the site appeared stable and so was placed on the inactive list in FY96 (Coder et al. 1995b; Leap et al. 1996). Medium-format photography was completed during the 1996 research flow (Balsom and Larralde 1996; Leap 1996d).

FY99 Recommendations

The stability of the site permits a continued inactive schedule.

C:06:005 Rock Art (inactive schedule)

This site consists of a rock image of three pecked figures on a Supai Sandstone bedrock ledge. An anthropomorph, a pecked line, and a U-shaped element comprise the figures. The elements have experienced only minimal wind and water erosion. Cultural affiliation is unknown.

Previous Work

The site was initially recorded in 1979, was re-recorded in 1989 by NPS archaeologists (Fairley et al. 1994), and has been monitored annually by the RCMP staff from FY94 through FY98 (Coder et al. 1995a, 1995b; Leap et al. 1996, 1997, 1998). The GRCA River Patrol monitored the site in August of 1998. The Southern Paiute Consortium trip stopped here in September of 1994; Hopi and Zuni personnel visited the site in 1995. The site, and thus the immediate area, has cultural significance to the Southern Paiute Consortium, Hopi, and Zuni people. Medium-format black-and-white and color prints were taken for archival purposes prior to the 1996 research flow (Balsom and Larralde 1996).

Monitoring Data Summary

In 1990, archaeologists observed that the petroglyph panel had undergone natural exfoliation, which had removed parts of the extremities of two elements. Boaters, hikers, and fishermen are frequent visitors. The site looked stable to the FY94 through FY98 monitors. Impacts included the slow process of natural exfoliation and human visitation. In FY97, there was an attempt made to remove with water and sand, an inscribed "X" on a boulder near the petroglyph.

The 1996 research flow of 45,000 cfs did not impact the site. The current recommendation is to have the GRCA River Patrol check on this site in the summer months. All the archaeological information has been recorded, and throughout the last several years, no disturbances have been noted on the petroglyph. This site was recommended for graffiti removal in FY96. Some work was done on the graffiti in FY97, though more work was recommended.

FY99 Recommendations

All information at this site has been collected. The site will remain on the inactive monitoring list, with annual monitoring for ARPA violations by the GRCA River Patrol rangers. Graffiti removal is unnecessary, as noted by PA signatories in April of 1999.

C:06:008 Small Structure (inactive schedule)

This site consists of two structures on bedrock ledges adjacent to the river. Feature 1 is a D-shaped wall outline abutting the back of a small overhanging rockshelter. Feature 2 is a possible rectangular wall outline surrounding the base of a low ledge above Feature 1. No artifacts are present, and the site area has probably been inundated on occasion, due to the presence of driftwood.

Previous Work

The site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994) and it was monitored in FY92 and FY96 (Coder et al. 1994b; Leap et al. 1996).

Monitoring Data Summary

When recorded, archaeologists mentioned only the possibility of inundation during high-water floods as a potential impact. The FY92 monitors noted that the site was stable, and probably not historic, but of modern origin. When monitored in FY96, minor spalling had occurred. The FY96 monitors thought that Feature 2 was probably not a cultural feature. Consequently, the recommendation was to test Feature 2 and put the site on a 5-year monitoring schedule. The site would be monitored prior to its scheduled visit if there were flows in excess of 50,000 cfs.

FY99 Recommendations

Place this site on the inactive list. Test Feature 2 for intact cultural remains. The monitoring schedule will be re-evaluated based on the findings of Feature 2 testing. The Hopi Tribe recommends employing Hopi cultural advisors in the determination of whether this is a cultural manifestation or not.

C:06:010 Small Structure (inactive schedule)

C:06:010 is located within a shallow rockshelter and consists of a crude, dry-laid wall outline with two parallel walls of a single course of undressed sandstone. One section of the wall contains four to five courses of thin slabs. No other rubble or artifacts were noted and cultural affiliation remains unknown.

Previous Work

The site was originally recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored by the RCMP staff in FY95 and FY99 (Coder et al. 1995b; Kunde 1998a).

Monitoring Data Summary

Monitors noted only minimal rock movement during their FY95 trip and no change in FY99.

FY99 Recommendations

An inactive schedule should be appropriate due to the stability of the site.

C:09:005 Pueblo (inactive schedule)

C:09:005 consists of at least three (possibly four or five) unshaped, dry-laid Redwall Limestone slabs and blocks abutting a Redwall cliff face. A Pueblo I–III affiliation is inferred, though no cultural materials were found. Feature 1 is a wall segment three courses high. Feature 2 represents a curving wall of upright, dry-laid Redwall slabs. Feature 3 contains large blocks delineating a circular cleared space. Feature 4 represents another wall portion.

Previous Work

The site was initially recorded in December of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored during FY97 by the RCMP staff (Leap et al. 1997).

Monitoring Data Summary

The site remains virtually free from dam and visitor-related impacts, due to its high and nearly inaccessible position. The site appeared stable and so was recommended for the inactive list.

FY99 Recommendations

The site's continued stability warrants an inactive schedule.

C:09:030 Special Activity Locus (inactive schedule)

The site consists of two historic but unrelated graves. Locus A is the grave of Peter Hansbrough who died in July 1889 on the Stanton and Brown expedition. His body was retrieved by the 1890 Stanton expedition and buried here. A carved inscription on a vertical face above the grave reads "PMH 1889." Hansbrough's grave is located under a Muav overhang.

Locus B is the grave of a Boy Scout named David Quigley who drowned on 26 June 1951. It consists of an oval arrangement of river and talus cobbles with a taller rock as a headstone. Quigley's grave is on an alluvial terrace.

Previous Work

Locus A was recorded two times (1969 and 1985) prior to the NPS survey recording in 1990 (Fairley et al. 1994). Locus B was also recorded twice (1963 and 1982) and was recorded yet a third time by NPS personnel in 1990. The site was monitored by the RCMP in FY93 (Coder et al. 1994a). Trail obliteration and retrailing was completed in FY95 and medium-format photographs were taken of the Hansbrough inscription in FY97 (Coder et al. 1995b; Leap et al. 1997).

Monitoring Data Summary

In FY97, there was a possible one-time trail leading along the cliff wall, both southeast and northeast of Hansbrough's grave (Locus A). It was undetermined if the trail was a result of animal or human use. The rocks outlining Hansbrough's grave had been displaced from the inside to the outside of the rock wall. Since FY92, the cairn on top of the Boy Scout grave headstone (Locus B) has been removed, and the rock at the base of the grave has been placed upright. The trails surrounding the site were previously vegetated with short grasses, though this was now absent. There were signs of compaction in the trails. (The trails are monitored and maintained annually by the NPS trail crew.)

FY99 Recommendations

This site should be placed on an inactive monitoring schedule, due to the stability of the graves. GRCA regularly maintains this area for trail traffic.

C:09:050 Special Activity Locus (semi-annual schedule)

The site originally consisted of a single complete Tusayan Black-on-red mug or pitcher eroding out of a cutbank, and nine rectangular rock cobbles in an alignment adjacent to Little Nankoweap Creek. After its discovery, the vessel was stabilized with local cobbles and boulders, then covered with sand. Park Archaeologist Balsom subsequently collected the vessel, and several others from the same locale, on a later visit. This is considered a Late Pueblo I–Early Pueblo II Formative site.

Previous Work

This site was discovered and initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994). Due to the site's proximity to a major river camp and the precarious nature of their depositional situation, the four vessels were subsequently removed to the South Rim at the discretion of the Park Archaeologist. The site was monitored once in FY92 (Coder et al. 1994b) and semi-annually from FY93 through FY99 (Coder et al. 1994a, 1995a, 1995b; Hubbard 1999a; Kunde 1998a; Leap et al. 1996, 1997, 1998). Medium-format photographs of the pot cache were taken in FY95 and FY98 (Leap 1995a, 1998b). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a). In FY97 an extensive water-diversion structure was constructed at the base of the cutbank to curtail further erosion from side canyon flooding and bank slump (Leap et al. 1997). After the stabilization, a total station map was completed of the entire site. Zuni Conservator Cheama noted that the

NPS should plant grass seeds and possibly cacti on the slope for further stabilization. The NPS could plant cactus on the slope on a future NPS river trip.

Monitoring Data Summary

Since FY90, monitors have noted that the site is located on a steep slope subject to erosion from runoff and seasonal flooding of Little Nankoweap Creek. Surface erosion and bank slump have at times been active here. The water diversion structure built in FY97 remains unchanged. Until Little Nankoweap Creek flash floods again it is unknown whether the water diversion bar will be successful. There has been no visitor disturbance to the site, although a trail is located nearby.

FY99 Recommendations

Semiannual monitoring will continue. The water-diversion structure will be monitored annually with Zuni Conservation Project personnel.

C:09:051 Pueblo Biennial Schedule

This is a large Pueblo II camp area on the lower side of Nankoweap delta. The site was recorded in 1989 as three separate loci. The GRCA crew retained this scheme and added a fourth locus, located on the bank of the creek to the north and northwest. Locus A contains an L-shaped roomblock of four to six rooms consisting of discernible cobble alignments, wall fall, clay daub, ash, scattered rock, ceramics, and a midden. Locus B is an area of fire-cracked rock, a broken mano, and a few sherds; no feature designations were assigned. Locus C consists of shattered cobbles, a few ceramics and flakes, and no definable features. Locus D is situated on the bank of Nankoweap Creek northwest of Locus A. It consists of a poorly defined roomblock, carbon, sherds, and fire-cracked rock eroding from the bank. A large San Juan Red Ware sherd was collected eroding out of the cutbank; the possibility of intact vessels is high and some stabilization is warranted. FY97 monitors found a newly exposed charcoal stain with several artifacts in a cutbank in Locus D.

Previous Work

The site was originally recorded in 1989 and was re-recorded by NPS survey crews in 1990 (Fairley et al. 1994). The site was visited once in FY92 and FY93 (Coder et al. 1994a, 1994b) and was monitored semi-annually in FY94 and FY95 (Coder et al. 1995a, 1995b), and then annually since FY96 (Kunde 1998a; Leap et al. 1996, 1997, 1998). The site has been the focus of trail obliteration work by the NPS trail crew prior to 1990. The RCMP conducted trail obliteration in FY96 and FY99 (Kunde 1999b; Leap et al. 1996). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a). Medium-format photographs were taken to document Locus D in FY95, FY96, and FY98 (Leap 1995a, 1996d, 1998b). The site was mapped with a total station instrument in FY97, and a portion of Feature 4 was excavated in July of 1997 (Yeatts and Leap 1997). See Hereford et al. (1996b) for photogrammetric topography mapping of the immediate area.

Monitoring Data Summary

Surveyors observed that the surface exhibits a high degree of impacts, such as accelerated cutbank erosion due to lowering of the base level, obvious trailing, wind deflation, and localized gullying. Cutbank erosion is particularly invasive all along Locus D (paralleling the creek bed) and has bisected Feature 3. Three large collection piles exist on this site (i.e., one has developed where a branch hiking trail drops into the creek at Locus D).

Feature 1 has new eolian deposition since the 1994 photographs. Feature 2 has new eolian erosion since 1994. Locus B and C are in stable condition, although they are experiencing minor eolian deflation. Generally, all the features are in stable condition. Factors that threaten the site include a trail leading to Feature 1 (Locus A) that shows signs of channel initiation. This could lead to further surface erosion and gullying. The other concern at the site is at Locus D, because of its location adjacent to Nankoweap Creek. As seen with Feature 3, it is highly likely that this creek will flash flood again, thus exposing additional materials. Excavation is recommended as needed, as additional features erode from the bank of Locus D. It is unrealistic to attempt to prevent the side canyon from impacting this site when it flashes. The cost of the excavations would be shared with this project and the Park-based program, as was the partial excavation of Feature 4 in FY97. The trailing leading from Locus D to Feature 1 is the only evidence of human disturbance. GRCA should conduct trail maintenance as needed.

FY99 Recommendations

Other than the potential for a catastrophic flash flood destroying the site, it is stable. The recommendation is to monitor the site biennially and have the GRCA rehabilitation crew maintain the trails annually.

C:09:052 Artifact Scatter (5-year schedule)

C:09:052 consists of an extensive Pueblo II occupation including structural outlines and a dense artifact scatter dominated by sherds and ground stone. The site is located within the upper mesquite zone on reworked riverside dunes. The prehistoric component consists of a high-density ceramic scatter, pockets of fire-cracked rock, a few lithics, fragmented ground stone tools, and three structures or activity-related features (Features 1–3). Sherds suggest an early to middle Pueblo II affiliation. Seven sandstone manos were notes. A fragment of a brown siltstone pendant was seen near Feature 2. Three hammerstone percussion tools were also observed. The historic component consists of a circular cobble fire ring (Feature 4) with charcoal in the interior. No historic or recent artifacts were seen in association. The site has excellent potential for buried remains.

Previous Work

Balsom initially recorded this site in November of 1989. NPS survey personnel photographed and mapped the site in greater detail in September of 1990 (Fairley et al. 1994). The site was monitored in FY92–FY96 and FY98 (Leap et al. 1996, 1997, 1998). GRCA conducted trail obliteration work in 1991 and FY96 (Leap et al. 1996). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a).

Monitoring Data Summary

Impacts on the site include eolian deposition and rodent burrowing. The same collection piles mentioned in FY96 are still present and do not appear changed. Previous monitors observed collection piles of more than 50 items. Only one set of footprints was observed during the most recent monitoring episode.

FY99 Recommendations

Monitor the site every 5 years due to the potential for additional cultural materials to become exposed in the active dunes. Trail maintenance by GRCA continues to be beneficial to this site and the surrounding delta.

C:09:053 Small Structure (5-year schedule)

This site consists of three artifact concentrations and a rock alignment. Artifacts consist of sherds, lithics, and bone, mostly concentrated on the east and south slopes of a dune. Artifact density is fairly heavy, with 200–300 sherds and 100–150 lithics. The rock alignment is 3 m long with possible corners at either end. It may be the foundation of a habitation unit or room of some kind. The rock alignment could also possibly be an historic or modern tent campsite. Cultural affiliation is considered Middle to Late Pueblo II.

Previous Work

This site was originally recorded by Euler in 1976 as part of site C:09:001. It was renumbered as C:09:053 by Balsom in 1989 because it was not located near site C:09:001. A third recording of the site was completed in 1990 by NPS survey personnel (Fairley et al. 1994). Since the survey, some retrailing and trail maintenance was carried out to curtail the impacts of hikers. The site was monitored by RCMP archaeologists in FY93, FY95, and FY97 (Coder et al. 1994a, 1995b; Leap et al. 1997). See Hereford et al. (1996b) for photogrammetric mapping results of the area. Hereford et al. also included this site in their geomorphic map of the Nankoweap area (1996a).

Monitoring Data Summary

The trail work has had a positive effect. Only deer are trailing through the site and that is something that has been going on since the site was abandoned. Wind deflation is also ongoing and is only a problem now because the dam no longer provides sand for refurbishment. Due to its location near a sand dune, some wind and water erosional processes are present, but the site is stable and in good condition.

FY99 Recommendations

Continue monitoring the site every 5 years.

C:09:056 Artifact Scatter (inactive schedule)

C:09:056 consists of two artifact concentrations, a charcoal scatter, and upright slabs. Monitors noted 13 flaked lithics, one side-notched reddish-banded tan chert projectile point, and four bone fragments (two burned). Function of the slabs remains unknown and the site dates between Late Archaic and Basketmaker II.

Previous Work

The site was originally recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored in FY97 by the RCMP staff (Leap et al. 1997).

Monitoring Data Summary

The site remains free from physical and visitor-related impacts. The excellent condition of the site supported an inactive schedule for monitoring.

FY99 Recommendations

An inactive schedule remains appropriate due to the stability of the site.

C:09:062 Small Structure (inactive schedule)

This site is a concentration of fire-cracked rock, a rock alignment, a scatter of lithics, and sherds indicating a Puebloan affinity. It is located on a dune-covered bench overlooking the secondary channel of a major side canyon. The site consists of four Redwall Chert flakes, several plain ware corrugated sherds, a FCR concentration (Feature 1), and a rock alignment (Feature 2). The alignment is circular and about 1.5 m in diameter, composed of limestone and sandstone cobbles. The flakes are dispersed, and the sherds were found clustered in the FCR area, which is 1 m in diameter. The cultural material is just beginning to erode out of a dune. Ceramics suggest a Pueblo II occupation.

Previous Work

The site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a).

Monitoring Data Summary

The FY96 monitoring staff observed that the site has remained stable since the survey. A game trail passes along the northern edge of the site, but does not affect the features. There is no evidence of visitation. Cryptogamic soil is present across the surface.

FY99 Recommendations

Place C:09:062 on the inactive monitoring list. The site has been stable for at least 6 years.

C:09:069 Structure–Thermal Feature Complex (inactive schedule)

This is an open sherd and lithic scatter with roasting pits and alignment features. The site is situated on a gently sloping terrace amidst saltbush and prickly pear and is almost completely surrounded by mesquite and acacia. There is a large roasting pit (Locus B) in the north-central portion of the site. Several metates and manos are clustered under mesquite trees in the northwest corner of the site (Locus C). To the south, on the slope of a small hill, are several rock alignments (Locus A). The latter might be agricultural features; they follow the hill contours, creating small terraces. Near these alignments is a circular stone feature approximately 75 cm in diameter, possibly a storage pit or cist. No artifacts or charcoal were observed in association with this feature. This may be a multicomponent site, with both late Pueblo I to early Pueblo II and late prehistoric–early historic Paiute occupations. FY97 monitors indicated that Locus C is a Paiute activity area.

Previous Work

The site was first recorded in 1990 (Fairley et al. 1994) and was monitored in FY92, FY93, FY97, and FY99 (Coder et al. 1994a, 1994b; Kunde 1998a; Leap et al. 1997). See Hereford (1996) for photogrammetric topography mapping of the immediate area. Hereford et al. also included this site in their geomorphic map of the Nankoweap area (1996a). Monitoring personnel in November of 1996 questioned the integrity of a circular cist feature. It was recommended at that time that the feature be excavated to determine its significance. In FY99 two large rocks at the northeast portion of the feature were removed to look for ashy soil and charred rocks (Kunde 1999b). The center of the feature was next investigated by taking a shovel-sized core from the feature. Soil to a depth of 20 cm below the surface was consistent and no evidence of cultural activity was identified. This feature is not considered to be a cultural manifestation.

Monitoring Data Summary

The major impacts to this site are animal caused. Large and small burrows are scattered across the site, and are particularly numerous near the roaster, causing some disturbance to the fire-cracked rock. Even though the trail to Little Nankoweap Canyon passes through the site, it avoids all the features. The main trail leading from Little Nankoweap to Nankoweap Creek is located between Locus A and C. This trail is not directly impacting any of the features, though there is the potential for multiple trailing to occur. Commercial river-runners camping at Little Nankoweap often hike across the alluvial terrace, creating multiple trailing on the delta.

FY99 Recommendations

An inactive monitoring schedule is recommended because the physical impacts are minor and the overall site is stable. GRCA maintains the trails on this delta.

C:09:072 Small Structure (5-year schedule)

This site consists of a ceramic scatter and a cluster of rocks. Feature 1 is situated near the top of the dune and measures 1.75 x 2 m. On a slope below Feature 1 is a larger rock cluster constructed of several rocks in an arc shape. The structures may be the remains of buried habitations or a farm-plot terrace. Ceramics indicate separate Pueblo I to Early Pueblo II occupations.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a).

Status and Recommendations

No physical impacts were observed at this site. The trail that was mentioned in 1994 is now very faint. The trail is not an impact to the site. The site is very stable and is anchored by several mesquite trees and cryptogamic soils.

FY99 Recommendations

Monitor in 5 years and reevaluate the schedule. The site may be placed on the inactive list.

C:09:073 Small Structure (inactive schedule)

C:09:073 contains three areas of concentrated limestone rock, possibly representing structural remains. Feature 1, two rubble piles, may represent two perpendicular walls. Feature 2, a circular formation of limestone rocks, may represent a storage facility. Feature 3 contains a rock cluster with an associated sandstone one-handed mano. Cultural affiliation is suspected to be Pueblo I to Pueblo III.

Previous Work

The site was originally recorded in October of 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored in FY96 by RCMP staff (Leap et al. 1996). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a).

Monitoring Data Summary

The site shows no physical or visitor-related impacts and was placed on the inactive schedule.

FY99 Recommendations

Given the stability of the site, it will continue to be on an inactive schedule.

C:09:082 Roasting Feature (5-year schedule)

This site consists of two distinct activity areas dominated by fire-cracked rock, sherds, and ground stone. Feature 1 contains ground stone, Tsegi Orange Ware, and lithic debris. Feature 2, a FCR concentration, contains Pueblo II ceramics and a single Southern Paiute sherd. The site is located in reworked dunes within the lower mesquite zone on Nankoweap Delta, 70 m from the river.

Previous Work

This site was initially recorded by NPS survey personnel in October of 1990 (Fairley et al. 1994) and was monitored at least annually from FY92 through FY96 (Leap et al. 1996, 1997, 1998). The site was also monitored in FY99 (Kunde 1998a). Hereford et al. included this site in their geomorphic map of the Nankoweap area (1996a).

Monitoring Data Summary

At the time of the survey, wind deflation and trailing had the largest adverse impacts at this location. Subsequent monitors noted minor eolian deposition at both features. When last monitored in FY96, the site was in stable condition. A 5-year monitoring schedule was recommended due to the possibility that new artifacts would erode from the surrounding dune areas in the future.

FY99 Recommendations

A 5-year monitoring schedule will continue at this site.

C:13:033 Small Structure (inactive schedule)

This is an open site with the remains of a three-sided structure open to the south. Six flakes are located 15 m west-northwest of the structure. No other artifacts have previously been found on this site (although some minor ash staining was noted in the southeast corner of the structure). This is a probable Pueblo I–III habitation site, inferred from other sites found in the area.

Previous Work

C:13:033 was initially recorded and mapped by Euler and Powers in 1962, and again by Balsom and Fairley in 1984. It was re-recorded during the 1990–1991 survey by NPS personnel (Fairley et al. 1994). The site was monitored by the RCMP in FY96 (Leap et al. 1996). Hereford included this site in his geomorphic map of the Palisades area (Hereford 1993).

Monitoring Data Summary

The site is currently stable. The greatest potential for impact is from runoff directed by the sandstone ledges behind the structure. There is no sediment associated with the site to warrant concern about buried materials. The structure is not subject to impacts from dam operations.

FY99 Recommendations

The site should be placed on the inactive list because the site is currently stable.

C:13:092 Historic Structure (5-year schedule)

This multicomponent site consists of an historic habitation camp and a prehistoric artifact scatter. The main historic feature is the remains of a small rectangular foundation or tent platform constructed of driftwood and thick hard-hewn pine planks. About 5 m to the east is another possible foundation of beams and driftwood. There is a possible sandstone outhouse foundation about 50 m east. This historic camp presumably belonged to the prospector Felix Lantier and dates to the turn of the century. The few historic artifacts that remain include the bulk of a small cast-iron stove, a 3-inch-long piece of half-inch rod with a threaded end, numerous wire-cut nails, and a single fragment of an opaque aqua glass bottle. To the north, on a talus slope, is a sparse prehistoric artifact scatter of sherds and lithics. The prehistoric component appears to be Late Pueblo I–Early Pueblo II affiliation. FY95 monitors found two grayware sherds north of the cabin. One was Tusayan Corrugated, probably associated with C:13:321.

Previous Work

Euler initially recorded this site in 1976. NPS survey personnel recorded the property in greater detail in 1990 (Fairley et al. 1994). GRCA staff has monitored this site many times. RCMP monitored the site at least annually from FY93 through FY97 (Còder et al. 1994a, 1995a, 1995b; Leap et al. 1996, 1997) and then again in FY99 (Kunde 1998a). Hereford et al. included the site area in their geomorphic map of Eastern Grand Canyon (1993).

Monitoring Data Summary

No physical impacts were observed, although an increase in visitor impacts was noted in the form of rearranged artifacts within the cabin. No artifacts appear to be missing and trails leading to the cabin are not entrenched. Photographs from 1978 and 1981 show only minor artifact movement. This minor movement of artifacts from year to year evidences occasional visits by tourists from the river camp located 70 m upstream. Large amounts of sand were deposited in the eddy upstream of the site during the research flow of 1996.

FY99 Recommendations

The recommendation is to decrease monitoring visits to every 5 years because the site is located in an active dune area. GRCA will perform trail maintenance.

C:13:101 Structure–Thermal Feature Complex (5-year schedule)

C:13:101 is a Pueblo II habitation including a structural outline, numerous cist features, and artifacts. The site is situated on a transport slope that is prone to intensive surface runoff. It is also proximal to a major hiking trail and located within 100 m of a river camp. The site is located in the pre-dam high-water zone. This is an open, multiple-feature site with roasting pits, a room, cists, and artifacts eroding out of dunes. It is divided into two loci (A and B). The Locus A features include one to five or more slab-lined cists of sandstone slabs. Artifacts include a metate and several manos. Ceramics are present, but in small quantities. Lithic flakes are abundant and scattered evenly over the area. Locus B consists of a masonry room and a cluster of grinding implements. Two roasting pits, each about 5 m in diameter, are located about 75 m southeast of the site. Additional artifacts are eroding from the dune base. Ceramics indicate a Late Pueblo I–Early Pueblo II occupation.

Previous Work

This site was initially recorded by Euler and Jones in 1978 and was recorded in greater detail by NPS survey personnel in 1990 (Fairley et al. 1994). It was noted in 1978 that a hiker had used slabs from a cist for a modern fire pit. The site was monitored annually between FY93 and FY96 (Coder et al. 1994a, 1995a, 1995b; Leap et al. 1996). The NPS trail crew obliterated the hiking trail that passed through the site in 1993. This has had a very positive effect on the area in general and on the site specifically. Hereford included this site in his geomorphic map of the Palisades area (1993).

Monitoring Data Summary

The site is in overall stable condition. General deflation of loose sediment across the surface of the site will continue as long as the dam causes a lack of free sand in the system. No new impacts were observed since the last visit in FY96.

FY99 Recommendations

Continue monitoring C:13:101 every 5 years.

C:13:131 Historic Structure (inactive schedule)

This historic site is the old tourist camp of Grand Canyon character, prospector, and entrepreneur "Captain" John Hance. The site was occupied during the late 1890s and the materials that remain on the surface are indicative of the period. Cans, posts and wire, broken glass, and the remnants of a cooking area are all that remain.

Previous Work

This site was initially recorded by Euler in 1978 and was re-recorded and mapped in greater detail in April of 1991 (Fairley et al. 1994). The site was monitored in FY92, FY93, and FY95 (Coder et al. 1994a, 1994b, 1995b). The site was assessed for trail work in FY95, but a backpacker's fire destroyed most of the remaining artifacts on 3 May 1995.

Monitoring Data Summary

This site has been highly impacted by visitors for decades. The recommendation is to place the site on the inactive list due to its distance from the river, the impacted surface, and the destruction caused by the fire in May of 1995.

FY99 Recommendations

This site should be placed on the inactive monitoring list. GRCA trail crews regularly conduct trail maintenance in this area.

C:13:322 Rock Art (inactive schedule)

This site consists of six faint images pecked into a Dox Sandstone overhang. Three letters also pecked into the wall above the elements are likely modern graffiti, though there is no record of the history of this incident. A fire feature and lithics were found in association with the pictographs. The site is considered to be Pueblo I–III Formative.

Previous Work

The site was originally recorded as a pictograph panel in 1989. The river corridor survey incorporated the fire feature and lithics into the site boundary in 1990 (Fairley et al. 1994). The site was monitored by RCMP staff in FY94, FY96, and FY98, and by the GRCA River Patrol in August of 1998 (Coder et al. 1995a; Leap et al. 1996, 1998). A medium-format photograph was taken of the site during the 1996 research flow (Balsom and Larralde 1996).

Monitoring Data Summary

No physical impacts were observed. This site is well protected from natural elements. No new visitor-related disturbances were observed. There is some graffiti that appears modern.

FY99 Recommendations

An inactive monitoring schedule is appropriate. Research to determine whether the incised letters are modern proved inconclusive. No graffiti removal will occur at this site. The GRCA River Patrol will visit the site annually to check for ARPA violations.

C:13:324 Thermal Feature (inactive schedule)

C:13:324 consists of three areas of fire-cracked rock and charcoal. Feature 1 contains two Dox Sandstone slabs surrounded by charcoal and fire-cracked rock; the other two features are amorphous concentrations of charcoal and fire-cracked rock. A lithic concentration containing a large amount (100+) of secondary reduction debitage, a small side-notched projectile point (Redwall Chert), and a large basin sandstone metate were also found. The site is believed to date to the Late Archaic.

Previous Work

The site was originally recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and it was monitored in February of 1996 by the RCMP staff (Leap et al. 1996). Fairley took carbon samples here in FY90. Trail obliteration and realignment in November of 1991 covered the site with jute mat to encourage plant growth (Fairley et al. 1994). Hereford et al. included the site area in their geomorphic map of the eastern Grand Canyon (1993).

Monitoring Data Summary

Following trail and vegetation work at the site, the area remains stable and no longer visible on the surface.

FY99 Recommendations

The continued stability of the site warrants an inactive schedule.

C:13:326 Thermal Feature (inactive schedule)

C:13:326 is located on a dune overlying an alluvial terrace. The site contains an eroded hearth and a light-density lithic scatter. The hearth was tested in April of 1990 and associated artifacts include 15 debitage items. Personnel also noted some heat-treated river cobbles and two unidentified bone fragments. Cultural affiliation remains unknown.

Previous Work

This site was originally recorded by the office of the Park Archeologist in 1989 (Fairley et al. 1994) and was added to the IMACS system in September of 1990. Hereford et al. included the site area in their geomorphic map of the eastern Grand Canyon (1993). H. Fairley took carbon samples from the site in FY90, and performed testing here in April of 1990 (Fairley et al. 1994).

Monitoring Data Summary

The area around the site received rehabilitation work by NPS revegetation crews and is now stable.

FY99 Recommendations

The site's stability warrants an inactive schedule.

C:13:335 Thermal Feature (inactive schedule)

C:13:335 is a small open site consisting of some scattered fire-cracked rock and several fragments of burned animal bone. The site is situated in a blowout on the top of a mesquite-covered dune. Cultural affiliation is not known.

Previous Work

This site was initially recorded in September of 1990 (Fairley et al. 1994) and was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b).

Monitoring Data Summary

Minor surface erosion and eolian deflation are occurring within the bone and FCR scatter area. Decomposing mesquite is being washed downslope in this area. The animal burrows mentioned in FY95 were not located and may have filled in with sediment. Overall, the site is in stable condition since FY95. Although minor physical impacts are occurring at this site, the bone and FCR scatter are in stable condition. There are no signs of human visitation or impacts from river fluctuations. The site should be monitored after a flow of 90,000 cfs. Surface evidence does not reflect the likelihood of buried deposits.

FY99 Recommendations

Since cultural or temporal affiliation is unknown, it would be good to date the site. Due to its stability it will remain on the inactive monitoring list.

C:13:337 Roasting Feature (5-year schedule)

The site consists of a circular distribution of fire-cracked rock, some of which are spalls, and most of which are fist sized or smaller. This assemblage is assumed to be the remains of a roasting pit, or perhaps an earth oven. No charcoal-stained soil or charcoal fragments were associated with this feature. A few lithics co-occur with the FCR scatter. Cultural affiliation is unknown.

Previous Work

The site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994) and it was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

This site is very stable and in good condition. There is a healthy abundance of cryptogamic soil. The only sediment movement evident is by eolian processes, yet this appears to have had a positive effect. The mesquite tree in the center of the main roasting feature acts as a stabilizing force. There is no sign of recent visitor-related impacts. It is recommended that the site be monitored in 5 years to see if the eolian processes have become erosive and new artifacts have been exposed.

FY99 Recommendations

Monitor this site in 5 years and, if stable, possibly place it on the inactive monitoring list.

C:13:338 Roaster Complex (4-year schedule)

This is an open site consisting of roasting features, a possible hearth or cist and a lithic scatter. No ceramics are present. Four of the five features lie within 2 m of the Hance-Tanner trail. Feature 1, a possible roasting feature, is a U-shaped arrangement of rock at the south edge of the site. One meter north of this is Feature 2, an elongated rubble pile of sandstone, limestone, and some fire-cracked rock. Twenty meters north, along the trail, is Feature 3, another roasting feature up to 3 m in diameter of sandstone, limestone, and cobble fire-cracked rock, and abundant charcoal. North of this is Feature 4, a slab-lined feature about a half meter in diameter. Feature 5 is a 1-m-diameter concentration of charcoal-stained soil and Dox Sandstone, limestone, and cobble elements. The site is located on a dissected alluvial terrace.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and it was monitored in FY96 and FY98 (Leap et al. 1996, 1998). Fairley took a carbon sample from here in FY90. Hereford et al. included the site area in their geomorphic map of the eastern Grand Canyon (1993). Features 3 and 4, located in the Tanner Trail, were excavated in FY97 (Yeatts 1998). A total station map of the site was completed in FY97 (Leap et al. 1997).

When excavated in FY97, Feature 3 (a supposed roasting feature) turned out to be a scattering of fire-cracked rock lacking any formal structure. Charcoal obtained from the base of Feature 3 supported the Pueblo II period date assigned by the original recorders. Feature 4 proved to be a cist and was likely used for storage purposes. There was no evidence that it had been used as a hearth. The author noted that the site is possibly part of the same occupation episode as two sites to the northeast (C:13:340 and C:13:008).

Monitoring Data Summary

Minor animal burrowing was noted at Feature 5 in FY96. There was also some minor downslope movement of rocks at this feature. All other features were unchanged. FY96 monitors noted an increase in bank slump, impacting Feature 3. The FY98 monitors noted that Features 3 and 4 had not changed since the excavations in FY97. There was minor animal burrowing at Feature 5, along with minor movement of stones downslope.

FY99 Recommendations

The features that were actively eroding at this site have been excavated. The three remaining features are stable. It is recommended that the RCMP staff decrease monitoring frequency from biennial to every 4 years.

C:13:340 Roasting Feature (4-year schedule)

This is a PII Puebloan site with two features and a small scatter of lithics, ceramics, and ground stone. Feature 1 is a 1.5-m-diameter roasting pit with Dox Sandstone slabs around its periphery and heat-cracked river cobble in the center. Feature 2 is a slab-lined cist (50 cm in diameter), with at least three remaining upright slabs. Lithic flakes, sherds, and manos litter the slope. The site is situated on a gravel-strewn terrace within the upper mesquite zone.

Previous Work

The site was initially recorded by NPS survey personnel in September of 1990 (Fairley et al. 1994) and it was monitored in FY96 and FY99 (Hubbard 1999b; Leap et al. 1996). The NPS trail rehabilitation crew completed trail obliteration and retrailing work in 1996 (Leap et al. 1996). Hereford et al. included the site area in their geomorphic map of the eastern Grand Canyon (1993).

Monitoring Data Summary

The condition of the site has been stable since 1990 with no evidence of human visitation or disturbance, even though a major hiking trail passes close by. Monitors noted active burrowing at Features 1 and 2 and throughout the entire site. RCMP recommends that the NPS trail and rehabilitation crew monitor the trail obliteration work annually. Rodent burrowing is the only active impact at the site.

FY99 Recommendations

The recommendation is to decrease the monitoring schedule to every 4 years, and then reevaluate the schedule if there is continued stability. The GRCA trail crew will perform annual trail maintenance.

C:13:342 Historic Structure (5-year schedule)

The site consists of the deteriorated remains of an historic wooden structure, possibly a storage building or log cabin. The structure is in very poor condition, and its original configuration is difficult to discern. The wood building elements include milled lumber, as well as logs. The milled lumber was probably used for the foundation or basal course, and rough logs were used for walls and possibly rough beams. It is obvious that many elements have been salvaged for use elsewhere. Square nails were primarily used, although a few large wire nails are also present. Historic trash includes two enamelware vessels (a bucket and coffee pot), a cast iron dutch oven lid, and purple glass, suggesting a turn-of-the-century occupation. The structural remains currently occupy a 6 x 9 m area, but the structure was obviously smaller when intact.

Previous Work

This site was initially recorded in 1991 (Fairley et al. 1994) and it was monitored in FY92, FY93, FY95, FY97, and FY99 (Coder et al. 1994a, 1994b, 1995b; Hubbard 1999b; Leap et al. 1997). FY95 monitors collected a shell button on the surface, which is curated at GRCA.

Monitoring Data Summary

The site is physically stable and has not changed since the FY97 monitoring visit. Several historic bottles were added to the collection pile of artifacts on the log foundation. This is a large delta with nearby backcountry trails. Due to the site's location, visitor-related impacts are likely to occur. Although the site is physically stable, visitors are moving artifacts.

FY99 Recommendations

Monitor this site every 5 years. GRCA should complete a thorough artifact inventory and take medium-format photographs of the site and associated artifacts. After this work is done, the site could be placed on the inactive monitoring list.

C:13:353 Small Structure (inactive schedule)

This site consists of a one-room, mid to late PII Puebloan structure (Feature 1) with a corner storage bin or cist under a Tapeats Sandstone ledge on an unnamed tributary of the Colorado River. A single sherd, a flake, and a corn cob fragment were recorded within the structure. No artifacts were observed outside of or proximal to the room. It is doubtful that any original fill or material remains within the structure. An historic wall (Feature 2) is situated in an overhang across the drainage to the south. It is a three-course wall that may have been used as a windbreak or rain shelter.

Previous Work

The site was initially recorded in September of 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). The monitor crew observed a second sherd and chert biface within the structure.

Monitoring Data Summary

The site has remained in stable condition since 1990.

FY99 Recommendations

This site should be on the inactive monitoring list.

C:13:354 Small Structure (5-year schedule)

This site consists of four granaries along a Dox Sandstone ledge. The granaries, designated Features 1–4, are in poor condition. Feature 1 is furthest upstream and is in the best condition; Features 2–4 are in the final stages of deterioration, with only fragments of stone outlines and walls remaining. The granaries are inferred to be PI–III Puebloan, but no artifacts were found in association.

Previous Work

The site was originally recorded in 1990 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1998).

Monitoring Data Summary

The granaries are well protected and in stable condition. The mortar at Feature 1 is deteriorating at a slow but steady pace. The granaries are easily accessible from the river, although they are difficult to see. One set of footprints was observed below Features 1 and 2 but there was no sign of visitor disturbance on the site. Because the granaries are easily accessible, there is the potential for more cultural information to surface.

FY99 Recommendations

The granaries should be thoroughly documented and photographed with a medium-format camera, as a prelude to stabilization, if that is warranted. The site could then be placed on an inactive monitoring schedule.

C:13:360 Small Structure (5-year schedule)

The site consists of the remnants of a wall, two redware sherds, and some mineralized charcoal at the base of a Tapeats cliff. The wall is of dry-laid Tapeats Sandstone and currently consists of five in-place elements with three more wall-fall elements. There is so much salt percolating through the bedrock that the sediment and surface of the rock is permeated with it. The site represents a possible late Pueblo I to early Pueblo II Formative association.

Previous Work

The site was originally recorded in 1990 by NPS personnel (Fairley et al. 1994) and was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

Surface erosion is present due to the Tapeats Sandstone dripline above the site but this is not threatening the site. The site appears stable, but in poor condition.

FY99 Recommendations

Monitor this site in 5 years and then reassess the schedule.

C:13:361 Small Structure (inactive schedule)

C:13:361 is located in an overhang on a small ledge adjacent the river. The site contains an isolated dry-laid granary wall remnant constructed with stone chinking. More than 50 corn kernel "shells" were located on the granary floor (five were collected). Based on similarity to nearby dated sites, cultural affiliation is believed to be Pueblo I to Pueblo III Formative.

Previous Work

The site was originally recorded in April of 1991 (Fairley et al. 1994) and was monitored during FY96 by RCMP staff (Leap et al. 1996).

Monitoring Data Summary

No physical or visitor-related impacts have been noted since April of 1991. The site's stable condition and protection warrants an inactive schedule.

FY99 Recommendations

An inactive schedule remains appropriate for this stable site.

C:13:362 Small Structure (4-year schedule)

The site is located on the edge of a delta terrace. It has one rock wall (Feature 1) and four areas of fire-cracked rock (Features 2–5), plus an associated scatter of lithics and ceramics. The rock wall is located on the sloping terrace below the FCR area. It is L-shaped and about 2.5 x 4 m in size. The northeast wall is eroding out of the soil and appears to be two to three courses high. Erosion has undercut the wall to some degree. Features 2–5 are all located along the edge of the terrace and all contain fire-cracked rock eroding out of the soil. Features 3–5 also have lithics and sherds. A stone pipe or tube fragment was observed. Ceramics suggest a Late PII–early PIII Puebloan affiliation.

Previous Work

The site was initially recorded in March of 1991 by NPS survey personnel (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996). Trail obliteration work was completed here in FY97 (Leap et al. 1997).

Monitoring Data Summary

Impacts noted in 1991 include trailing and surface erosion. The monitors also commented that because the delta is a well-known archaeological area, human visitation was the greatest impact. A well-defined trail goes through the site and bisects Features 2–5. When monitored in FY96, minor animal impacts were occurring, along with visitor trailing. Trail obliteration was recommended to protect Features 2–5. This work was completed in FY97, when 75 m of trail were obliterated.

FY99 Recommendations

A 4-year monitoring schedule at this site seems appropriate. Trail maintenance by GRCA personnel will continue.

C:13:363 Small Structure (inactive schedule)

This site is in a rockshelter at the base of the exposed Shinumu Quartzite. It contains the remains of two small standing side walls that are four to five courses high and dry-laid. The large amount of rock fall in front of the shelter probably functioned as another wall. A large corrugated sherd and a single one-handed sandstone mano were the only cultural artifacts observed. A small piece of wood in the corner of the shelter was obviously imported. The single sherd suggests a late Pueblo II–early Pueblo III cultural affiliation.

Previous Work

NPS personnel recorded this site in 1991 (Fairley et al. 1994), and it was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

No physical impacts have occurred since the survey, although packrat feces are abundant. Human disturbances were also not observed. The site was unchanged from 1991 through FY96. Upon completion of one more monitoring episode in FY99, the site was placed on the inactive monitoring schedule.

FY99 Recommendations

An inactive monitoring schedule will continue at this site.

C:13:364 Small Structure (inactive schedule)

C:13:364 consists of a single room outline constructed of local Dox Sandstone built against a low Dox outcrop. Up to four courses are visible. The site is on the north side of a tributary arroyo at its confluence with the river. There was one Tusayan corrugated sherd in the vicinity. Other artifacts have probably been washed away by river floods. The sherd suggests a Pueblo II affiliation.

Previous Work

Archaeologists recorded the site in March of 1991 (Fairley et al. 1994) and the RCMP staff monitored it in FY94 and FY96 (Coder et al. 1995a; Leap et al. 1996). Hereford et al. included the site area in their geomorphic map of the eastern Grand Canyon (1993).

Monitoring Data Summary

RCMP has consistently recorded the site's stability. There has been no evidence of visitation or ongoing erosion since the site was recorded.

FY99 Recommendations

C:13:364 will remain on the inactive monitoring list.

C:13:372 Roasting Feature (inactive schedule)

C:13:372 is located on a broad alluvial fan upstream and across from a major side canyon. The site consists of a semicircular roasting feature lined with Muav Limestone cobbles. An associated discard pile of fire-cracked limestone, sandstone rocks, and charcoal chunks is located downslope. A few Redwall Chert flakes near the roasting feature represent the only artifacts at the site. Cultural affiliation remains unknown.

Previous Work

The site was originally recorded in October of 1990 by NPS survey personnel (Fairley et al. 1994) and was monitored in February 1996 by RCMP staff (Leap et al. 1996). FY96 monitors noted a light dispersement of surface charcoal 4 m west-southwest of the fire feature.

Monitoring Data Summary

The site remains stable and in a discrete location. The site location, paired with an increase in vegetation at the site, prompted an inactive schedule.

FY99 Recommendations

An inactive schedule remains appropriate for this stable site.

C:13:373 Thermal Feature (3-year schedule)

The site consists of a large, concentrated amount of charcoal, fire-cracked rock, Hopi sherds, and animal bone. This material is eroding out of the west side of a dune just below the top. The charcoal is fairly recent looking. All of the sherds were severely refired in the "hearth" area. The site could be evidence of late prehistoric–early historic Hopi use of the area.

Previous Work

This site was initially recorded in 1990 by NPS personnel (Fairley et al. 1994) and was monitored in FY97 (Leap et al. 1997).

Monitoring Data Summary

The FY97 monitors noted that, overall, the dune was stabilized by a heavy growth of mesquite. The sherds, bone, and charcoal visible on the surface were slowly migrating down the dune face. An increase in surface erosion was apparent. A portion of the dune continued to slump away, slowly deteriorating beneath the site. The recommendation was to map the site with a total station and perform data recovery. No sign of human visitation was noted.

FY99 Recommendations

Continue monitoring this site on a 3-year schedule, and conduct an assessment for preservation treatment.

C:13:377 Artifact Scatter (5-year schedule)

This is a PII Puebloan site in a 15 x 45 m area, consisting of three loci (A–C) of flakes, a chopper, the remains of a pot break, a few Dox Sandstone slabs, possibly used as building material, and two ground stone items. No structures or hearth features were observed, but on the north end of the site (Locus A) is a deflated area with one burned rock, a couple of flakes, and a depression that might be the location of a pithouse. Locus B consists of a pot break of corrugated sherds and ground stone fragments. Locus C is a small scatter of sherds and lithics at the south end of the site. A sandstone slab with a ground lateral edge was found near the pot break, and a small sandstone mano fragment was observed on the south end of the site. One rhyolite chopper was also noted. The bulk of this site may remain buried beneath the dune deposit.

Previous Work

The site was initially recorded in March of 1991 by NPS survey personnel (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

The 1991 surveyors recorded wind deflation as the major impact to the site, plus surface erosion and off-site gullying. There were no discernible visitor-related impacts. The FY96 monitors recorded that the site was very stable, affected only by minor localized episodes of eolian erosion and deposition. A collection pile was noted at Locus B.

FY99 Recommendations

This site will continue to be monitored on a 5-year schedule.

C:13:384 Thermal Feature (inactive schedule)

This is a buried site revealed in a cutbank up Lava-Chuar Creek. The deposition shows an alternating regime of overbank flooding from the Colorado River and the seasonal side canyon flooding of Lava-Chuar. GCES geomorphologists Hereford and others originally found this site at Lava-Chuar in October of 1990 while facing off a cutbank for a stratigraphic column. The profile they exposed is composed of (from bottom to top) a basal prehistoric upright slab-lined hearth inset in and overlain by gravel lenses, an episode of overbank flooding, a level of intermediate fine-grained sediment with another episode of expedient fire hearths, and a surface unit of sand and gravels containing historic artifacts. The lowest slab-lined hearth (Feature 1) produced several carbon dates indicating an early Pueblo II (or possibly late Pueblo I) temporal affiliation. The carbon date from Feature 3 indicates a protohistoric temporal affiliation. Also, up Lava-Chuar Creek is a rock structure with associated historic artifacts. In general, this site is suggestive of three components: late Pueblo I–Early Pueblo II, protohistoric Pai or Paiute, and turn-of-the-century Euro-American.

Previous Work

This site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, FY97, and FY98 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1997, 1998). Geomorphologic studies conducted along the side canyon drainage included a carbon date at Feature 3, indicating a protohistoric affiliation. The arroyo cut was faced-off and Fairley took charcoal samples in 1990. Two meters down at the base of the cutbank is a vertical-slab-lined hearth. In 1991 the USGS and NPS did some work at this location and on completion did expedient shoring up of the base of the cutbank with dirt and dead vegetation. See Hereford et al. (1996b) for photogrammetric topography mapping of the immediate area. Hereford also included this site in his geomorphic map of the Palisades area (1993). The site was mapped with a total station in FY98.

Monitoring Data Summary

In FY92 and FY93 it was noted that further episodes of runoff down Lava-Chuar will continue to erode or destroy the site. In FY94 the first episode was recorded. Bank slump covered the slab-lined feature. The arroyo wall continued to erode regardless of human intervention.

The site was visited 3 years later (FY97). The cist was no longer visible as noted by monitors in 1994, bank slump had increased, and wood fell from the bank's edge above the features. Erosion was present, but all features were visible with the exception of the cist. No management actions were recommended at that time. They did suggest that the FY98 archaeologists monitor the site and if the erosional processes were occurring annually, a mitigation plan should be implemented.

In FY98 monitors observed that there were no features remaining worthy of any mitigative work. All, if not most, of the features were lost to erosion from Lava-Chuar Creek. There was little archaeological information present. It was recommended that the site be placed on the inactive monitoring list. It would be beneficial to the RCMP staff, however, to spot check this cutbank for newly exposed features while monitoring other sites in the area.

FY99 Recommendations

The RCMP staff agrees with the FY98 recommendations to place the site on the inactive monitoring list. Due to the possibility that additional cultural materials may become exposed, it would be a good idea for the RCMP to spot check this site when they are in the area.

C:13:389 Structure–Thermal Feature Complex (3-year schedule)

The site consists of an overhang shelter (Feature 1) and two roasting features (Features 2 and 3). Feature 1 is a Dox overhang ledge and may be both prehistoric and the result of river-runner rebuilding or additions; matchsticks and recent-looking charcoal are in the shelter. Surface erosion at the base of the overhang has exposed charcoal and the stained living surface of the prehistoric occupation. Burned bone, lithics, a biface, and charcoal fragments are eroding out of this surface. North of the structure is an open area with a small retaining wall and lithic material eroding downslope. Feature 2 is a large roaster north of Feature 1. A soil stain is at the top, on river-deposited sands. Boulders and cobbles are mounded around the feature and stacked rocks appear to stabilize or act like a retaining wall for the roaster on the north side. Flakes are downslope and on the feature itself. Feature 3 is a smaller roasting feature or FCR midden downslope of Feature 1. The site has two possible components: Pueblo II and late prehistoric–early historic Paiute. The site is located in bedrock ledges overlooking a major rapid in Reach 5.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and it was monitored in FY96, FY97, FY98, and FY99 (Hubbard 1999b; Leap et al. 1996, 1997, 1998).

Monitoring Data Summary

Monitoring staff have continuously observed active surface erosion adjacent to Feature 1. In FY99 this erosion appeared to be increasing, so data recovery was recommended. Features 2 and 3 have remained stable through time.

The visitor-related disturbance at this site is attributed to both backpackers and boaters. There is a trail leading from a downstream camping beach to the site. Feature 1, the overhang, is the most impacted feature. Visitors continually rearrange the rock wall and move artifacts.

FY99 Recommendations

Continue monitoring this site every 3 years. It is recommended that GRCA perform data recovery at Feature 1 before any more cultural remains are disturbed or removed by river-runners and backpackers.

C:13:393 Artifact Scatter (5-year schedule)

This is an artifact scatter eroding from a high sand dune. Artifacts include PII sherds, lithic debris, ground stone and bone. A green soapstone pendant, collected from the surface during the survey, is housed at the GRCA curation facility. The site is located at the mouth of a major side canyon.

Previous Work

The site was initially recorded by NPS survey personnel in April of 1991 (Fairley et al. 1994) and it was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

Surficial amounts of sand have rearranged themselves since the survey, exposing new artifacts and covering others. Backpackers camp in low spots in this same dune 40 m toward the river but do not seem to be aware of this archaeological site.

FY99 Recommendations

A 5-year monitoring schedule is appropriate for this site because of the potential for newly exposed cultural remains.

G:02:001 Artifact Scatter (inactive schedule)

G:02:001 is located atop a prominent isolated basalt flow. The site consists of a light scatter of artifacts, including two grinding slabs, a light scatter of white Kaibab Chert flakes, a single obsidian flake, a small brown chert polishing stone, and a hand percussor or chopper. Two sherds of Aquarius Brown Ware suggest a Cerbat or Pai affiliation.

Previous Work

The site was originally recorded by Euler and later by NPS survey personnel in February of 1992 (Fairley et al. 1994). The site was also monitored in FY95 by RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

This site remains fairly isolated and very stable.

FY99 Recommendations

The continued stability of the site supports an inactive schedule.

G:02:100 Historic Structure (5-year schedule)

G:02:100 is an historic site known as Bridge Canyon City. Reclamation engineers established it in the 1930s as a base of operations for the proposed Bridge Canyon Dam. The location is remote and rugged but a permanent spring made the place viable for a small town. The "city" exhibits a lot of work on the surface; clearing living spaces, constructing roomblocks from the local granite, laying pipelines, pouring cement, and designing a trail system. Between 1939 and 1960 Bridge Canyon City was at various times a very busy place. The dam was never built and now G:02:100 remains as a modern ghost town in the west end of Grand Canyon.

Previous Work

Archaeologists recorded this site in April of 1991 (Fairley et al. 1994) and the RCMP monitored it for the first time in FY95 (Coder et al. 1995b). Reclamation archaeologist Hurley mapped the site with a total station in FY95. Further detailed mapping is needed to complete the Hurley map. In FY94, the site was recommended for nomination to the National Register based upon its significance as an historic engineering site, and the State Historic Preservation Office concurred (Leap 1994c).

Monitoring Data Summary

The site exhibits minor surface erosion. The RCMP staff observed a few minor changes during the FY95 visit; the water heater fell over since 1991, and some rocks came down from the walls. Further detailed mapping is needed to complete the total station map.

FY99 Recommendations

The site should be monitored every 5 years. For logistical reasons, it is recommended that the Hualapai conduct the monitoring at this site.

G:02:101 Historic Structure (5-year schedule)

G:02:101 is the well-crafted powder house for the operations at Bridge Canyon City. The feature is constructed of wood planks utilizing a natural vug (small, unfilled cavity) in the rock near river level.

Previous Work

This site was recorded in April of 1991 (Fairley et al. 1994) and was monitored for the first time in FY95 (Coder et al. 1995b). In FY99, Hualapai archaeologists and tribal members monitored this site. In FY94, the site was recommended for nomination to the National Register based on its significance as an historic engineering site, and the State Historic Preservation Office concurred (Leap 1994c).

Monitoring Data Summary

G:02:101 is in very stable condition. No changes were observed between the original recording of the site and the FY95 monitoring episode. The Hualapai tribe reported no new changes in FY99.

FY99 Recommendations

For logistical reasons, the site should be monitored every 5 years by the Hualapai cultural preservation staff.

G:02:102 Historic Structure (inactive schedule)

G:02:102 represents a possible historic base camp and associated trail. Features include two possible tent platforms, a crescent-shaped wall, and another wall feature with charcoal and trash. Artifacts feature a scatter of materials from the 1920s to 1930s, as well as recent times, including a cluster of broken brown glass, 3 pieces of sawed wood, 11 Prince Albert tobacco tins, 8 wire nails, a possible coffee can, one metal hacksaw blade, one modified metal wire, and a metal box lid. Also present at the site are three Vishnu slab walls, one 8–9 courses high, another 5–6 courses high, and another 4–5 courses high. Each wall is dry-laid and constructed of local unshaped rock. The site may belong to the City of Los Angeles Water Commission Project in an attempt to establish a physical presence on the Colorado River for water claims.

Previous Work

The site was initially recorded in April of 1991 by NPS survey personnel (Fairley et al. 1994) and it was monitored in FY95 by the RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

The site remains stable without threat from dam or visitor impacts.

FY99 Recommendations

An inactive schedule should continue based on the site's continued stability.

G:02:106 Historic Structure (inactive schedule)

G:02:106 represents an historic or recent activity area associated with the proposed Bridge Canyon Dam. The site features four areas with platforms stabilized by dry-laid rock walls and scattered trash. Trash and artifacts include a plank table, glass fragments, milled lumber pieces, two broken bastard files, drill bits, seven hacksaw blades, chain link, one coil of steel, and a 2.5-inch coupler. Other artifacts and associated trash include 75 cans, bailing wire, charcoal, welding rods, nails, 1" steel rods, metal pipe, a brass petcock, wire-reinforced rubber hose, and stove pipe. The Bureau of Reclamation dated the site to 1926.

Previous Work

The site was originally recorded in April of 1991 by NPS survey personnel (Fairley et al. 1994) and it was monitored in FY95 by RCMP staff (Coder et al. 1995b).

Monitoring Data Summary

The site remains stable and, for the safety of project personnel and preservation of site condition, G:02:106 was placed on the inactive list.

FY99 Recommendations

For reasons stated above, the site will remain on an inactive schedule.

G:02:108 Historic Structure (5-year schedule)

This site is an engineering site associated with the Bridge Canyon Dam project. The site consists of a series of built-up platforms connected by trails running parallel to the river. Artifacts present on the surface include cut lumber, a large homemade grappling hook, intact glass jars, cans, tobacco tins, wire, cable, industrial sized bolts, and parts of broken tools. The assemblage indicates a 1939 to 1960 occupation. G:02:108 is located on a series of narrow benches adjacent to the river in a very constricted section of the canyon.

Previous Work

This site was initially recorded by NPS survey personnel accompanied by members of the Hualapai Tribe in March of 1992 (Coder et al. 1994b) and was monitored for the first time in FY95 (Coder et al. 1995b). In FY99, Hualapai archaeologists and tribal members monitored this site.

Monitoring Data Summary

The platforms were stable when monitored in FY95. No change was reported to the RCMP office by the Hualapai tribal office for FY99. This site is susceptible to extreme high water and should be monitored every 5 years.

FY99 Recommendations

A 5-year monitoring schedule will continue, with monitoring conducted by the Hualapai Cultural Preservation Department for logistical reasons.

G:03:027 Special Activity Locus (inactive schedule)

The site consists of an isolated bedrock mortar in a large Redwall Limestone boulder. The upper surface is almost flush with the ground surface. The mortar is in the center of the boulder and is 25 cm in diameter and 28 cm deep. There is obvious use-wear around the rim of the opening and pecked divets at the bottom of the mortar. This item may have been a "hydrofact" originally that was subsequently adopted for cultural use. There are two other "incipient mortars" in river-worn boulders 50 m away; however, these do not exhibit use wear.

Previous Work

This site was recorded in February of 1991 (Fairley et al. 1994). It has been monitored in FY92, FY93, and FY95 (Coder et al. 1994a, 1994b, 1995b). A total station map of this site was completed in FY96 (Leap et al. 1996). Hereford et al. included the site area in their geomorphic map of Granite Park (1996b).

Monitoring Data Summary

The boulder and mortar are in very stable condition. A hiking trail from the river passes directly by the boulder and causes no site impact. It is recommended that this site be placed on the inactive monitoring schedule but be monitored subsequent to flows in excess of 60,000 cfs.

FY99 Recommendations

An inactive monitoring schedule will continue at this site. Medium-format photographs could be taken of this site and used as interpretive tools.

G:03:037 Artifact Scatter (5-year schedule)

The site is located in an outcropping basalt overhang on a Tapeats Sandstone slope. It consists of two loci (A and B), about 10 m apart, each containing an artifact scatter. Approximately 100–150 flaked lithics were noted, mostly at Locus B. Tools include bifaces, a core or chopper, and projectile point tip. The 50–65 sherds indicate that this is a multicomponent site, with late Pueblo I–early Pueblo II Cohonina and late prehistoric–early historic Pai occupations. Locus B also contains several ground stone items, such as a ground or pecked shale slab metate, a basalt slab metate, a Tapeats mano, and a partially polished basalt cobble shaped like a maul. There is also a sparse charcoal scatter and a piece of shaped wood at Locus B.

Previous Work

The site was initially recorded by NPS personnel in 1991 (Fairley et al. 1994) and it was monitored in FY97 (Leap et al. 1997).

Monitoring Data Summary

Overall, Locus A is stable. Animal burrowing and root disturbance from a brittle bush is occurring at Locus B. Pooling and slight surface runoff is also present near the dripline; overall, Locus B has changed very little since 1991. No sign of human disturbance was observed. Monitoring is recommended every 3 to 5 years because Locus B shows minimal signs of surface erosion in the artifact concentration area. No new cultural materials are being exposed with the burrowing, but this will be something to look for during future monitoring.

FY99 Recommendations

This site will continue to be monitored every 5 years.

G:03:046 Thermal Feature (inactive schedule)

G:03:046 consists of several (15–20) fragments of fire-cracked rock, two flakes and a single sherd of southern Paiute grayware. The site takes up less than a 2 x 3 m area on the surface of a riverside dune.

Previous Work

This site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and it was monitored in FY94 and FY95 (Coder et al. 1995a, 1995b). In FY96 this site was investigated for effects from the experimental habitat-building flow (Balsom and Larralde 1996).

Monitoring Data Summary

Presently the site is being impacted by surface runoff and wind deflation. Although the site is faint and lacks much research potential, it acts as an erosion barometer for events in this section of the river corridor.

FY99 Recommendations

The surface remains at this location may be the end, rather than the beginning, of an eroding feature. Test site integrity, but keep the site on the inactive monitoring list.

G:03:048 Artifact Scatter (4-year schedule)

G:03:048 is a shallow rockshelter located on Tapeats Sandstone ledges surrounded by steep rocky talus slopes. Artifacts are common on the surface and include flakes, numerous ground stone items (fragmented and complete), two Desert Side-notched points, charcoal, and at least two Southern Paiute utility gray ware sherds. The artifacts indicate a Paiute occupation.

Previous Work

This site was located and recorded in March of 1991 (Fairley et al. 1994) and was monitored in FY95 and FY99 (Coder et al. 1995b; Hubbard 1999b).

Monitoring Data Summary

The dripline from the Tapeats Sandstone ledges is causing surface erosion under the overhang that also extends downslope. The surface erosion is not currently uncovering new cultural material. Rodent burrowing continues to be active. Eight sherds were located downslope of the overhang. Despite the active surface erosion, the site is in stable condition. The two Desert Side-notched points were collected during the 1990–91 survey. An obsidian point was observed at the site. There are no camping beaches or attraction areas nearby. If visitation occurs in the future, it could be attributed to boaters, since there are no hiking trails in the area. The site is well above current river flows. It displays active rodent burrowing, downslope movement of artifacts, and surface erosion.

FY99 Recommendations

A 4-year monitoring schedule is appropriate for this site. The surface erosion should be assessed for preservation treatment.

G:03:049 Artifact Scatter (inactive schedule)

The site is located under columnar basalt boulder rockshelters on the first Tapeats Sandstone ledge outcrop above the river. These are multicomponent shelters, possibly used temporarily or seasonally during food processing and lithic tool manufacture activities, as indicated by ground stone implements and abundant lithic debitage. There are 80–125 flakes on the site, mostly in front of the rockshelter area on the Tapeats ledges. Nearly all of the flakes in the shelter area have been placed in a collector's pile. The 15 or so sherds found on the site suggest Pueblo II Virgin and late prehistoric–early historic Pai or Paiute occupations. Two metates, three manos, a grinding slab, and two tools are in the vicinity of the shelter. There is a sparse scatter of charcoal fragments in the southeast end of the rockshelter area.

Previous Work

This site was first discovered and recorded by NPS survey personnel in 1991 (Fairley et al. 1994) and it was monitored for the first time in FY97 (Leap et al. 1997).

Monitoring Data Summary

Sediment has been blown out of both shelters, exposing new gravel and basalt fragments. A few basalt fragments also appear to be spalling off the large boulders. The collection pile in the southern shelter has been rearranged. The mano that was in the northern shelter is now on top of the metate in the southern shelter. A popular stop called the Diving Board is directly below the shelters. Two cairns are located below the shelters, indicating the route to the Diving Board, yet visitor impacts are minor. New collection piles could become a problem in the future due to the site's proximity to the Diving Board.

FY99 Recommendations

This site should be placed on an inactive monitoring schedule. GRCA trail crew will be notified whenever trail maintenance is needed.

G:03:053 Artifact Scatter (inactive schedule)

G:03:053 is located on the first Tapeats Sandstone ledge outcrop above the river. The site contains two lithic concentrations, with 100 to 150 flakes. Surveyors noted no formal or diagnostic tools, but did locate a slightly used limestone river cobble. A Tapeats Sandstone slab metate was also observed, stashed for unknown reasons, 30 m from the site. Some bifacial thinning flakes suggest a Late Archaic to Basketmaker II affiliation.

Previous Work

The site was originally documented by NPS survey personnel in March of 1991 (Fairley et al. 1994) and it was monitored by RCMP staff in FY97 (Leap et al. 1997).

Monitoring Data Summary

Monitors observed no physical or human-related impacts, suggesting an inactive monitoring schedule for the site.

FY99 Recommendations

An inactive schedule remains appropriate for this stable site.

G:03:065 Artifact Scatter (3-year schedule)

G:03:065 consists of a rockshelter with some lithic debris. Handtools and a worked stick are present. Charcoal was found on the slope below the shelter area. The site is located on a series of Tapeats Sandstone ledges.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY94 and FY98 (Coder et al. 1995a; Leap et al. 1998). In FY94, the site was tested and determined eligible to the National Register of Historic Places (Leap 1994c). The eligibility determination was made based upon the presence of abundant charcoal, a quid, and a yucca sandal fragment exposed by erosion within the rockshelter when it was visited in FY94.

Monitoring Data Summary

There is minor surface erosion on the slope below the overhang. Because of the loose, spalled-off condition of the slope below, the site is potentially unstable. The overhang shows no change since the survey photograph, but there is a fairly active packrat midden. Human disturbance was not observed. Two years ago a packrat exposed a yucca sandal fragment. Because there is high potential for more cultural materials to be exposed, monitoring will continue every 3 years.

FY99 Recommendations

This site will continue to be monitored every 3 years.

G:03:066 Roasting Feature (inactive schedule)

The site consists of a partially buried ring of fire-cracked rock measuring 1.4 m in diameter that is probably a small roasting feature in pristine condition. Also present is a grinding slick on the face of a large talus boulder about 6 m from the roasting feature. This site is located at the base of a talus slope on an eolian sand-covered bench overlooking the local side canyon drainage. The cultural affiliation is unknown.

Previous Work

This site was initially recorded by NPS survey personnel in March of 1991 (Fairley et al. 1994) and was monitored in FY92, FY93, FY94, and FY96 (Coder et al. 1994a, 1994b, 1995a; Leap et al. 1996).

Monitoring Data Summary

When recorded in 1991, monitors noted surface erosion and the presence of a nearby arroyo. Continued surface erosion and eolian activity were noted from FY92 through FY96. In FY96 the site was considered to be in excellent condition. A large amount of modern trash was found a few meters from the roaster. This was apparently an abandoned food cache deteriorating in place. The site is presently stable and in pristine condition. It is recommended that G:03:066 be put on the inactive monitoring schedule.

FY99 Recommendations

This site will remain on the inactive monitoring list.

G:03:071 Artifact Scatter (4-year schedule)

The site consists of a small rockshelter with a triangular opening in a granite outcrop with sherds eroding downslope in front of it. The 15 sherds observed represent at least three different vessels. The interior roof of the shelter is heavily smoke blackened and a packrat nest mostly obscures the rear wall and floor. The ceramic assemblage indicates a multicomponent site of Pueblo I–III Cohonina and late prehistoric–early historic Pai.

Previous Work

The site was recorded initially in 1991 by NPS personnel (Fairley et al. 1994) and was monitored in FY97 and FY99 (Kunde 1998a; Leap et al. 1997). Hereford et al. included the site area in their geomorphic map of Granite Park (Hereford et al. 1996b).

Monitoring Data Summary

Minor movement of the rocks along the slope is evident. It appears that the packrat midden, noted as active in FY97, has been abandoned. No sign of human visitation was observed. The site is unchanged since it was last monitored, with the exception of minor surface erosion.

FY99 Recommendations

This site will be placed on a 4-year monitoring schedule.

G:03:073 Roaster Complex (4-year schedule)

This is a roaster complex with an artifact scatter and an overlay of early twentieth century trash. Ceramics indicate a Puebloan and protohistoric Pai presence. The site is located on a very old river terrace underlain by Tapeats Sandstone.

Previous Work

The site was initially recorded by NPS survey personnel in April of 1991 (Fairley et al. 1994) and was monitored for the first time in FY96 (Leap et al. 1996).

Monitoring Data Summary

The site is currently very stable. Thick vegetation obscures the visibility of the features. The site should be photographed in February of 1997, when the vegetation is not so dominant.

FY99 Recommendations

Monitor this site on a 4-year schedule and then reassess for possible placement on the inactive list.

G:03:077 Rock Art (inactive schedule)

G:03:077 consists of three hematite pictographs and an associated grinding slick located in a major tributary of the Colorado River. The site is adjacent to a permanent water source and has a trail leading directly to it. Cultural affiliation is unknown. The Hualapai Tribe has indicated that this is a Traditional Cultural Property and they should be consulted regarding any action taken or change noted at this site.

Previous Work

This site was recorded in April of 1991 (Fairley et al. 1994) and was monitored in FY93, FY95, and FY99 (Coder et al. 1994a, 1995b; Hubbard 1999b). Medium-format photographs have been taken of the pictographs (Leap 1997b). Additionally, GRCA trail crews have maintained the established trail over many years.

Monitoring Data Summary

The pictographs are in good condition with no change since the FY95 trip. The grinding slicks are also unchanged. There is a well-established trail leading to the panel that GRCA maintains. The site is an attraction for river-runners. However, there are currently no signs of visitor-related impacts at the site.

FY99 Recommendations

It is recommended that this site be placed on the inactive monitoring list. GRCA will continue to manage any visitor-related impacts that occur and will conduct trail maintenance as needed. The GRCA River Patrol will visit the site periodically to check on any ARPA violations.

G:03:082 Småll Structure (inactive schedule)

The site consists of three main rockshelters in the Tapeats ledges. Locus A, the lowest shelter, contains a concentration of about 20 white Kaibab chert flakes in a 3-m diameter area. Locus B is a shelter with a collection pile of sherds, flakes, core fragments, and a smoke-blackened ceiling. Lithic debitage and a few sherds extend downslope. Two smaller shelters, one with a single-course rock alignment, are directly above the Locus B shelter. This shelter appears to have been the main habitation focus. Locus C contains a single wall of stacked and upright Tapeats slabs. This is a possible multi-component site, with both Late PI–early PII Virgin and late prehistoric–early historic Pai or Paiute occupations.

Previous Work

NPS survey personnel recorded this site in April of 1991 (Fairley et al. 1994). It was monitored in FY92, FY93, and FY95 (Coder et al. 1994a, 1994b, 1995b).

Monitoring Data Summary

The 1991 surveyors noted some surface erosion at the site, plus evidence of visitation as indicated by collection piles at Locus B. The FY92 and FY93 monitors noted spalling and the presence of pack rat burrows in the shelters. These same minor impacts were observed in FY95, and the site was placed on the inactive monitoring list.

FY99 Recommendations

This site will remain on the inactive monitoring list.

G:03:083 Artifact Scatter (inactive schedule)

The site consists of an historic cache of seven 5-gallon "honey cans" for gasoline, several motor oil cans, 25+ food cans, a broken crate, several glass jars (one containing matches), playing cards, and other items. Also present is a first aid kit in a green metal tool box that includes two Reader's Digest magazines dated April 1945 and July 1945. River lore has it that this cache was left by Post-WWII power boaters up-running from Lake Mead when the lake was higher. Another possibility is that this cache may have belonged to Harry Aleson.

Previous Work

The site was originally recorded in 1991 (Fairley et al. 1994) and was monitored in FY97 and FY98 (Leap et al. 1997, 1998). The GRCA River Patrol monitored the site for ARPA violations in FY98.

Monitoring Data Summary

No physical impacts were observed. Artifacts have been slightly rearranged compared to the last photograph dated in 1991. As long as there is a detailed inventory of the artifacts, this site should be visited by river patrol for ARPA violations.

FY99 Recommendations

This site will remain on the inactive list with periodic monitoring for ARPA violations by GRCA River Patrol rangers. High flows may remove the box and its contents; therefore a detailed artifact inventory should be completed.

G:03:085 Artifact Scatter (inactive schedule)

This site consists of two artifact areas separated by an interdunal area. One area contains a Cerbat Brown Ware pot break with approximately 14 sherds and 5 lithics. The downstream portion of the site contains a biface knife base, a projectile point base fragment, and other utilized flakes. It is possible that this site is a late prehistoric–early historic Pai site.

Previous Work

The site was originally recorded during the river corridor survey (Fairley et al. 1994). Monitors visited the site in FY92, FY93, FY95, and FY99 (Coder et al. 1994a, 1994b, 1995b; Kunde 1999b).

Monitoring Data Summary

The pot break is unchanged since last visited in November of 1994. Both the knife base and the point base were relocated. No signs of human visitation were observed. The site is extremely stable and in excellent condition. There is a thick crust of cryptogamic soil across the entire dune area. It is recommended that this site be placed on the inactive list and be monitored only after river flows greater than 90,000 cfs.

FY99 Recommendations

This site will remain on the inactive monitoring list.

CHAPTER 9. FY92–FY99 DATA SYNTHESIS SUMMARY

Lisa M. Leap

The monitoring database is a compilation of observations recorded from FY92 through FY99 for 264 archaeological sites in the Colorado River corridor. It reflects what has been observed and accomplished for the past 8 years, and documents how sites were observed and how remedial actions were implemented.

The database has great value, despite some fundamental problems with its structure (see Chapter 11). For example, after 15 years of monitoring, the GCMRC is finally addressing the issue of internal consistency (Council 1999). Without consistent data sets, it is nearly impossible to develop a comprehensive understanding of how variations in dam operations have affected Grand Canyon resources (Council 1999).

Internal consistency is one of the stronger attributes of the RCMP database. The same base staff has completed all of the monitoring, and with the exception of a major monitoring form alteration in FY93, core variables have also remained the same. Compared to most of the GCMRC data, the RCMP is one of the few programs demonstrating long-term monitoring consistency. Several GCMRC studies have yet to identify core variables, measurement locations, frequencies, or methods with which to develop a long-term monitoring program (Council 1999). The RCMP has integrated information from researchers outside the archeology discipline, such as geomorphological studies of drainage systems, and has incorporated them into its long-term monitoring program. Although 8 years of data collection could be construed as preliminary by many researchers, the database nevertheless has supplied much information on site activity and the mitigative measures implemented. The collected data have also given RCMP staff and PA members the ability to refine the current monitoring program.

RCMP staff members consider sites with river-based drainages to be directly impacted by dam operations. Seventy sites have been identified with river-based drainages. Because these drainages reach the river, the river directly controls their depth and width. If river flows are high, the drainages retreat; if flows are low, drainages deepen to reach the river. Additionally, Hereford has theorized that these sites cannot be preserved successfully due to this direct cause-and-effect relationship (Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996a, 1996b).

The RCMP staff considers the 76 sites with terrace- and side canyon-based drainages to be indirectly impacted by dam operations. These drainages have yet to reach the river and therefore are the most critical to preserve, according to Hereford, Thompson, and others (Hereford 1996; Hereford et al. 1993, 1995, 1996; Thompson et al. 1996). Preservation treatments for sites with terrace- and side canyon-based drainages are more successful because, in contrast to river-based drainage sites, they are proactive as opposed to reactive.

Sites with undeveloped drainages (118 sites) are considered potentially impacted by dam operations. These sites have no drainages deeper than 10 cm. Treatments implemented at these sites are likely to have positive effects. The following discussion presents a synthesis of the three main physical impacts—direct, indirect, or potential—caused by dam operations at the relevant 264 sites.

PROPERTY TYPES WITHIN THE APE

Various PA members have suggested that the property types defined in the original survey should be collapsed into more comprehensive and descriptive site types. RCMP personnel have therefore condensed the original 25 property types into 10 categories (see Chapter 1). These are preliminary categories; final property types will be assigned according to the GRCA site type definitions to assure uniformity in GRCA's database. For individual site information, refer to Appendices E–I.

Using the 10 preliminary groups, any site types with a roasting or thermal feature constitute the highest percentage (46%) of the property types along the river corridor. The remaining property types each represent 25 percent (small structures) or less (see Table 7).

Table 7. Property Types Represented in the APE

Site Count	Property Type
34	Artifact Scatter
18	Historic Structure
13	Multi-Thermal/Structure Complex
11	Other
5	Pueblo
39	Roaster Complex
32	Roaster Feature
10	Rock Art
65	Small Structure
37	Thermal Feature
264	Total

Tables 8–10 reflect the three groups of sites within the APE as defined by the RCMP: (1) sites with river-based drainages directly impacted by dam operations; (2) sites with terrace- and side canyon-based drainages indirectly impacted by dam operations; and (3) sites with undeveloped drainages potentially impacted by dam operations. Each table lists the property type counts and their current condition. Overall, the tables show that the majority of sites with river-based drainages are in fair to poor condition: all five artifact scatters in Table 8 are in poor condition. Sites with terrace- and side canyon-based drainages are generally in good or fair condition, and most sites with undeveloped drainages are in excellent or good condition.

PRESENCE OF PHYSICAL IMPACTS FROM FY92 TO FY99

Physical impacts documented in the database have been consistent for the past 8 years. On average, 83 percent of the sites visited each year show some form of physical impact (see Table 11). As discussed in Chapter 1, physical impacts include surface erosion, gullying, arroyo cutting, bank slump, eolian and alluvial processes, and other impacts, such as animal disturbance and spalling. Eighty-four percent of the physical activity observed is surface erosion or sheet wash. Gullying is the second highest impact at 48 percent. The other impacts noted in the past 8 years, in decreasing percentages, include "other" at 43 percent, eolian and alluvial processes at 39 percent, animal disturbance at 34 percent, arroyo cutting at 24 percent, bank slump at 19 percent, and side canyon erosion at 10 percent.

CHANGES OBSERVED IN SITE CONDITION

Determination of current site condition is based on data from monitoring forms and site maps. Determining a site's condition can, at times, be very subjective; however, RCMP staff used the IMACS classification to lessen subjectivity. The definitions for a site's condition are Excellent (virtually undisturbed), Good (75% undisturbed), Fair (50–75% disturbed), and Poor (more than 50% disturbed).

The RCMP's basic approach to determining site condition is to compare the site's current status with a documented previous status. By comparing a site's condition identified during the 1991 survey (Fairley et al. 1994) with RCMP's current site evaluations, 49 sites (19%) are shown to have deteriorated over the past 8 years. Sites experiencing the most change are those with river-based drainages. For example, 1991 survey personnel recorded six sites in excellent condition; the RCMP staff recorded no sites in excellent condition. The RCMP noted 19 of these sites in good condition; the 1991 survey staff recorded 35 in good condition. Another example within this group that exemplifies deterioration is the increase by 144 percent in the number of sites in poor condition since the survey. Sites indirectly and potentially impacted by dam operations demonstrate small variations in the numbers; however, sites directly and indirectly impacted by dam operations show general deterioration over the years (see Figure 21).

Table 8. Property Type and Site Condition for Sites With River-Based Drainages

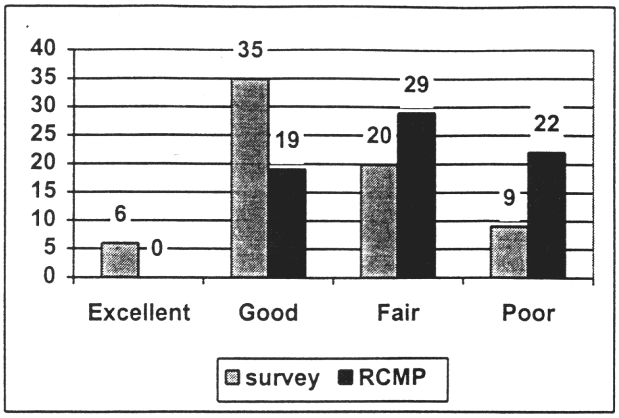
Property Type	Site Condition				Total
	Excellent	Good	Fair	Poor	
Artifact Scatter	0	0	0	5	5
Historic Structure	0	3	0	0	3
Structure-Thermal Feature Complex	0	0	3	2	5
Other	0	1	2	1	4
Pueblo	0	1	0	2	3
Roaster Complex	0	8	9	2	19
Roasting Feature	0	2	2	3	7
Small Structure	0	2	8	3	13
Thermal Feature	0	2	5	4	11
Total Number of Sites	0	19	29	22	70

Table 9. Property Type and Site Condition for Sites With Terrace- and Side Canyon-Based Drainages

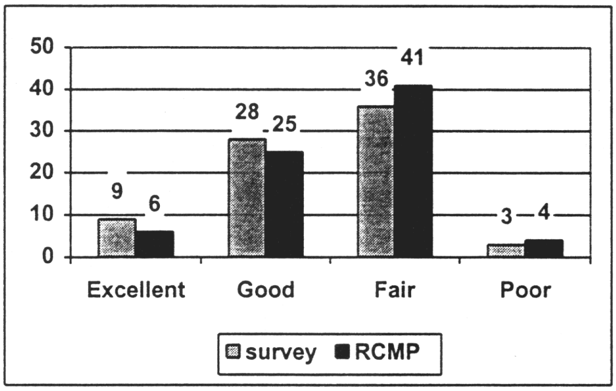
Property Type	Site Condition				Total
	Excellent	Good	Fair	Poor	
Artifact Scatter	0	2	4	0	6
Historic Structure	2	0	2	0	4
Structure-Thermal Feature Complex	0	1	1	1	3
Other	1	1	0	0	2
Roaster Complex	1	7	8	0	16
Roasting Feature	0	2	8	2	12
Rock Art	1	0	0	0	1
Small Structure	0	7	10	0	17
Thermal Feature	1	5	8	1	15
Total Number of Sites	6	25	41	4	76

Table 10. Property Type and Site Condition for Sites With Undeveloped Drainages

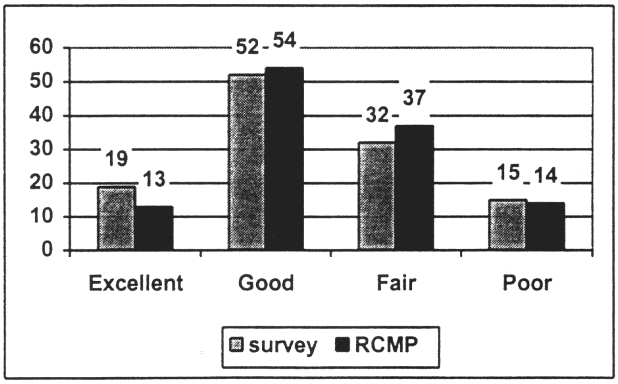
Property Type	Site Condition				Total
	Excellent	Good	Fair	Poor	
Artifact Scatter	5	11	7	0	23
Historic Structure	2	5	1	3	11
Structure-Thermal Feature Complex	0	3	2	0	5
Other	0	4	1	0	5
Pueblo	0	1	1	0	2
Roaster Complex	0	2	2	0	4
Roasting Feature	2	10	1	0	13
Rock Art	3	4	1	1	9
Small Structure	1	10	16	8	35
Thermal Feature	0	4	5	2	11
Total Number of Sites	13	54	37	14	118



Comparison of survey site condition with RCMP site condition for sites with river-based drainages (sites directly impacted by Dam operations)



Comparison of survey site condition with RCMP site condition for sites with terrace- and side canyon-based drainages (sites indirectly impacted by Dam operations)



Comparison of survey site condition with RCMP site condition for sites with no drainages (sites potentially impacted by Dam operations)

Figure 21. Bar graphs comparing 1991 survey site condition with RCMP site condition by drainage type.

STABLE SITES LOCATED IN THE APE

Of the 264 sites, 87 sites are on RCMP's inactive monitoring list. The inactive list represents sites located within the APE that for various reasons are not monitored by this program. Reasons for placing sites on the inactive list include that the site is under GRCA management, site integrity is questionable, data potential is exhausted, or the site is in stable condition. Of the 87 sites present on the inactive list, 78 have not shown active erosion and are considered stable. The number of stable sites includes 9 in the river-based group, 10 in the terrace- and side canyon-based group, and 59 in the group with undeveloped drainages (see Appendix I).

SITES WITH ACTIVE PHYSICAL EROSION AND THE REMEDIAL ACTIONS RECOMMENDED

Thirty-seven percent of the sites identified by the RCMP staff are being impacted by physical erosion. As expected, 67 percent of the sites with river-based drainages are actively eroding, and the percentages decrease with the other two categories: 38 percent for sites with terrace- and side canyon-based drainages and 17 percent for sites with undeveloped drainages. Active erosion for all of these sites consists of gullying and arroyo cutting. Sites with undeveloped drainages are experiencing active erosion in the form of bank slump, sheet wash, and eolian and alluvial processes (see Table 12).

Table 13 lists the site condition frequencies by drainage type. Comparing current site conditions with active erosion shows that 86 percent (19 sites) of the sites with river-based drainages are in poor condition and are actively eroding. Of the sites with terrace- and side canyon-based drainages, four are in poor condition and all but one are actively eroding. Fourteen sites with undeveloped drainages are in poor condition, but only one is physically eroding. It is likely that visitor impacts account for the other 13 sites in poor condition. See Table 14 for a list of sites actively eroding and in poor condition by property types.

Table 11. Physical Impacts and Number of Monitoring Episodes Since FY92

Fiscal Year	Number of Monitoring Episodes	Percent of Physical Impact
92	83	88
93	163	85
94	160	77
95	165	76
96	150	89
97	104	89
98	105	81
99	112	79
Total	1,042	

Table 12. Sites With Active Physical Erosion

Physical Activity	Sites with River-Based Drainages	Sites with Terrace- and Side-Canyon-Based Drainages	Sites with Undeveloped Drainages	Total	Percent
Active	47	29	20	96	37
Potential	23	47	98	168	64
Total	70	76	118	264	100

Table 13. Site Condition by Drainage Category

Site Condition	Sites with River-Based Drainages	Sites with Terrace- and Side-Canyon-Based Drainages	Sites with Undeveloped Drainages	Total	Percent
Excellent	0	6	13	19	7
Good	19	25	54	98	37
Fair	29	41	37	107	41
Poor	22	4	14	40	15
Total	70	76	118	264	100

Table 14. Sites in Poor Condition and Actively Eroding by Drainage and Property Type

Property Type	Sites with River-Based Drainages	Sites with Terrace- and Side-Canyon Based Drainages	Sites with Undeveloped Drainages
Artifact Scatter	A:16:158 C:02:092 C:02:098* C:13:358		
Multi-Thermal-Structure Complex	C:02:096* C:13:099*	C:13:371*	
Pueblo	C:13:010* C:13:100*		
Roaster Complex	C:13:273 G:03:064		
Roaster Feature	A:16:180 C:13:355*	A:15:035	
Small Structure	C:13:291* C:13:345 C:13:347*		
Thermal Feature	B:15:138 C:02:085 C:13:381 G:03:038	C:13:323	A:15:042

* Indicates sites recommended for data recovery in (Leap 1999).

TYPES OF TREATMENTS RECOMMENDED

The type of remedial actions recommended for eroding sites varies from site to site. See Tables 15 and 16 for the treatments recommended for preservation in place and data recovery projects. As a result of this data synthesis, the majority of work recommended for preservation is to assess sites with terrace- and side canyon-based drainages for treatment, such as building checkdams or planting vegetation, within the drainages to curtail the erosion process. The RCMP staff, accompanied by Zuni Soil Conservation Project personnel and NPS personnel, will make the assessments. It is imperative that these assessments occur before the drainages become river based and therefore more threatening to the site. It is important to shift our efforts to these sites. This shift will allow the PA program to avoid pressure situations regarding emergency archaeology, similar to the situation we are now facing for a selected number of sites.

Another treatment that RCMP will facilitate is trail work. Because we have recorded where the trailing occurs, it is important that we relay this information to GRCA trail crews. Trail work is generally completed on GRCA trails trips with a GRCA archaeologist; however, GRCA trail crews do accompany RCMP trips at times to complete the necessary work.

Most data recovery work is conducted on sites with river-based drainages. The recommendation for testing for intact materials signifies that site integrity is questionable. Commonly, especially at sites with undeveloped drainages, no additional monitoring is recommended until site integrity testing is completed. For sites recommended for data recovery, monitoring will continue and emergency data recovery will be conducted until funds are allotted for full-scale excavations. It is better to retrieve what little information is left, than to let information about the history of the Canyon erode.

Table 15. Preservation Recommendations for Sites in Each Drainage Category

Preservation Recommendation	Sites with River-Based Drainages	Sites with Terrace- and Side-Canyon-Based Drainages	Sites with Undeveloped Drainages	Total	Percent
Assessment—drainage	10	44	0	54	24
Assessment—preservation treatment	4	5	9	18	8
Checkdam installation	0	1	0	1	0
Checkdam maintenance	16	12	1	29	13
Quantify checkdam effectiveness	16	12	0	28	12
Close site	3	1	0	4	2
GRCA obliterate trail	1	2	0	3	1
GRCA retrail	1	0	0	1	0
GRCA trail maintenance	18	16	11	45	20
Medium format photography	1	3	4	8	3
Site documentation	1	4	3	8	3
Total station base map	1	2	0	3	1
Total station map update	5	1	0	6	3
Tribal participation	6	5	10	21	9
Total	26	56	27	227	

Table 16. Data Recovery Recommendations for Sites in Three Drainage Categories

Data Recovery Recommendation	Sites with River-Based Drainages	Sites with Terrace- and Side-Canyon-Based Drainages	Sites with Undeveloped Drainages	Total	Percent
Date recovery assessment	5	3	0	8	13
Radiocarbon sample	5	2	2	9	15
Data recovery	17	5	3	25	41
Testing for intact materials	6	5	8	19	31
Total	32	15	13	61	100

REMEDIAL ACTIONS COMPLETED

Data recovery has been completed at 43 sites. These actions consisted of feature-specific excavations, radiocarbon sample collections, or testing specific features for intact subsurface cultural deposits. The majority of the work was conducted at thermal and roasting sites. As mentioned in Chapter 1, 20 sites had carbon samples taken from them in the late 1980s and early 1990s in conjunction with the research completed by Hereford. Refer to Appendix B for a summary of the sites having some form of data recovery.

Several sites have been recommended for excavation in the past (Leap 1999). However, the recommendation for several of these locations has not been considered due to the lack of funding. It has been difficult for Reclamation to obtain the necessary funds to complete the work. As a result, very few data recovery projects have been initiated, and very few have been completed. In the meantime, project staff are doing what they can to delay the destruction of these archaeological sites until funds are allotted for the proposed excavations. (An additional reason for these delays is the lack of a research design; this is discussed in more detail in Chapters 3 and 11.)

Preservation actions, as listed in Table 17, have been completed at 96 sites. Most of the preservation work has been completed on sites with river-based drainages and on sites in fair to poor condition.

Table 17 shows that 74 percent of the sites with river-based drainages that received preservation treatment are still active, whereas 65 percent of the sites with terrace- and side canyon-based drainages are active. The RCMP staff acknowledges that at some sites, gullies with checkdams are collecting sediment, vegetation transplanting has been successful, and multiple trails are decreasing in number. However, it is far too early for the complete recovery of several sites. To date, RCMP staff members have observed no whole-site improvement since the implementation of preservation treatments beginning in FY95. For example, although checkdams are collecting sediment, it has been insufficient to fill in the gullies (defined as drainages 10 cm to 1 m deep). Plants are growing, but they have not matured enough to begin stabilizing the gully walls or slopes.

As recognized by the NRC (Council 1999), when evaluating a long-term monitoring program, discussing the success of preservation actions can be premature because these actions will not yet yield significant documentable results. The only real way to evaluate the short-term success of preservation actions is to conduct frequent site visits to attain very detailed information (Council 1999). This type of monitoring has been completed in the past 2 years using a total station instrument (see Chapter 1), but due to the redistribution of funds and the disinterest of some PA members, this method of tracking success or failure by quantifying change has been discontinued. Other methods for tracking the success of preservation treatments are currently being investigated by project personnel. The success of these treatments should be evaluated intensely for several years. After these evaluations, a decrease in monitoring frequencies is anticipated.

A total of 30 sites are monitored less frequently (this includes placing 17 sites on the inactive list) as a result of this synthesis. Preservation treatments have allowed decreased monitoring frequencies for seven sites (C:09:031, C:09:034, C:02:101, C:13:338, C:13:381, G:03:003, and G:03:026). Treatments for sites C:09:031 and C:09:034 included detailed medium-format photography. C:02:101, C:13:381, G:03:003, and

Table 17. Preservation Treatments and Current Status

Impact Category	No. of Sites Treated	Site Condition				Physical Activity	
		Excellent	Good	Fair	Poor	Active	Potential
Sites with river-based drainages	43	0	10	18	15	32	11
Sites with terrace- and side canyon-based drainages	23	0	8	14	1	15	8
Sites with undeveloped drainages	30	3	17	8	2	7	23
Total	96	3	35	40	18	54	42

G:03:026 had checkdams installed, and data recovery was performed at site C:13:338 on two features located on an active slope.

Most of our efforts have concentrated on sites directly impacted by dam operations. The RCMP staff acknowledges that excavations should occur at sites with river-based drainages because the drainage systems at these sites are commonly too advanced. Therefore, future preservation work will be focused on sites with terrace-based and side canyon-based drainages.

PRIORITIZATION OF TREATMENTS

The RCMP staff has prioritized treatments (preservation and data recovery) based on the findings of this report. Although each site is individually assessed for various treatments, certain descriptive generalizations can be made for each of the three groups in order to initiate priority treatment. For example, 72 percent of the sites with river-based drainages—sites considered to be directly impacted by dam operations—are in fair to poor condition (41% in fair condition and 31% in poor condition). Sites with terrace- and side canyon-based drainages—sites indirectly impacted by dam operations—are in fair to good condition (54% in fair condition and 33% in good condition). Sites with undeveloped drainages—sites potentially impacted by dam operations—are in good to fair condition (46% in good condition and 31% in fair condition).

Most actively eroding sites have river-based drainages (68%). Thirty-eight percent of sites with terrace- and side canyon-based drainages exhibit active physical erosion, and 19 percent of sites with undeveloped drainages are actively eroding. It is therefore clear that erosion is more advanced at sites with river-based drainages. This is true at two sites (C:13:099 and C:13:100) even after the implementation of checkdams. However, this observation is based solely on the preliminary results in this report (see Chapter 1), which demonstrate that maintenance was performed on checkdams within river-based drainages more often than sites with terrace or side canyon-based drainages. All checkdams installed in the various drainage types need to be researched much more closely to determine their effectiveness. This entails detailed mapping of the areas to measure volumetric change in sediment. It is possible that this work will be completed by GCMRC this fiscal year.

Until this work is completed, no reliable evidence exists to prove that river-based drainages cannot be stabilized. However, because of the advanced stages of erosion, RCMP staff members recommend that all sites with river-based drainages that are recommended for data recovery should be the PA's first priority for data recovery work. As shown in Table 14, 19 sites are recommended for data recovery; six have already been proposed for excavations prior to the findings in this report (Leap 1999).

Data recovery treatments for sites with terrace- and side canyon-based drainages should not receive priority over sites with river-based drainages. Only 3 of the 76 sites (C:13:371, A:15:035, and

C:13:323) are in a critical state and in need of data recovery. One site (C:13:371) has been previously recommended for data recovery by the RCMP staff (Leap 1999c). Site C:13:371 has a side canyon-based drainage that is fairly advanced; its priority should be equal to sites with river-based drainages.

Data recovery actions for sites with undeveloped drainages should be completed only after work has been conducted at the other two groups. The one site recommended for data recovery, A:15:042, is a thermal feature and in poor condition.

All other data recovery recommendations should be completed based on the same prioritization (river based first, then terrace and side canyon based, then undeveloped drainages). Regarding the recommendation to test for intact cultural materials, the RCMP staff suggests that these 19 sites should be tested during the regularly scheduled monitoring trips. This work will determine the significance of the sites and whether any additional work is necessary. The work would be completed in the same priority order (river based, then terrace and side canyon based, then undeveloped drainages).

The PA's first priority for preservation treatments should therefore be sites with terrace- and side canyon-based drainages, and then sites with undeveloped drainages. The goal is to prevent any drainage system from becoming river based. After drainages are river-based, erosion control is probably nearly impossible. They are then inexorably connected to a much larger erosive force, the Colorado River. These sites are very fragile and if preservation in place is postponed, they will very likely eventually be listed for data recovery instead. The continuation of checkdam installation will be dependent on the information generated by GCMRC this fiscal year on the effectiveness of checkdams.

The majority of the preservation work recommended on sites directly impacted by dam operations constitutes continued monitoring until full-scale or limited excavations are completed. Because river-based drainages are active (68% actively eroding), the potential for newly exposed cultural materials is great.

ADDITIONAL FACTORS IN PRIORITIZING TREATMENTS

There are several additional factors to consider prior to conducting any remedial tasks. For example, prior to conducting archaeological excavations, PA members should consider the research design that should be in place prior to any recovery. This will help focus excavations on sites that will benefit the archaeological record within the corridor and within the area. Some corridor considerations include site type, site condition, site location, and cultural affiliation.

For preservation work, PA members should consider not only the archaeological potential of the site, but also a couple of other factors. The geomorphological setting is extremely important; the work completed by Thompson et al. (1998) is a good starting point in this regard. Information about sediment type, catchment systems, slope, and general drainage cross-sections should be gathered before implementing a preservation treatment. Identification of the vegetation in the area will supplement this data. The maturity of the plants and the root systems can also aid in the success or failure of a preservation project.

Much of this additional archaeological, geomorphological, and botanical information is supplied on the original survey form. The task of incorporating this information into the monitoring database would be considerable, but the RCMP staff believes it is a necessary and valuable task to complete.

CHAPTER 10. VISITOR-RELATED IMPACTS OBSERVED FROM FY92 TO FY99

Duane C. Hubbard and Lisa M. Leap

Five million people visit Grand Canyon National Park every year. About 22,000 people raft the Colorado River and 15,000 backcountry permits are issued (USDI 1998). Those who partake in a backcountry wilderness experience will most likely wander upon or intentionally visit at least one archaeological site. Some may even camp within a site due to the optimum topographic location or simply for shelter. A lack of archaeological education, curiosity, or malice are the main causes of disturbance to many sites. This project has defined these intentional or incidental disturbances along the river corridor as visitor-related impacts (Coder et al. 1994a, 1995a; Leap et al. 1996, 1997, 1998). Visitor-related impacts include trailing through sites, collection piles, on-site camping, criminal vandalism, and an "other" category (trash, tourist shrines).

Members of the PA have expressed concern regarding visitor-related impacts at sites along the river. SWCA's data synthesis report points out that tribes see visitation as the "primary impact" to cultural resources (Neal et al. 1998:39). The RCMP staff does not believe that visitor-related impacts are the primary impact to sites; however, visitation is substantial, as indicated by the RCMP monitoring data (25% of the sites monitored from FY94 to FY99 have active visitor-related impacts).

PA members have discussed the responsibility for managing visitor-related impacts at sites along the river corridor for many years. While this debate continues, the RCMP staff will continue to record and mitigate visitor-related impacts during regularly scheduled monitoring visits; taking no action would simply be irresponsible. The RCMP staff has taken the lead in recording visitor-related impacts, and GRCA rehabilitation crews have mitigated visitor-related impacts by conducting trail and revegetation work.

GRCA acknowledges its responsibility to mitigate visitor-related impacts under Section 110. However, the RCMP staff also believes that there is a connection between the dam's existence and operations, and the frequency of visitor-related impacts in the river corridor. Important considerations presented here include RCMP visitor-related impact data, findings regarding which user groups primarily impact archaeological sites in the river corridor, and why the dam's existence and operations regulate user group behavior. Future visitor-related impact research should focus on clearly defining how the dam's operations affect the frequency of visitor impacts in the river corridor. In the meantime, NPS and Reclamation will work together to develop effective approaches to deter these ongoing visitor-related impacts.

RCMP VISITOR-RELATED IMPACT DATA (FY92 TO FY99)

FY92 and FY93 visitor-related impact data were collected differently than the FY94 to FY99 data due to differences in the RCMP monitoring form (Coder et al. 1994a, 1995a, 1995b; Hubbard 1999a, 1999b; Kunde 1998a, 1999b; Leap et al. 1996, 1997, 1998). FY92 and FY93 visitor-related impact data were categorized as high, moderate, minimal, or no impacts. In total, 144 visitor-related impacts were noted at 136 sites. Eleven sites had high impact, 46 sites had moderate impact, and 79 sites had minimal human impact.

The RCMP staff revised the monitoring form in FY94 to specifically define the types of visitor-related impacts, where they were occurring on sites, and whether visitor-related impacts were present, absent, increasing, or decreasing. In FY98 the monitoring form was changed to record only the presence or absence of visitor-related impacts while continuing to identify the on-site impact locations. The RCMP staff deleted the "increase" or "decrease" categories in the matrix to reduce subjectivity. However, monitors continued to describe what they saw as increases or reduction in visitation in the descriptive section of the monitoring form. Table 18 presents a summary of visitor-related impacts observed and recorded from FY94 through FY99.

Table 18. Visitor-Related Impacts Observed and Recorded FY94–FY99

Fiscal Year	Sites Monitored	Sites with New Impacts	Vandalism	On-Site Camping	Trails	Collection Piles	Other Impacts	Total No. Observed
94	128	33	1	4	64	18	6	93
95	144	41	0	8	67	17	11	103
96	142	36	3	6	54	13	9	85
97	97	21	2	4	36	9	2	53
98	99	22	1	1	39	8	6	55
99	103	19	3	6	36	8	12	65
Total	713	172	10	29	296	73	46	454

From FY94 to FY99 trailing was the most frequently identified visitor impact. The entrenchment of trails, which causes compaction, the removal of vegetation, and the development of rills and gullies are all of concern to monitors. Due to the compaction of soil and obliteration of vegetation in trails, surface flow is channeled through trails that lead downslope to the river. As a trail-gully becomes entrenched, the potential for a river-based drainage to develop increases.

USER GROUPS IMPACTING ARCHAEOLOGICAL SITES IN THE RIVER CORRIDOR

By examining the proximity of backcountry trails, river-runner camps, research areas, or highly used fishing areas to archaeological sites, the RCMP staff can determine who is most likely impacting a certain site. The RCMP staff believes that the operations of Glen Canyon Dam affect where river-runners camp, where GCMRC scientists conduct research and camp, and which sites are highly impacted by visitors.

The RCMP staff realizes that scientists cause some impacts to archaeological sites. Researchers include natural and cultural scientists involved in GCMRC programs or the GRCA Science Center. Some scientists have conducted research in the same locations since the inception of GCES in 1982. The RCMP staff speculates that certain visitor-related impacts such as trailing are a direct result of scientists traveling to research areas throughout the Grand Canyon. Scientists often camp in one research area for extended lengths of time (a week or more). Extended stays in certain areas cause higher impacts to resources in that area.

The RCMP staff is attempting to obtain records of various research locations along the river. Preliminary findings indicate that about 50 research trips were conducted in FY99. By identifying research areas, the RCMP staff can make scientists aware of the damage they may be causing to archaeological sites in the vicinity. More research is needed to further define the extent of researcher impacts at archaeological sites.

The RCMP staff and GRCA recreation specialists have been identifying backpacker impacts at sites for more than 20 years. The most common manifestations of backpacker impacts are recent hearths, tent rings, and trash. GRCA successfully manages backpacker impacts by rerouting trails away from sites, performing revegetation work, and educating users on backcountry etiquette. Backpacker impacts are a Park responsibility and have nothing to do with the operations or existence of Glen Canyon Dam.

Anglers impact sites in Marble Canyon, particularly around Lees Ferry. Anglers look for shade during the day and find it within overhangs. Many of the sites in Marble Canyon are in overhangs. The RCMP staff has identified five sites within the Lees Ferry vicinity that contain evidence of angler visitation and impact.

RCMP staff members attribute most of the visitor-related impacts in the river corridor to river-runners. RCMP data (FY94 to FY99) indicate that archaeological sites with consistently high frequencies of impacts are often located directly above primary river camps (Kearsley and Warren 1993). Archaeological sites with no history of visitation are often located far from river camps. Some archaeological sites with consistently high visitor-related impacts have primary camps below the sites as well as nearby backcountry trail systems. The combination of backcountry trails and primary river camps results in the highest frequencies of impacts to archaeological sites (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

Sixty-eight percent (45 of 66) of the sites with active visitor-related impacts have a river-runners camp in proximity; proximity is defined as less than one 1 km (Coder et al. 1994b). It should be noted that many of the sites in this group have camps within 500 m.

The operations of Glen Canyon Dam determine which beaches remain conducive to camping. Researchers have recorded the loss of "suitable campsites" due to accelerated erosion for many years (Beus et al. 1985; Kearsley and Warren 1993; Schmidt et al. 1992; Schmidt 1989; Webb et al. 1987). The reduction of suitable campsites since the construction of Glen Canyon Dam was demonstrated by Kearsley and Warren in 1993. The researchers inventoried existing river corridor campsites in 1991 and compared the inventory results with previous inventories from 1973 and 1983 (Brian and Thomas 1984; Weeden 1975). Their comparison of the 1991 inventory with the 1983 inventory showed a 48 percent decrease in the number of campsites. The comparison of the 1991 data to the 1973 data revealed a 51 percent reduction in the number of large campsites (Kearsley and Warren 1993:12). The researchers attributed the campsite reduction to erosion and vegetation growth.

The reduction of sediment in the river and the absence of annual floods that would otherwise replenish beaches cause erosion that is directly related to dam operations. The reduction of campsites in the river corridor is therefore directly linked to the operations of the dam (Kearsley and Warren 1993). The resultant higher concentrations of river-runners at a limited number of campsites translates into higher occurrences of visitor-related impacts at the archaeological sites located within the vicinity of these camps (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

Other evidence of a reduction in the number of beaches has been illustrated by historic photographers such as Stone, Belknap, Kolb, and Hillers. Comparison with these photographs indicates a reduced number of beaches, which affects the availability and quality of camping locations. Some pre-dam beaches still exist; however, the absence of large annual floods no longer controls the vegetation cover of the shoreline, making many beaches unsuitable for camping.

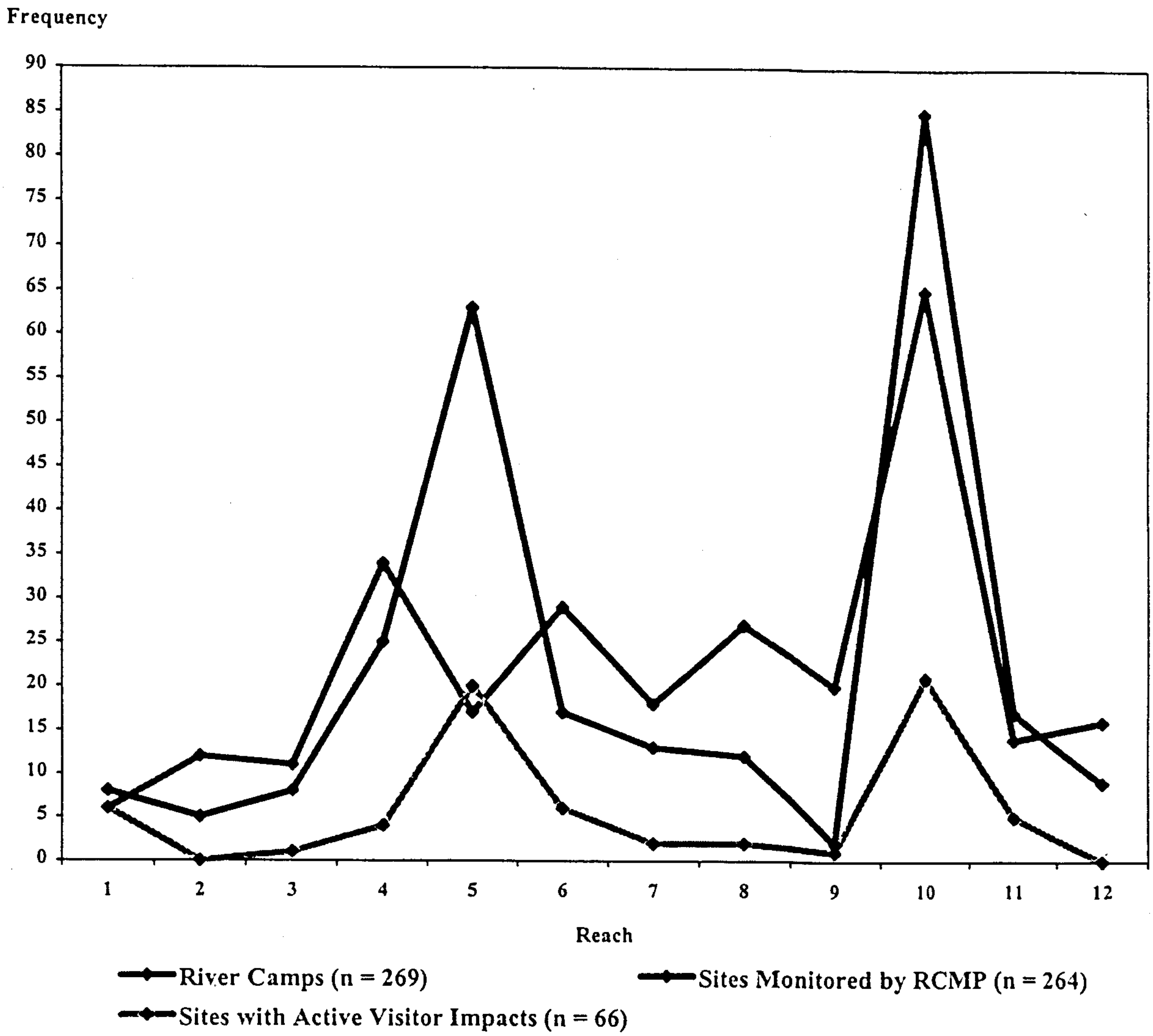
The effects of the 1996 research (beach and habitat building) flow illustrate the importance of sediment replenishment. The high flow redeveloped existing beaches and created new camping beaches, a process that happened annually prior to the construction of Glen Canyon Dam. The 45,000 cfs flow experiment indicates that the absence of pre-dam floods affects what beaches exist, and which beaches river-runners prefer due to beach size, location to attraction sites, flat camping areas, and beach aesthetics.

Figure 22 illustrates the frequency of sites, the frequency of active visitor-impacted sites and the frequency of campsites distributed by reach as defined by Schmidt and Graf (1990). The frequency of sites identified with active visitor-related disturbance is based on at least one occurrence of visitor activity recorded at the site from FY94 to FY99. It should be noted that monitors recorded one or more visitor-related occurrences at many of the 66 actively impacted sites.

Figure 22 illustrates that monitors recorded visitor-related impacts at 75 percent of the sites in Reach 1, mostly by anglers. Reach 1 contains numerous hiking trails from the rim to the river on both the GRCA side of the river (north bank) and the Navajo Nation side (south bank). The most frequently hiked trails in this stretch include the Jackass, Badger, and Soap Creek trails.

Reaches 2 and 3 have limited campsites, low site frequencies, five backcountry trails, and only one site impacted by visitors (C:05:004). Reaches 2 and 3 have limited access to the river (Salt Water Wash, Shinumo, Rider Canyon, North Canyon, and South Canyon. FY94 monitors identified extensive angler impacts at C:05:035 in Reach 3. Due to the severity of the impacts, which resulted in the loss of site integrity, the site was discontinued from the RCMP program.

Reach 4 has the second highest frequency of campsites, one backcountry trail (Nankoweap), the third highest frequency of sites, but a very low frequency of sites impacted by visitation. All of the sites actively impacted in this reach are river-runner attraction sites (C:09:030, C:09:031, C:09:034, and C:09:088). River-runner attraction sites are identified as points of interest to river guides or places known in the boating community where commercial guides give tours, discuss topics such as the human history of the Canyon, or tell stories of past events.



Reach	1	2	3	4	5	6	7	8	9	10	11	12
River Camps (n=269)	6	12	11	34	17	29	18	27	20	65	14	16
Sites Monitored by RCMP (n=264)	8	5	8	25	63	17	13	12	2	85	17	9
Sites with Active Visitor-related Impacts (n=66)	6	0	1	4	20	6	2	2	1	21	5	0

Figure 22. Graph displaying the relationship between the frequency of river campsites by reach (n = 269), the frequency of archaeological sites monitored by the RCMP by reach (n = 264), and the frequency of sites identified with active visitor-related disturbance by reach (n = 66).

Reach 5 has one of the lowest frequencies of campsites, four backcountry trails (Beamer, Tanner, Escalante, New Hance), the second highest frequency of sites, and the second highest frequency of impacted sites. Both river-runners and backpackers impact the sites in this reach. This broad stretch of the Canyon contains several popular backpacking trails and river-runner attraction sites. Many of the Puebloan sites in this reach contain noticeable cultural material such as decorated pottery and structures. Sites are located within a short distance to the limited camping beaches, translating into higher frequencies of visitor-related impacts.

Reaches 6, 7, 8, 9, 11, and 12 have a limited number of campsites (range = 14 to 35), low frequencies of sites, and low frequencies of visitor-related impacts. Reach 6 has the highest number of backpacking trails in the Canyon that reach the river (n = 8).

Reach 10 has the highest frequency of sites, the highest frequency of camps, only two backcountry trails (Lava and Whitmore), and the highest frequency of active visitor-related impacts. The impacts in this reach are attributed primarily to river-runners due to the abundance of river camps and river-runner attraction sites. The Whitmore Wash helicopter pad is an area where some river companies conduct river trip exchanges.

Figure 22 shows the general distribution of visitor-related impacts at archaeological sites throughout the river corridor. The staff agrees that this graph is dynamic due to annual changes in the frequency of campable beaches, discovery of new archaeological sites, and increases or decreases in sites visited by humans. This figure establishes a baseline for future research regarding visitor-related impacts in the river corridor.

VISITOR-RELATED IMPACT STUDIES OUTSIDE THE RCMP

RCMP staff members have discovered that if trails are not maintained or obliterated, gullies usually form after one heavy rainfall. If our staff cannot conduct the required maintenance within about 10 minutes, the Park is informed of the areas that need work, and GRCA rehabilitation crews do the work on their scheduled river trips. The Park maintains or has completed trail work at 72 percent of the river corridor sites that the RCMP monitors have recommended for trail work.

The Park mails several educational brochures to commercial and noncommercial river trip participants and also to backpackers regarding site etiquette. There is also a video that backpackers and private boaters watch prior to trips. The Park is currently conducting a river trip research project that simulates river traffic along the corridor (Gimblett 1997; Roberts 1999). This research will help the Park determine where most of the attraction areas are, and how to manage the number of people that go to these areas.

The RCMP staff used the Grand Canyon River Trip Simulation Model (GCRTSim) to examine the relationship between visitor-related impacts and river flows (Gimblett 1997; Roberts 1999). The goal of the GCRTSim is to develop and test a statistical computer-implemented model for estimating the movement and interactions among river trips on the Colorado River in the Grand Canyon. The modeling system employs statistical analyses and mathematical models based on existing river trip itinerary data as well as new data collected from river trip reports in 1998. It is an interactive system providing visual displays of individual trip progress, as well as interactions among trips during specified time periods. Locational information includes specified river reaches, camps and attraction sites, exchange points, and restricted areas. The model provides NPS managers with an effective decision support tool for representing and evaluating the distribution and volume of use along the river corridor.

RCMP staff members are using the model to identify trends in river-runner behavior and to identify areas of high river-runner use. The GCRTSim data indicate that commercial river trips follow set schedules, camp in the same places, and visit the same attraction sites. Many of the primary camping beaches in the river corridor are located on deltas with abundant cultural resources. Because of the oft-repeated schedules followed by commercial companies, monitors record higher frequencies of impacts to archaeological sites located in these areas (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

Consistent river trip schedules are correlated to predictable dam-released flows; river guides predict travel time and coordinate launch and take-out schedules according to the weekend and midweek speed of the river current. In pre-dam times, predictable water flows did not exist and river-runners negotiated a dynamic hydrological system. Many of the river guides participating on RCMP trips confirm that they camp in the same spots, and that guides typically show people the same attraction sites every time. RCMP personnel are not implying that river trip schedules are static; rather, commercial river-running companies are taking the opportunity to plan consistent river trip schedules due to the regulated river flows caused by dam operations.

Another research project conducted by the University of Illinois will further assist the RCMP in managing visitor-related impacts along the river (Stewart 1998). The project's objectives include (1) determining the attitudes and preferences of current users toward recreation opportunities and setting attributes related to river flows, (2) evaluating changing attitudes and preferences of users, and (3) comparing and contrasting user attitudes and preferences to stakeholder visions. The expected results of the project include an assessment of the appropriate opportunities and river flows for the Colorado River as developed through stakeholder and user-based information. The RCMP staff will use this research to further identify the relationship between dam operations and visitor-related impacts to archaeological sites (Coder et al. 1995a, 1995b; Hubbard 1999b; Kunde 1998a; Leap et al. 1996, 1997, 1998).

CHAPTER 11. EVALUATION, MODIFICATION, AND IMPROVEMENTS TO THE RCMP

Jennifer L. Kunde and Lisa M. Leap

The RCMP database has been the subject of much debate amongst entities associated with the Glen Canyon Dam Adaptive Management Program. To date, two independent research projects have reviewed portions of the RCMP database to evaluate and assess its reliability. SWCA, Inc., of Flagstaff is currently evaluating portions of the RCMP database to produce a data synthesis report for the GCMRC (Neal et al. 1998). A Master's thesis at Northern Arizona University evaluates and analyzes monitoring methods in the natural resources realm and also applies a model to cultural resource monitoring (Kunde 1999b). Neither of these projects reviews the database in its entirety, though each has contributed valuable feedback to the RCMP program.

SWCA SYNTHESIS REPORT

The GCMRC issued a request for proposals to synthesize the RCMP database from FY92 through FY98. SWCA was awarded this contract and a synthesis is currently being produced (Cooperative Agreement No. 1425-98-FC-40-22730). The final report is due 30 September 1999 and will be an elaborated version of the draft report with consideration of comments from outside reviewers (Neal, personal communication 1999).

One issue that caused some difficulty for SWCA was the changes made to the RCMP monitoring form. The form has evolved over the years, with the occasional addition or subtraction of variables, or changes in the values of certain variables based upon comments from PA representatives and agency archaeologists. The changes in variable values through time have made a synthesis of the entire RCMP database beyond the scope of the RFP originally submitted by the GCMRC. The SWCA synthesis focuses "on the appropriateness of the monitoring schedules and remedial (preservation and/or data recovery) recommendations and actions, and the degree to which they were followed" (Neal et al. 1998).

The SWCA draft report noted that although changes in RCMP monitoring forms from FY92 through FY98 were justified, the method of simply altering the form with justifications in each annual report (Coder et al. 1994a, 1995a; Leap et al. 1996, 1997, 1998) made any future database comparisons problematic due to differing variable numbering and values between FY92 and FY93 and from FY94 through FY97 (Neal et al. 1998). Problems related to this method of comparison are addressed in a later section of this chapter.

Evaluation of the RCMP by SWCA revealed that monitoring schedules assigned to individual sites were not consistently followed. They also have claimed that schedules assigned one year at a site were often changed the following monitoring episode to a different schedule with no historical record of the schedule change, and that there were discrepancies between the use of *inactive* and *discontinue* schedules (Neal et al. 1998). For RCMP responses to these comments, see Chapters 6, 16 and this chapter.

The SWCA report is also critical of the priority ranking for remedial actions, claiming that the information available for review of assessments made and the priority rankings based upon them is difficult to extrapolate from the matrix data and forms. The variable and dynamic nature of field conditions and has proven to be a challenge for database management. Priority ranking for remedial actions is discussed later in this chapter.

STUDENT THESIS

As a requirement for completing a Master of Arts degree in Anthropology at Northern Arizona University, Jennifer Kunde reviewed and analyzed natural resource monitoring methods and applied a model to cultural resource monitoring (Kunde 1999b). Kunde sampled a portion of the RCMP database for consistency and reliability. The sample population consisted of 32 sites monitored a minimum of four times each from FY94 through FY97. A second portion of this thesis compared the occurrence of increased impacts with the number of management recommendations made to curtail further site destruction. The hypothesis tested was that the observation of increased impacts is positively correlated with an increase in the number of management recommendations made at each site.

The matrix variables for each site were compared for each monitoring episode to measure recording consistency and to attempt to identify observer bias. Of the possible 3,890 observations made on variables in the site matrix, only 103 recording errors (3% of all possible observations) were identified. Most of these errors can be attributed to the FY94 change from a five-page to a two-page monitoring form. Before the new form, off-site gullies and arroyos were included in drainage rankings for river corridor sites. Many forms from FY94 docmented the presence of gullies or arroyos in places where they did not exist for all subsequent monitoring episodes. Of the recording errors identified not attributed to FY94 monitoring, a large majority were attributable to volunteer or intermittent staff who were likely unfamiliar with the variables being monitored or their interpretations. Kunde found that when the full-time RCMP staff members exclusively filled out the monitoring forms, recording errors were substantially reduced. Recorder bias was not identifiable in the monitoring data, although certain monitors consistently recorded errors (Kunde 1999b).

Comparing the occurrence of increased impacts with increased management recommendations required Kunde to divide the data into physical impact and visitor-related impact categories. There did appear to be a relationship between increased physical impacts and increased management recommendations to treat physical impacts. There was not a relationship between increased visitor-related impacts and an increase in management recommendations to treat visitor-related impacts. This lack of relationship in the visitor-related impact category is likely a result of the ongoing relationship between the RCMP and GRCA rehabilitation and revegetation crews. Often times, increased visitor-related impacts were observed but no management recommendations were made because these impacts were the responsibility of Park-based staff, not the RCMP staff.

Overall, Kunde found that the RCMP did follow a standard monitoring protocol as outlined in the natural resources realm (Spellerman 1980). Because monitoring methods are not standardized in either the natural or cultural resource fields (Kunde 1999b), the RCMP has achieved the management objectives identified for the project on cultural resource monitoring. Though some areas of deficiency have been identified, the RCMP made important contributions to the method and theory of sustained, systematic research (Kunde 1999b).

RCMP AREAS IDENTIFIED FOR IMPROVEMENT

As the RCMP evolves, and as a direct result of this report, several areas have been identified for improvements. None of these areas require redesign of the monitoring program itself, though each builds upon established methods to streamline and improve documentation, monitoring, and treatment of cultural resources along the river corridor in Grand Canyon.

SITE DOCUMENTATION

Secretary of the Interior's Documentation Standards

Documentation of historic properties can occur at a number of levels. During the original cultural resource inventory, each site identified was documented based on a Park-wide site documentation form and a separate form designed to address river-specific impacts (Fairley et al. 1994). The survey report was found by the Arizona SHPO to be "thorough and consistent with the Secretary of the Interior's guidelines for cultural resource investigations" (Howard 1991). All sites within the project area were documented at the basic level of site recordation, but there are five sites requiring further documentation. Mapping conducted at the time of site documentation has been found to be inadequate at some locations due to the dynamic nature of the landscape or other changes to the site that require more detailed visual documentation. It is the recommendation of the RCMP staff that further mapping be conducted at these locations.

HABS/HAERS documentation, though useful for historic structures, has not been conducted for sites within the project area, nor is it common at any archaeological site. Sites containing rock art have been documented with medium-format photography for archival purposes.

Historic Contexts

To summarize Chapter 3 of this report, decisions regarding the identification, evaluation, nomination, and preservation treatment plans of historic properties are most reliably made in the context of relating properties to one another. An historic context is a tool for achieving this goal by organizing related properties based on a theme, geographic limit and chronological period (Federal Register 48 [190]). Historic contexts describe aspects of the historical development of an area and identify significant patterns that individual properties represent. Historic contexts aid in considering a full range of properties for preservation treatment. Because historic contexts are linked to actual property types, a connection is established between historic properties identified and their shared physical or associative characteristics outlined in the contexts (Federal Register 48 [190]).

In the absence of historic contexts for river corridor sites, preservation and recovery plans have been considered on a site-by-site basis. Priority ranking for treatment, based on property types, cannot be fully considered in the absence of historic contexts. The Hopi Tribe agrees that priority ranking for treatment of historic properties cannot be adequately or fully considered in the absence of historic contexts.

RCMP staff members consider the baseline site documentation data gathered during the river corridor cultural resource inventory (Fairley et al. 1994) to be the starting point for compilation of river corridor historic contexts. The Secretary of the Interior has outlined five steps for developing historic contexts: (1) Identify the concept, time period and geographical limits for the historic context, (2) assemble the existing information about the historic context, (3) synthesize information, (4) define property types, and (5) identify information needs. PA signatories should place priority in FY2000 on outlining the structure and number of individual historic contexts for river corridor sites and clarifying the property types to be included. Clarification of PA signatory needs would set the stage for the development of historic contexts in the project area. Some of this was done in the final draft of the Historic Preservation Plan produced by Reclamation and the other PA signatory representatives in June of 1997 (USDI et al. 1997).

Creating Property Types

During the cultural resource inventory of 1990–1991 (Fairley et al. 1994), 25 property types were identified and used to document river corridor cultural properties. Discussions with PA signatories have resulted in a condensed listing of 10 property types based on the type of features identified. This listing is currently in draft form and should be revised and finalized. One area of consideration is that many sites along the river corridor contain evidence of multiple occupations through time. A substantial number of cultural properties along the river corridor can be classified as multicomponent, and classification and treatment based on historic contexts will require special consideration at these locations. Property types have also been discussed in greater detail in Chapter 1 of this report.

National Register Nomination for Eligibility

All sites monitored within the project area are considered eligible for the National Register of Historic Places based on information gathered during the original site documentation and continued monitoring of site condition from FY92 through the present. The sites are considered eligible under at least one of four National Register eligibility criteria, and exhibit the integrity to warrant eligibility (see Chapter 3).

Formal nomination of the properties within the project area has been discussed in several PA meetings, but no consensus has been reached on the scope of the nomination process. Areas of concern include the level to which the properties will be nominated, for instance as a district or cultural landscape, and the degree to which sensitive tribal information should be included.

TCP Identification

PA signatories encompass a broad range of both tribal and federal agency representatives. Defining what constitutes a traditional cultural property (TCP) has been problematic based on the vast number of constructs placed on identifying TCPs through tribal and federal interpretations. The RCMP has used NRB 38 as the basis for TCP identification.

Discussions at PA meetings over the past fiscal year led to the inclusion of the Arizona SHPO in TCP discussions in March of 1999. The essence of the discussion focused on how Bulletin 38 defines TCPs as properties associated "with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community." In addition, the property must also retain integrity of relationship and integrity of condition. Identification of TCPs and more detailed information on the RCMP perspective can be found in Chapter 3.

The SHPO recognizes that each individual tribe has their own ability to identify TCPs. Existence is not the issue, but rather, are the properties eligible for the National Register and under which criteria for evaluation will these properties be addressed?

As the issue stands today, the RCMP only visits and treats sites along the river corridor that are eligible for nomination to the National Register. Whether or not these sites are TCPs has not been given greater weight in treatment priority evaluations. TCP information has also been excluded from the RCMP site database at the request of tribal representatives. Tribal participation under the PA allows for one river trip per fiscal year to address properties significant to individual tribes. Monitoring of properties that may qualify as TCPs, but may not be eligible properties as archaeological sites, is carried out by the tribes. Monitoring, treatment plans, or revisions to management strategies requested by tribal members are incorporated into the RCMP as those requests are received.

MONITORING FORM REFINEMENT

Several problems have been identified as a result of the 8-year data synthesis. They are addressed here along with suggestions for improvement and further refinement. The current river corridor monitoring form (see Appendix A) has been an invaluable tool for identifying and understanding changes to cultural resources along the river corridor in the Grand Canyon. One measure of this success has been the degree to which Indian tribes, the Arizona SHPO, GRCA, Reclamation, and other entities have concurred with monitoring assessments and treatment recommendations. Observations made both in the field and in the lab, and as a direct result of the 8-year data synthesis, have resulted in the identification of areas of improvement that should be addressed by PA signatories.

Variable definitions on the monitoring forms have periodically been modified based on PA discussions. Requests for changes made by PA representatives have not been fully illustrated on the forms, although the changes that have been made have resulted in changes in variable analysis and annual report dissemination from year to year. The requests for changes made by PA signatories have all been valid requests and the RCMP has accommodated these requests whenever possible. Unfortunately, changes made to the forms have resulted in data that are difficult to compare through time, or that appear missing in certain years. An example of this is the introduction and subsequent discontinuation of a control group of sites to be monitored.

Control group sites were intended to offer a scientific basis for understanding change to sites located within the area of potential effect. Although the control group sites were randomly chosen from the population of sites recorded during the river corridor survey, most were located on substrate that had no potential for impact and thus could not be compared with sites located within the more active APE. In FY99, after discussions with PA signatory representatives, a decision was made to place the control group sites on the inactive monitoring list, because they are out of the project area, they are not being perceptibly impacted, and they are thus not serving as a true control group.

Another source of error comes from volunteer or intermittent staff members, who can misinterpret variables when filling out the monitoring form. These people are unfamiliar with the terms used, the sites monitored, and the actual process of filling out the form. Greater field supervision will be instituted to address this lack of consistency.

PA signatories should be aware that the "other" category, used on the monitoring form to include variables not discretely identified on the form, results in data which cannot be compared through time. The "other" category is the most inconsistently recorded variable in the monitoring database. Use of "N/A" (variable 3) versus "absent" has resulted in inaccurate data through time. Absent refers to the absence of an impact at feature specific locations when there is the possibility for the impact to occur.

N/A refers to a variable that will never occur at that specific location; for example, a site with only rock art does not need to be monitored for impacts to structures or storage features.

The presence and subsequent absence of certain variables, particularly surface erosion and eolian-alluvial deposition and erosion, is another example. These variables can and do occur and then disappear in the time between monitoring episodes. The presence, and subsequent absence of these variables, without a comment field for further clarification, results in the appearance of inconsistencies in observations that are interpreted as errors.

Monitoring schedules assigned to individual sites were also not recorded consistently (Neal et al. 1998). The RCMP staff in FY96 also made this observation. Beginning with the 96-3 monitoring trip, the field forms prepared in the office included the monitoring schedule. Filling in the schedule variable before entering the field removed monitor subjectivity, though it also discouraged monitoring staff from recommending schedule changes when sites were identified as newly active. If change was recommended for a monitoring schedule, this information was recorded in the "Management Assessment and Recommendations" comment field. Schedule change recommendations were then assessed and considered upon completion of each field season.

As noted, variability in a site schedule through time is also a reflection of the dynamic environment of the river corridor sites. The RCMP staff views this as recognizing *why* a schedule has changed rather than focusing on the change of schedule itself.

Due to the active nature of the river corridor environment, new features and artifacts are found regularly. Two additional sites have been recorded by RCMP staff that were not identified during the survey. In addition to the new sites recorded, 53 new features and numerous diagnostic artifacts have also been recorded and added to the original site documentation.

In FY94, the form was changed from a five-page to a two-page monitoring form (Coder et al. 1995a). The new form categorized impacts to specific features rather than characterizing the site as a whole. This change from general to specific monitoring considerations resulted in a number of errors in recording the presence of on-site drainages (gullies or arroyos), as noted by Kunde (1999b). Several presence-absence errors detected in the FY94 monitoring data are likely attributable to the use of the new monitoring form.

Proposed Solutions

Possibilities for improving use of the "other" category include removing the category from the variable list and using the comment field to address other impacts, or the addition of an "other" variable in a different section with a separate comment field related only to this new variable.

The RCMP staff would like to reiterate the understanding that only the full-time, permanent RCMP staff should complete the monitoring forms. Use of the full-time staff reduces the likelihood of recorder error due to misinterpretation of the variables on the form. Definitions for individual variables will be included in the fiscal year raw monitor data (available at the project office) and will be included as a supplement to field forms for monitoring staff.

An additional section specifically addressing drainage existence, development, and advancement is also recommended. Headcut advancement and the development of additional nickpoints within drainages are our first indications of accelerated erosion due to base-level lowering. This information may also aid in identifying drainages that are most likely to change from one category to another due to erosion or deposition from research flows. This information, easily obtained via regular monitoring activities, may additionally aid in the development of a predictive model for site erosion.

The RCMP would like to implement the above-mentioned changes to the monitoring form, and would like a member of the NAU Information Technologies Department to be included in the development of additional variables.

DATABASE MANAGEMENT

In an effort to use the most up-to-date software and simplify the monitoring form, as requested by the monitoring staff and PA representatives, the RCMP has created databases that can be difficult to compare through time, due to changed values or variables.

Changes over time have resulted in the use of four (Imacs, Dbase III, Paradox, and Access) software programs to store the RCMP data. These databases are incompatible without proper manipulation by software experts. All of these identified problems have contributed to difficulties in comparing variables through time without re-naming, reformatting, or re-coding variables.

In the future, all changes to the RCMP database variables should be carefully reviewed for any possible incompatibility with previous variable names, definitions, or coding values with a computer programmer. Project monitors do not currently anticipate extensive changes like those experienced between FY92 and FY94.

It is recommended that one software package be chosen that best accommodates the vast quantity of data collected and generated by the RCMP. Project monitors also recommend that database experts at NAU's Information Technology Services continue to work in conjunction with project staff to convert the database into a single, compatible format.

SITE MANAGEMENT

Although preservation and recovery options have been recommended since the inception of the RCMP, remedial action work was not formally undertaken until FY95 (Leap and Coder 1995). Beginning in FY96, checkdams became a more consistently recommended and implemented preservation option based on initial success rates and the knowledge of the Zuni Conservation Project members. The RCMP also at that time began working in conjunction with GRCA rehabilitation crews.

As the RCMP has evolved, PA signatory and representative input has resulted in the present preservation and recovery options. The RCMP continues to investigate and consider methods with the potential to improve and streamline preservation and recovery efforts of cultural resources along the river corridor.

Priority Ranking for Remedial Action

During the collection of baseline data, sites were prioritized for remedial actions based on the degree of impacts observed. This prioritization resulted in a numerical ranking for sites which was, in theory, to be related to monitoring frequency. The FY99 data synthesis and the work done by SWCA (Neal et al. 1998) has shown that there was not always a perfect correspondence between priority ranking for impacts and the monitoring schedule.

Sites in the river corridor have not yet been ranked according to potential contributions to research questions or significance to Native American religion or culture. The RCMP staff recognizes that all sites are not equal in these respects and that a priority ranking based on site type should be developed in conjunction with observed erosional activity to guide the monitoring sample population.

Overall site condition has not been discussed with PA signatories. Site condition should be addressed and incorporated into a priority ranking for sites. The RCMP staff is currently evaluating site condition based on information gathered during the 1990–91 survey (Fairley et al. 1994) and during the preparation of this report. Appendices E–I outline site trends based on drainage type and give a condition ranking for each site based on the original Imacs recording in 1990–1991 (Fairley et al. 1994); there have been only minor alterations, if major impacts occurred since the original site condition assignment. See Chapter 6 for additional information on site condition. Condition should be determined based on a variety of variables, including property type, data potential, condition, and erosional activity.

Turn-Around Time for Data Recovery Implementation

Because of funding considerations, there can be a substantial gap between the recommendation of data recovery and its actual implementation. Funding availability also dictates the level of field or laboratory effort and the timeliness of reports. When data recovery has been implemented, only partial recovery occurs, and artifacts and samples are stored for future analysis.

Proposed Solutions

The RCMP staff proposes creating a ranking system that includes site condition, property type, data potential, and erosional activity. This ranking should be based on the FY92–FY99 data synthesis.

Implementation of recommendations is key to the success of the program. Without the ability to implement actions, the resources that we are trying to preserve will be lost. The commitment must exist for the program to be successful. Professional archaeological work as defined in the Secretary of the Interior's Standards for Archaeology and Historic Preservation specifically includes the completion of each project through data analysis, reporting, and curation. All projects within this program must meet the minimum standards as defined in existing departmental and NPS policies and guidelines. Data recovery and other mitigation treatments have been recommended for a number of years. Although these recommendations have been accepted by Reclamation and the other PA representatives, many have yet to been implemented. Attention to these recommendations and their implementation will greatly improve the success of the program and its stated goal of preservation.

PROGRESS AND REFINEMENT OF THE RCMP

Zuni Conservation Project

One of the greatest successes of the mitigation implementation strategy has been the involvement of the Zuni Conservation Project. This project first proposed use of traditional checkdams as a method of erosion control during our 1995 stabilization workshop. The use of checkdams has successfully curtailed further sediment erosion in several areas along the river corridor. The RCMP staff believes that the continued involvement of the Zuni Conservation Project in our efforts for preservation in place of cultural resources along the river corridor is critical to the continued success of the program. The Hopi Tribe has requested that the RCMP staff measure the success of checkdams by quantifying decreased erosion rates.

Formal Assessments for GRCA Work

The RCMP staff will initiate a formal request process for mitigation work in conjunction with the GRCA rehabilitation and revegetation crews. A formalized assessment form will be used to track the initial request and subsequent completion of work by other agencies to river corridor impacted cultural resources. The RCMP is currently using an assessment form still in the first stages of development.

Quantifying Change

Although the RCMP can be perceived as one of the few consistently operated long-term monitoring programs, when compared to natural and biological studies it is somewhat deficient in quantifiable measurements. It is imperative that this program advance toward more measurable methods for two reasons: to supplement the current efforts of this program, and to increase the efforts of integration with other studies conducted in the Canyon concerning the effects of the operation of Glen Canyon Dam. In This progression would make the cultural program more credible to some researchers.

As discussed in Chapter 1, RCMP personnel have used survey techniques with a total station instrument to quantify the accumulation and or loss of sediments at an archaeological site. This program has ceased, and RCMP archaeologists are currently investigating other methods for quantifying, measuring, and illustrating changes. Some possibilities are aerial photogrammetry, digital cameras, 35 mm cameras with a tripod and point provenience locations, and measuring particular attributes on selected river-, terrace-, and side canyon-based drainages. This would supplement the current geomorphological studies by Thompson and Potochnik (Thompson et al. 1998).

FUTURE RECOMMENDATIONS

Ground Penetrating Radar

Most recently, the RCMP staff has intensively investigated the use of ground-penetrating radar (GPR). Since the late 1960s this technique has been applied to civil engineering, geophysical, geological, and archaeological problems involving subsurface phenomena. The unit uses low frequencies to penetrate the ground, achieves high resolution in both depth and cross-range to discriminate an objective, and efficiently couples radar signals into the ground. Clay soils and moisture-laden soils, however, continue to be problematic, except when work efforts are concentrated in very shallow depths.

The benefits of using a GPR unit in the Canyon are many. Several of the alluvial terraces where historic remains exist are fragile dune areas. It has been proven that numerous archaeological deposits are positioned at least a meter below the surface. Instead of placing a shovel through the soil, increasing the possibility of destabilizing cultural remains, it is more efficient and environmentally correct to use a GPR unit to minimize surface and subsurface disturbance. Additionally, this instrument can cover much more ground in less time. The data gathered will generate a map to provide information on buried remains, and it will facilitate a more detailed and relevant preservation or excavation proposal.

It is anticipated that Jim Doolittle, research soil scientist from the Natural Resources Conservation Service, will accompany one of the monitoring trips in FY2000. Prior to this trip, a list of sites selected for data recovery and preservation will be generated. The GPR unit will be used at these sites in an attempt to identify site magnitude and to facilitate more accurate cost and time projections for site management implementations.

Integration of Other Studies in Grand Canyon

One of the main goals of the Adaptive Management Plan is to integrate all the research conducted in the Canyon. This integration will increase the understanding of the effects of current dam operations on cultural, natural, and recreational resources, and assist in predicting the effects of alternative flow regimes and experimental flows on these resources. One obvious way to achieve this is by continuing communication with other researchers. Currently, the most successful integration of data for the RCMP is with the geomorphological studies conducted by Lucchitta, Hereford, and others (Balsom et al. 1989; Hereford 1993, 1996; Hereford et al. 1993, 1995, 1996b; Lucchitta 1990, 1991; Lucchitta et al. 1995a, 1995b; Thompson et al. 1998). More specifically, Hereford (1993; Hereford et al. 1993) has created core variables that can be identified on archaeological sites that will tie in the geomorphological studies with this cultural program. Thompson and Potochnik are currently testing Hereford's hypothesis. The results of the research will be twofold: a refinement or confirmation of the Hereford hypothesis, and the development of a model to determine the vulnerability of cultural resources on pre-dam terraces to erosion. Completion of the final report by Thompson and Potochnik is scheduled for the end of 1999.

Integration of the RCMP data with other research is in progress, but in the initial stages. To reiterate, it is important, when studying the process of physical change to archaeological sites, to understand the geographical setting. In addition to the geomorphological studies mentioned above and discussed in Chapters 4, 6, 7, and 8, the RCMP is coordinating information with NAU's Department of Geology concerning the topographic and bathymetric changes along the Colorado River corridor, and discussing how these modifications can alter cultural resources (Hazel et al. 1996, 1999; Kaplinski et al. 1997). Eventually the integration of the RCMP research with these studies will prove to be beneficial in understanding sediment processes along the corridor. Further, this research by NAU's Department of Geology is recognized as another constant, long-term monitoring program consisting of reliable core variables that can be compared throughout the years.

Another example of data integration in progress is the combination of the RCMP visitor-related impact data with the current visitor studies conducted by Stewart (1998), Kearsley and Warren (1993), and NAU-GRCA (Gimblett 1997; Roberts 1999; all discussed in Chapter 10), and more recently a proposal produced by Behan through GCMRC. The information RCMP has collected for the past 8 years regarding visitor-related impacts will supplement several of these studies currently in progress by initially relating visitor activity to archaeological site locations.

Predictive Model

Predicting the occurrence of change is a fundamental goal of monitoring in general. Within the field of archaeology, predictive models are used primarily to determine site densities across a landscape, but it would be expedient if prediction of change was grounded in an interdisciplinary approach, such as a combination of archaeology and geomorphology. One example of how a predictive model may be developed concerns terrace-based drainages.

Hereford and others (1993) discussed how all terraced-based drainages have the potential for increased arroyo cutting and breaching of the terrace level. Terrace-based drainages become river based when their catchment size becomes larger than 3,000 m^2 and the channel ends less than 100 m from the river. The RCMP, in conjunction with geomorphologists, could measure the catchment basins of all the sites with terrace-based drainages. A ranking of terrace-based drainages based on size could lead to development of a model of predicted erosion along the river corridor. A sample of these identified sites could be treated with preservation options to determine if erosion can be controlled in the locations most vulnerable to increased erosion due to dam operations.

Five-Year Strategic Plan

Upon conclusion of the PA meeting held at Northern Arizona University in April of 1999, a number of questions were raised that needed to be answered prior to the development of a strategic plan. Upon completion of this 8-year data synthesis, the RCMP staff believes that all but three of the questions itemized by Reclamation (Coulam 1998) have been addressed. These should receive top priority during the next PA meeting: Is there utility in the preparation of an historic preservation plan? In planning treatment, how do we weigh information values against other values? And, how should the group proceed to prepare a draft strategic plan?

Is there utility in the preparation of a historic preservation plan? At the time of the initial cultural resource inventory (Fairley et al. 1994), no research design existed to address the uniqueness of river corridor cultural resources. Unfortunately this fact remains true today, 9 years later. In the absence of any river corridor research design, preservation and recovery options have been criticized as not being grounded in scientific theory (also see Neal et al. 1998). Preparation of a research design must be a top priority for FY2000.

The RCMP staff believes that finalization of the HPP is a top priority. Tom King, who recently completed a report and recommendations for the ongoing PA program (USDI et al. 1994) as requested by Reclamation, also agrees with this. PA representatives have spent countless hours developing and writing several drafts of the HPP; this work should not go untended. Because the HPP was in final draft form, only minor adjustments should be made to this document and then it should be finalized. Additionally, completion of an HPP was a stipulation in the original PA. Until and unless the PA changes, this stipulation remains a requirement of the agreement.

In planning treatment, how do we weigh information values against other values? Within the National Park Service, information potential and the costs of treatment are frequently balanced in determining an appropriate level of treatment. Definition of the "other values" is therefore essential to this balancing act. In lieu of that definition, it is clear that the value the public places on archaeological resources and preservation of them are the priority goals for this program. Existence values in many cases may outweigh research values. The entire river corridor and its record of human habitation must be viewed as a whole in order to weigh the information and the values we are charged with preserving.

How should the group proceed to prepare a draft strategic plan? We believe that a strategic plan is essentially an action plan that evolves from the HPP. The involved parties as a whole need to recognize the goals and objectives of the program as articulated in the draft HPP (USDI et al. 1997) and commit to implementing a program that addresses those needs. A 5-year strategic plan to implement the HPP is recommended and should be developed in consultation with the PA signatories.

SUMMARY AND CONCLUSIONS

Under the current methods used to fulfill the requirements of the PA, only minor changes are needed for the daily activities of monitoring mentioned above. However, it has recently been brought to the attention of the RCMP staff that a change in philosophy may be appropriate. Whole-site treatment as opposed to feature-based treatment options should be addressed. If the PA signatories agree to this proposal brought forward by Reclamation, then the RCMP may undergo large-scale revision in FY2000 (Leap 1999).

Reclamation has suggested that whole-site treatment is more appropriate given the Secretary of the Interior's Standards for Archaeology and Historic Preservation and their section 106 responsibilities. However, PA representatives have voiced the opinion that unless a feature was damaged, preservation treatments rather than excavation are the most appropriate option. Whole-site treatments should only be considered in instances where preservation treatments would not be effective (Leap 1999).

If whole-site treatment is supported by the PA signatories, adjustments will be made to the current long-term monitoring program to address large-scale data recovery strategies. The current program is feature based within sites. A shift to whole-site treatments would change the monitoring emphasis and add significantly to the proposed excavation priorities and costs. This would begin by implementing a comprehensive testing program to define the lateral and vertical extent of the site, and whether there is a multicomponent aspect to the site. Testing for these attributes has not been done in the past because the PA program practiced an "as needed" data recovery program—feature specific, not site specific. It will be very important for the project staff to identify site extent so that appropriate research designs can be developed.

CHAPTER 12. SCOPE OF WORK FOR FY2000

Lisa M. Leap

At the request of Reclamation, RCMP submitted a budget estimate and work plan for FY2000 at approximately 25 percent less than the FY99 level. We achieved the reductions by focusing on the most urgent monitoring aspects of the program, deferring some monitoring and all assessments and new remedial actions until after the Protocol Evaluation Panel (PEP) review is complete and the final Historic Preservation Plan is accepted.

This year the RCMP staff proposes three trips for the upcoming year, with a reduction in the number of sites evaluated and no site assessments or preservation treatments. The only sites that will be evaluated are those regularly scheduled for FY00 (47 sites) and those where invasive preservation treatments have occurred (29 sites with checkdams). This revised program will allow for consistency in assessments of the most heavily impacted archaeological sites; however, no evaluations of sites on a 3–5 year schedule (21 sites) will be completed. RCMP staff members are unable to move forward in any form of treatment, thus deferring the transition from monitoring to treatment. See Table 19 for the list of property types to be monitored in FY00.

With the onset of FY00, project staff members have already been occupied with completing this extensive 8-year data synthesis report, compiling multiple budgets and proposals, preparing for the PEP review, and reviewing numerous GCMRC reports. It has been critical to focus staff time on the PEP review and preparation of the HPP. However, the reduction of funds will reduce the ability to provide the same level of service for all of the affected entities. The PEP review will require considerable staff time in the preparation of materials and compilation of site records, photographs, and so forth.

The scope of work precludes any new activities, such as completing preservation assessments, quantifying checkdam effectiveness, creating total station base maps, recording newly uncovered archaeological site, medium-format photography, conducting limited data recovery, or collaboration with NPS base programs or the Hualapai Nation and Navajo Nation. Further, there will be minimal to no participation in public outreach or professional and nonprofessional presentations.

The work completed in FY00 will be lacking in scope. In FY00 it will be critical to refine the current MRAP and to complete an HPP; however, cultural resources fieldwork is being sacrificed because of budget cuts. The money-allocating shareholders have failed to respond, in a timely fashion, to numerous arguments for preservation in place and excavation of significant resources. Postponing these types of remedial actions will only increase the backlog of the work proposed in this report.

Table 19. Number of Property Types to Be Monitored by RCMP Staff in FY2000

Property Type	Number of Sites
Artifact Scatter	3
Historic Structure	2
Multi Thermal-Structure Complex	7
Other	1
Pueblo	2
Roaster Complex	11
Roaster Feature	6
Thermal Feature	4
Total	47

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Appendix A

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORMS

FISCAL YEARS 92 AND 93
ARCHAEOLOGICAL SITE RIVER MONITORING FORM

MANAGEMENT INFORMATION

1. Site # AZ : : 2. Monitor session #

3. Monitor(s)____

4. Date __/__/________________

5. USGS Quad map 7.5'__________________ 6. Use Area Name__________________________

7. Date of first visit / /

8. UTM location (Zone 12)_____________East____________North

9. General location description

10. Does this site have any visible structures? 0 = no, 1 = yes ___

11. River mile ____ River bank (L=left, R=right, B=both) ___

12. Is this site located in or on Colorado River fluvial deposits?
0=no, 1=yes ___
If yes, describe the setting specifically:

13. Distance/direction from and height above current high water (approx. 30,000 cfs) to lowest boundary of site area:
Distance ____ mtrs Direction ____ degrees Height ____ mtrs Slope ____ degrees

14. Distance/direction from and height above current high water to a central site datum
Distance ____ mtrs Direction ____ degrees Height ____ mtrs Slope ____ degrees

ENVIRONMENTAL SITUATION

15. PRIMARY physiographic setting: 1. Riverside beach/dunes 2. Alluvial terrace 3. Talus slope 4. Base of cliff 5. Bedrock Ledges 6. Non-riverside dunes 7. Other ______________________________ ___

16. Degree of shelter: 1. Open 2. Overhang/cave 3. Combination ___

17. DOMINANT soil type: 1. Alluvium/Aeolian 2. Colluvium 3. Bedrock 4. Residual ___

18. DOMINANT soil texture: 0. Not sandy or gravelly 1. Gravelly 2. Sandy 3. Gravelly and Sandy ___

NATURAL IMPACTS (use the following scores: 0=none, 1=minor (<10% of site area affected), 2=moderate (>10% but less than 50% of site area affected), 3=extensive (50% of site area affected)

19. Evidence of surficial sheet washing? ___

20. Evidence of gullying (cuts 10-100 cm deep)? ___

21. Active arroyo cutting (cuts >100cm)? ___

22. Evidence of animal-caused erosion? (Sum of items below) ___
    (a) general trampling ___
    (b) trailing through site ___
    (c) burrowing ___
    (d) Other ___

23. Evidence of other erosion? (Sum of items below) ___
    (a) wind deflation ___
    (b) bank slumpage ___
    (c) dune migration ___
    (d) Other ___

TOTAL NATURAL IMPACT

24. First method: if score for items 18-23 is greater than zero, item # = 1. (Sum total - maximum total = 5). First Method Total ____

25. Second method: sum actual scores for all items. Maximum score for items 19-21 equals 3 each; maximum score for items 22 and 23 equals 12 each. (Maximum possible for all items combined is 33.) Second Method Total ____

26. Characterize the stability of the site: 0=stable (no active erosion) 1=incipient erosion, 2=active erosion ___

27. Do any of the above impacts appear to be related to river/dam operation? 0=no, 1=yes ___

    Indicate with a '1' any that apply:
    (a) direct inundation within past 30 years (post-dam) ___
    (b) bank slumpage/steepening adjacent to current highwater zone ___
    (c) headward migration of arroyos due to lowered base level ___
    (d) Other ______________________________ ___

28. If arroyos or gullies are present, do they drain all the way to the river? (Note: Some drainages die out in dune fields or on terraces before reaching the river.) 0=no, 1=yes, 2=N/A ___

29. Comments: (Explain/describe river-related impacts in more detail; any new features or structures exposed by erosion; changes in types or degree of erosion; imminent threats; what to look at on next visit, etc.):

HUMAN IMPACTS EVALUATION

30. Collection Piles: 0= None 1= 1 pile 2= > 1 pile ___
If more than one pile, list total number: 0

31. Trails: 0 = No distinct trails 2 = 1-2 distinct trails
4 = >2 distinct trails ___

32. Trails eroded >5 cm below ground level? 0=no, 1=Yes ___
(Show all distinct trails on site map.)

33. Evidence of on site camping? 0=None; 2=minimal (1 of the below);
4=Considerable (2 or more of the below) ___

Indicate with a "1" what kinds of evidence are present?
a. Fire scars, fire pits, recent charcoal: ___
b. Rearrangement/clearing of rocks: ___
c. Recent camper trash: ___
d. Obvious concentrated soil compaction
(tent site): ___
e. Other: ___

Does this evidence appear to be recent (< 5 years old)? ___

Did evidence appear since last visit? ___

34. Evidence of deliberate vandalism? ___
0= None
1= Surficial disturbance only (e.g., grafitti)
2= Slight amount of subsurface disturbance(<1 m2 excavated)
3= Substantial subsurface disturbance (>1 m2 area excavated)

Does this evidence appear to be recent (<5 years old)? ___

Did evidence appear since last visit? ___

35. Any other evidence of visitation other than above (e.g. obvious erosion/compaction from human trampling, scattered surface trash, etc)
0=no, 1=yes ___
If yes, describe:

TOTAL HUMAN IMPACT RATING ___

36. Human Impact Condition Class (see rating system below) ___
Condition Class 1: No human impacts (Impact rating = 0)
Condition Class 2: Minimal impact (Impact rating 1-3)
Condition Class 3: Moderate impact (Impact rating 4-6)
Condition Class 4: High impact (Impact rating 7-9)
Condition Class 5: Very high impact (Impact rating 10-12)
Condition Class 6: Extreme impact (Impact rating 13-15)

37. Describe changes/new human impacts since last visit:

RIVER-RELATED HUMAN IMPACTS

38. How close is the nearest rivercamp to this site?
1=>1 km; 2=<1 km but >500 m; 3=<500 m but >100 m; 4=<100 m ___

39. Are any of the human impacts directly related to river fluctuations and/or dam operations? 0=no, 1=yes ___
If yes, indicate with a '1' any that apply)
(a) development of new trailing to avoid highwater ___
(b) availability of new beaches in proximity to site ___
(c) other: ___
____

40. Any human impacts directly related to recent recording/monitoring activities? 0=no, 1=yes ___

If yes, indicate with a '1' any that apply
(a) development of new trails ___
(b) damage to cryptogamic crust ___
(c) other: ___
____

MANAGEMENT ASSESSMENT AND RECOMMENDATION

41. What types of impacts threaten this site? (i.e. what to watch out for)
Rank each threat according to the criteria listed below:

0: Not a threat now or in the foreseeable future
1: Possible threat
3: Definite threat
5: Actively occurring at the present time

a) bank slumpage from river/dam related processes ___
b) development of new gullies and/or headward migration of arroyos due to river/dam related base level lowering ___
c) bank slumpage from non-river related processes ___
d) deepening/widening of arroyos from non-river related natural processes (i.e. side canyon flooding) ___
e) exposure/destabilization of features due to a or b ___
f) exposure/destabilization of features due to c, d, or weathering ___
g) exposure/destabilization of features due to visitation ___
h) impacts from human visitation (other than g) ___
i) burial or exposure of features due to dune migration ___
j) other ______________________________ ___

42. Recommended Actions: 0=never/not necessary or applicable; 1=eventually (>3 years from :
2=soon (within 1-3 years); 3=immediately (within 1 year/less if possible);
4=action currently in progress

Discontinue monitoring	___
Monitor visitation with remote sensing devices	___
Monitor erosion with stationary cameras	___
Retrail or define existing trails	___
Obliterate trails	___
Install check dams	___
Plant vegetation to stabilize site surface	___
Stabilize banks with rock armor or similar technique	___
Stabilize structures	___
Surface collect entire site	___
Test for presence/depth of subsurface cultural deposits	___
Map as a form of data recovery (excavation not warranted)	___
Full data recovery (excavation)	___
Close site to all public visitation	___
Develop for public interpretation	___

43. Justify your recommendation:

44. Ranking - See MONITORING PRIORITY RANKING CRITERIA

Stability	___
Accessibility	___
Visibility	___
Natural Impacts	___
Human Visitation	___

45. What is the monitoring priority rank of this site. ___

46. Has this value changed from previous visit? 0=no, 1=yes ___
If yes, explain below.

47. Additional comments/continuations

Monitoring Priority Scores

Circle one value within each category:

Stability

1 Stable—no exposed fragile features such as rock art, standing masonry, middens, etc.

2 Moderately stable—fragile features present but not deteriorating (protected by overhang, etc.)

3 Moderately unstable—fragile features present with definite potential for deterioration

4 Unstable—fragile features exposed and deteriorating

Accessibility

1 Protected—located more than 1 km from road/trail/camp or difficult access (technical climbing)

2 Moderately protected—located 1 to 1/2 km from road/trail/camp with moderate to difficult access (exposure)

3 Moderately unprotected—located 1 to 1/2 km from road/trail/camp with easy access, or 500-100 m with moderately difficult access (exposure but no technical climbing)

4 Unprotected—located less than 100 m from road/trail/camp with easy access

Visibility

1 Low profile—site difficult to recognize, few or no artifacts, subtle features

2 Moderately low profile—site not readily apparent, sparse scattered artifacts, features not obvious

3 Moderately high profile—site is easily recognized from close proximity, abundant surface artifacts, features obvious

4 High profile—site sticks out, attracts attention from a distance, lots of artifacts, well-defined features

Natural Impacts

1 None—natural impact score (Method 1) equals 0

2 Slight—natural impact score equals 1

3 Moderate—natural impact score equals 2-3

4 High—natural impact score > 4

Human Impacts/Visitation

1 None—human impact condition class equals 1 (no impact)

2 Slight—human impact condition class equals 2 (minimal)

3 Moderate—human impact condition class equals 3

4 High—human impact condition class equals 4 or more

Rank	Total Score	
1	20-17	Sites with these scores require monitoring biannually or quarterly; high priority
2	16-13	Sites with these scores require at least annual monitoring; second-highest priority
3	12-9	Sites with these scores require a longer monitoring cycle, perhaps every 2 to 3 years
4	8-5	Sites with these scores should be monitored every 3-5 years; lowest priority
5	-	Site discontinued.

FISCAL YEARS 94 AND 95

10/94

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

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

NATURAL IMPACTS

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 7 - 14)

		Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
7.	Surface Erosion (0-10cm)						
8.	Gullying (10-100cm)						
9.	Arroyo Cutting (>1m)						
10.	Bank Slumpage						
11.	Eolian/Alluvial Erosion/Deposition						
12.	Side Canyon Erosion						
13.	Animal-Caused Erosion (trailing,burrowing)						
14.	Other Natural Impacts (spalling, roots)						

15. If arroyos 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 ____________

16. Do any of the above impacts appear to have occurred since the last monitoring episode? 0=no; 1=yes If yes, explain in 17. ____________

17. Comments:

HUMAN IMPACTS

Site Number :

Monitor Session :

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 18 - 24)

18.

	Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
Visitor Impacts						

19. Collection Piles: If present, explain in 26. ______
20. Trails: If present, explain in 26. ______
21. On-site Camping: If present, explain in 26. ______
22. Criminal vandalism/ARPA violations: If present, explain in 26. ______
23. Other: If present, explain in 26. ______
24. Human impacts since last monitoring: ______
25. Are any human impacts directly related to river fluctuations and/or dam operations? 0 = no; 1 =yes If yes, explain in 26 (i.e., development of new trails to avoid high water, availability of new beaches in proximity of site). ______
26. Comments:

MANAGEMENT ASSESSMENT AND RECOMMENDATION

27. Monitor Schedule: 1) discontinue 2) semiannually 3) annually 4) every-other-year 5) every three to five years ______
28. Monitor with a stationary camera: 0 = no; 1 = yes ______
29. Recommended measures to reduce site impacts: 0 = no; 1 = yes

    Retrail ______ Plant vegetation ______ Stabilize ______

    Obliterate trail(s) ______ Install check dams ______ Close site to visitors ______

30. Recommended measures to protect the site's integrity: 0 = no; 1 = yes

    Surface collect entire site ______ Test for depth of subsurface cultural deposits ______

    Map as a form of data recovery ______ Excavate entire site ______

31. Comments: (i.e., surface sample unit)

FISCAL YEAR 96

11/95

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

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

PHYSICAL IMPACTS

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 7 - 14)

		Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
7.	Surface Erosion (0-10cm)						
8.	Gullying (10-100cm)						
9.	Arroyo Cutting (>1m)						
10.	Bank Slumpage						
11.	Eolian/Alluvial Erosion/Deposition						
12.	Side Canyon Erosion						
13.	Animal-Caused Erosion (trailing, burrowing)						
14.	Other Natural Impacts (spalling, roots)						

15. If arroyos 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 ____________

16. Do any of the above impacts appear to have occurred since the last monitoring episode? 0=no; 1=yes If yes, explain in 17. ____________

17. Comments:

VISITOR-RELATED IMPACTS

Site Number :

Monitor Session :

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 18 - 24)

18.

	Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
Visitor Impacts						

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

MANAGEMENT ASSESSMENT AND RECOMMENDATION

27. Monitor Schedule: 1) discontinue 2) semiannual 3) annual 4)biennial 5) every three to five years 6) inactive ________
28. Recommended measures to reduce site impacts: 0 = no; 1 = yes

    Retrail _____ Plant vegetation _____ Other _______

    Obliterate trail(s) _____ Install checkdams _____ Close site to visitors _______
29. Recommended measures to protect the site's integrity: 0 = no; 1 = yes

    Surface collect entire site ________ Test for depth of subsurface cultural deposits ________

    Map as a form of data recovery ________ Data recovery ________
30. Comments: (i.e., surface sample unit)

2/97

FISCAL YEAR 97

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

1. Site Number AZ ______________
2. Monitor Session ______________
3. River Mile _______ Bank (L/R/B) _____
4. Date ______________________
5. Site Type ____

6a. Monitor (s) ____

6b. PA Signatories ____

PHYSICAL IMPACTS

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 7 - 14)

		Structures/ Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
7.	Surface Erosion (0-10cm)						
8.	Gullying (10-100cm)						
9.	Arroyo Cutting (>1m)						
10.	Bank Slumpage						
11.	Eolian/Alluvial Erosion/Deposition						
12.	Side Canyon Erosion						
13.	Animal-Caused Erosion (trailing,burrowing)						
14.	Other Natural Impacts (spalling, roots)						

15. If arroyos 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 ______________

16. Do any of the above impacts appear to have occurred since the last monitoring episode? 0=no; 1=yes If yes, explain in 17. ______________

17. Comments:

VISITOR-RELATED IMPACTS

Site Number :
Monitor Session :

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 18 - 24)

18

	Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
Visitor Impacts						

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

MANAGEMENT ASSESSMENT AND RECOMMENDATION

27. Monitor Schedule: 1) discontinue 2) semiannual 3) annual 4) every-other-year (biennial) 5) every three to five years ________
28. Monitor with a stationary camera: 0 = no; 1 = yes ________
29. Recommended measures to reduce site impacts: 0 = no; 1 = yes

    Retrail ____ Plant vegetation ____ Stabilize ____
    Obliterate trail(s) ____ Install check dams ____ Close site to visitors ____

30. Recommended measures to protect the site's integrity: 0 = no; 1 = yes

    Surface collect entire site ________ Test for depth of subsurface cultural deposits ________
    Map as a form of data recovery ________ Excavate entire site ________

31. Comments: (i.e., surface sample unit)

FISCAL YEAR 98

3/98

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

1. Site Number AZ: ________ ____ __
2. Monitor Session ____________
3. River Mile ________ Bank (L/R/B) ______
4. Date ____________
5. Site 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 Cutting (> 1 m)						
11.	Bank Slump						
12.	Eolian/Alluvial Erosion/Deposition						
13.	Side Canyon Erosion						
14.	Other Physical Impacts (animals, spalling, roots)						

15. If arroyos or gullies are present, do they drain to the river? (Note: Some drainages die out in dunes or terraces before reaching the river.) 0 = No, 1 = Yes, 2 = Side Canyon Based, and 3 = NA ______

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:

3/98

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

VISITOR-RELATED IMPACTS

Site Number:
Monitor Session:

Coding: 0 = Absent, 1 = Present, 3 = NA (for items 18 - 24)

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

19. Collection Piles: If present, explain in Question # 26. ________

20. Trails On-Site: If present, explain in Question # 26. Explain any off-site trails also. ________

21. Camping On-Site: If present, explain in Question # 26. ________

22. Criminal vandalism/ARPA violations: If present, explain in Question # 26. ________

23. Other visitor impacts: If present, explain in Question # 26 ________

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 ________

28. Preservation Options: 0 = No, 1 = Yes

Retrail	________	Plant vegetation	________	Other Preservation Options	________
Obliterate trail(s)	________	Install checkdams	________		

29. Recovery Options: 0 = No, 1 = Yes

Test	________	Data Recovery	________	Other Recovery Options	________

30. Comments:

FISCAL YEAR 99

9/98 **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. Site 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 Cutting (> 1 m)						
11.	Bank Slump						
12.	Eolian/Alluvial Erosion/Deposition						
13.	Side Canyon Erosion						
14.	Other Physical Impacts (animals, spalling, roots)						

15. If arroyos or gullies are present, do they drain to the river? (Note: Some drainages die out in dunes or terraces before reaching the river.) 0 = No, 1 = Yes, 2 = Side Canyon Based, and 3 = NA ________

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:

9/98 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 - 24)

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

19. Collection Piles: If present, explain in Question # 26. ______
20. Trails On-Site: If present, explain in Question # 26. Explain any off-site trails also. ______
21. Camping On-Site: If present, explain in Question # 26. ______
22. Criminal vandalism/ARPA violations: If present, explain in Question # 26. ______
23. Other visitor impacts: If present, explain in Question # 26 ______
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

Retrail	______	Plant vegetation	______	Other Preservation Options	______
Obliterate trail(s)	______	Install checkdams	______		

29. Recovery Options: 0 = No, 1 = Yes

Test	______	Data Recovery	______	Other Recovery Options	______

30. Comments:

Hualapai may monitor this site on their trip leaving 4/16/99.

Appendix B

DATA RECOVERY COMPLETED

Appendix B: Data Recovery Completed

Site	P	Action	Justificati	Acti	Organi	Site	Depth of fill	Site	Area	Integri	Report
A:15:030		Feature	Erosion	Yes	RCMP	16.00	0 - 20 cm	3.20	0.873	0.00%	RCMP #60
A:15:035		Limited	Site	No	RCMP	24.00	21 - 100 cm	24.00	0.245	98.97	RCMP #19
A:15:048		Feature	Erosion	Yes	RCMP	250.00	> 100 cm	250.00	1.945	99.22	In Progress
A:16:180		Feature	Erosion	Yes	RCMP	600.00	21 - 100 cm	600.00	0.9	99.85	RCMP #60
B:10:230		Artifact Collection	PA	No	RCMP	168.00	0 - 20 cm	33.60	0	100.00	RCMP #37
B:11:278		Limited Testing	Site	No	RCMP	25.00	0 - 20 cm	5.00	0.2	96.00	RCMP #19
B:11:284		Limited Testing	Site	No	RCMP	16.00	Surface	16.00	0.125	99.21	RCMP #35
C:02:085		Carbon Sample	Research	No	USGS	1.00	> 100 cm	1.00	1	100.00	T. Melis, GCES
C:02:096		Carbon Sample	Erosion	Yes	RCMP	50.00	> 100 cm	50.00	0	100.00	RCMP #63, #66
C:09:051		Feature	Erosion	Yes	NPS	9,000.00	21 - 100 cm	9,000.0			In Progress
C:09:069		Limited Testing	Feature	No	RCMP	9,000.00	21 - 100 cm	9,000.0	.5	99.99	RCMP #66
C:13:010		Feature	Erosion	Yes	RCMP	30,000.0	> 100 cm	30,000.	77	99.74	In Progress
C:13:069		Carbon Sample	Research	No	USGS	3,000.00	21 - 100 cm	3,000.0	0	100.00	T. Melis, GCES
C:13:070		Carbon Sample	Erosion	Yes	RCMP	10,800.0	> 100 cm	10,800.	0	100.00	RCMP #66
C:13:099		Limited Testing	Erosion	Yes	RCMP	450.00	> 100 cm	450.00			In Progress
C:13:272		Carbon Sample	Research	No	USGS	800.00	21 - 100 cm	800.00	0	100.00	Hereford et al.
C:13:273		Feature	Complianc	Yes	RCMP	4,800.00	> 100 cm	4,800.0	4.05	99.91	RCMP #23, #60
C:13:321		Limited Testing	Complianc	No	RCMP	1,400.00	21 - 100 cm	1,400.0	.25	99.99	RCMP #42
C:13:323		Carbon Sample	Research	No	GRCA	96.00	0 - 20 cm	19.20	0	100.00	RCMP #1
C:13:324		Carbon Sample	Research	No	USGS	750.00	> 100 cm	750.00	0	100.00	Hereford et al.
C:13:326		Carbon Sample	Research	No	USGS	225.00	21 - 100 cm	225.00	0	100.00	Hereford et al.
C:13:327		Carbon Sample	Research	No	GRCA	300.00	0 - 20 cm	60.00	0	100.00	RCMP #1
C:13:332		Carbon Sample	Research	No	USGS	100.00	21 - 100 cm	100.00	0	100.00	Hereford et al.
C:13:338		Feature	Erosion	Yes	RCMP	600.00	0 - 20 cm	120.00	1.2	99.00	RCMP #60
C:13:339		Limited Testing	Complianc	No	NPS	5,000.00	> 100 cm	5,000.0	5.76	99.88	RCMP #23, #50
C:13:342		Artifact Collection	Research	No	RCMP	120.00	Surface	120.00	0	100.00	RCMP #27
C:13:343		Limited Testing	Erosion	Yes	RCMP	150.00	> 100 cm	150.00	.9	99.40	RCMP #66
C:13:347		Limited Testing	Site	No	RCMP	100.00	> 100 cm	100.00	1	99.00	RCMP #66
C:13:349		Feature	Erosion	Yes	RCMP	4,250.00	> 100 cm	4,250.0	40	99.05	RCMP #66
C:13:350		Carbon Sample	Erosion	No	USGS	25.00	21 - 100 cm	25.00	0	100.00	Hereford et al.
C:13:355		Carbon Sample	Research	No	USGS	1,050.00	0 - 20 cm	210.00	0	100.00	Hereford et al.

C:13:356	Feature	Erosion	Yes	RCMP	12.00	21 - 100 cm	12.00	1	0.00%	RCMP #63
C:13:359	Feature	Erosion	No	RCMP	1,500.00	21 - 100 cm	1,500.0	0.045	99.90	RCMP #60
C:13:365	Limited Testing	Complianc	No	RCMP	1,800.00	21 - 100 cm	1,800.0	.32	99.98	RCMP #37, #40
C:13:371	Limited Testing	Complianc	No	RCMP	9,000.00	> 100 cm	9,000.0	.361	99.99	RCMP #37, #40
C:13:384	Carbon Sample	Research	No	USGS	0.00	> 100 cm	0.00	0	100.00	Hereford et al.
C:13:387	Artifact	Erosion	No	RCMP	1,575.00	> 100 cm	1,575.0	0	100.00	RCMP #50
G:03:020	Feature	Erosion	Yes	RCMP	2,000.00	> 100 cm	2,000.0	1.22	99.99	In Progress
G:03:026	Carbon Sample	Research	No	USGS	15,400.0	> 100 cm	15,400.	0	100.00	Hereford et al.
G:03:043	Carbon Sample	Research	No	USGS	2,400.00	21 - 100 cm	2,400.0	0	100.00	Hereford et al.
G:03:048	Artifact Collection	PA	No	RCMP	400.00	0 - 20 cm	80.00	0	100.00	RCMP #1
G:03:064	Carbon Sample	Erosion	No	RCMP	11,200.0	> 100 cm	11,200.	0	100.00	RCMP #66

Appendix C

RCMP PHOTOGRAPHIC LOG

Appendix C: Photographic Log

RCMP PHOTOGRAPHIC LOG								
Camera		Film		Roll #				9/23/98
EXP	SITE	DUP .000	TYPE	FEA. #	DESCRIPTION	VIEW	PHOTO-GRAPHER	DATE
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

RCMP PHOTOGRAPHIC LOG								
Roll #								
EXP	SITE	DUP	TYPE	FEA. #	DESCRIPTION	VIEW	PHOTO-GRAPHER	DATE
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								

Appendix D

GPS LOCATIONS FOR GRCA SITES

Appendix D: List of 40 Sites with GRCA GPS Locations

A:15:005
A:15:037
A:16:004
A:16:153
A:16:157
A:16:159
A:16:179
A:16:184

B:09:315
B:09:319
B:11:272
B:11:278
B:14:105
B:14:107
B:15:124
B:15:127

C:02:094
C:02:096
C:09:067
C:13:005
C:13:006
C:13:009
C:13:069
C:13:070
C:13:092
C:13:098
C:13:099
C:13:100
C:13:131
C:13:272
C:13:291
C:13:321
C:13:347
C:13:356
C:13:357
C:13:358
C:13:371

G:03:020
G:03:026

Appendix E

SITES WITH RIVER-BASED DRAINAGES

Appendix E: Sites with river-based drainages

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:003	Roaster Complex	☐	4	Biennial	Potentially Active	Active	Good			Assessment - drainage
A:15:005	Structure-Thermal Feature Complex	☑	6	Annual	Active	Active	Fair	Checkdams, Medium format photos, Trail obliteration, Retrail, Trail maintenance		Checkdam maintenance, Quantify checkdam effectiveness, GRCA trail maintenance
A:15:033	Thermal Feature	☑	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:037	Roaster Complex	☐	1	Inactive	Potentially Active	None	Fair			
A:15:039	Roaster Complex	☐	5	3-5 Years	Active	None	Fair			Total station base map, Assessment - drainage
A:15:043	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:048	Roaster Complex	☑	2	3-5 Years	Active	None	Fair		Data recovery	
A:16:149	Thermal Feature	☑	• 1	3-5 Years	Active	None	Fair	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness
A:16:153	Roaster Complex	☐	1	Inactive	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:158	Artifact Scatter	☐	5	3-5 Years	Active	Active	Poor			Testing
A:16:174	Roasting Feature	☑	4	Biennial	Active	None	Fair	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness, Data recovery
A:16:175	Thermal Feature	☐	3	3-5 Years	Active	None	Good			Data recovery, C14 sample, Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:180	Roasting Feature	☑	2	Biennial	Active	None	Poor	Checkdams	Data recovery	Checkdam maintenance, Quantify checkdam effectiveness
B:10:229	Small Structure	☐	2	Inactive	Potentially Active	None	Fair			Testing
B:10:249	Historic Structure	☐	1	Inactive	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:10:261	Roasting Feature	☐	5	Inactive	Potentially Active	None	Good			
B:11:275	Small Structure	☐	•2	3-5 Years	Potentially Active	None	Fair			Testing, Tribal participation
B:14:105	Small Structure	☐	5	Biennial	Potentially Active	Active	Fair	Trail work		GRCA trail maintenance, Assessment - preservation treatment

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:15:123	Special Activity Locus	☐	3	Inactive	Potentially Active	None	Fair			Medium format photographs, Tribal participation
B:15:138	Thermal Feature	☑	• 3	Annual	Active	Active	Poor	Trail work		Assessment - data recovery, GRCA trail maintenance
C:02:085	Thermal Feature	☐	3	Inactive	Active	Active	Poor		Carbon sample	Testing

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:02:092	Artifact Scatter	☐	4	3-5 Years	Active	Active	Poor			Testing
C:02:096	Structure-Thermal Feature Complex	☑	5	Annual	Active	None	Poor		Carbon samples	Data recovery
C:02:097	Artifact Scatter	☐	3	Biennial	Potentially Active	Active	Poor	Trail work		GRCA trail maintenance

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:02:098	Artifact Scatter	☑	4	Annual	Active	Active	Poor	Trail work		GRCA trail maintenance, Data recovery
C:02:101	Thermal Feature	☑	5	Inactive	Active	None	Fair	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness
C:05:031	Small Structure	☐	7	Biennial	Active	None	Good			Assessment - preservation treatment

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:09:031	Special Activity Locus	☐	2	Inactive	Potentially Active	Active	Good	Retrail, Obliterate trail		GRCA trail maintenance
C:09:034	Special Activity Locus	☐	•3	Inactive	Potentially Active	Active	Poor	Trail work, Medium format photos		GRCA trail maintenance
C:09:088	Historic Structure	☐	6	Inactive	Active	Active	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:003	Special Activity Locus	☐	0	Inactive	Potentially Active	None	Fair	Medium format photos		
C:13:009	Pueblo	☐	4	Biennial	Active	Active	Good	Medium format photos		Site documentation, Data recovery
C:13:010	Pueblo	☐	5	Annual	Active	Active	Poor	Medium format photos, Close site to visitors	Data recovery	Data recovery

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:070	Small Structure	☑	10	Annual	Active	None	Fair	Medium format photos	Carbon samples taken from Locus D	Data recovery
C:13:098	Historic Structure	☐	13	Annual	Active	Active	Good	Retrail, Obliterate trail, Trail maintenance, Medium format photos		GRCA trail maintenance, Assessment - preservation treatment
C:13:099	Structure-Thermal Feature Complex	☑	14	Semiannual	Active	Active	Poor	Checkdams, Trail work, Medium format photos	Data recovery	Data recovery, GRCA trail maintenance, Checkdam maintenance, Quantify checkdam effectiveness

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:100	Pueblo	☑	14	Annual	Active	Active	Poor	Checkdams, Trail work, Medium format photos		Data recovery, GRCA trail maintenance, Checkdam maintenance, Quantify checkdam effectiveness
C:13:272	Small Structure	☐	9	Biennial	Active	None	Fair	Medium format photos	Carbon sample	Assessment - drainage, GRCA trail maintenance
C:13:273	Roaster Complex	☑	6	Annual	Active	Active	Poor	Trail work	Data recovery, Test	Data recovery, GRCA trail maintenance

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:291	Small Structure	☑	10	Annual	Active	Active	Poor	Trail work, Medium format photos		Data recovery, GRCA trail maintenance
C:13:321	Roaster Complex	☑	9	Annual	Active	Active	Fair	Medium format photos	Test	Assessment - data recovery
C:13:333	Thermal Feature	☐	4	3-5 Years	Active	None	Fair			C14 sample

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:334	Structure-Thermal Feature Complex	☐	3	3-5 Years	Potentially Active	None	Fair			Assessment - preservation treatment
C:13:339	Small Structure	☑	6	Annual	Active	Active	Fair	Retrail	Test	GRCA trail maintenance, Data recovery
C:13:345	Small Structure	☐	1	Inactive	Active	None	Poor			Testing

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:347	Small Structure	☑	9	Annual	Active	None	Poor	Medium format photos	Test	Data recovery, Tribal participation
C:13:355	Roasting Feature	☐	4	3-5 Years	Active	None	Poor		Carbon sample	Assessment - drainage
C:13:359	Small Structure	☑	7	Biennial	Active	None	Fair	Checkdams	Data recovery	Checkdam maintenance, Quantify checkdam effectiveness

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:368	Artifact Scatter	☐	3	Inactive	Active	None	Poor			Assessment - data recovery, C14 sample
C:13:381	Thermal Feature	☑	5	Inactive	Active	Active	Poor	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness
C:13:387	Small Structure	☐	2	3-5 Years	Active	None	Fair		Documentation of metates	

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:002	Roaster Complex	☑	4	3-5 Years	Potentially Active	None	Good	Checkdams, Checkdam maintenance, Obliterate trails, Total station plots on Hereford map		Checkdam maintenance, Quantify checkdam effectiveness, Total station map update
G:03:003	Roaster Complex	☑	13	Annual	Active	Active	Fair	Checkdams, Checkdam maintenance, Retrail, Obliterate trails, Trail maintenance, Total station plots on Hereford map, Medium format photos		GRCA trail maintenance, Checkdam maintenance, Total station map update, Tribal participation, Quantify checkdam effectiveness, Close site
G:03:004	Roaster Complex	☐	10	Annual	Active	Active	Fair	Obliterate trail, Retrail, Trail maintenance, Medium format photos		Data recovery, Close site

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:006	Roaster Complex	☐	2	3-5 Years	Potentially Active	None	Good			Assessment - drainage
G:03:020	Roaster Complex	☑	9	Annual	Active	Active	Fair	Obliterate trail	Excavated Features 7, 8 and 9	Assessment - data recovery
G:03:024	Roaster Complex	☑	5	Biennial	Potentially Active	Active	Good	Checkdams, Checkdam maintenance, Obliterate trail, Total station plots on Hereford map		Checkdam maintenance, GRCA trail maintenance, Total station map update, C14 sample, Quantify checkdam effectiveness

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:025	Roaster Complex	☑	4	3-5 Years	Potentially Active	None	Good	Checkdams, Checkdam maintenance, Obliterate trails, Total station plots on Hereford map		Checkdam maintenance, Quantify checkdam effectiveness, GRCA trail maintenance
G:03:028	Roaster Complex	☑	6	Biennial	Potentially Active	Active	Good	Obliterate, Retrail, Plant vegetation, Total station plots on Hereford map		GRCA trail maintenance
G:03:034	Roaster Complex	☐	4	Biennial	Active	Active	Fair			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:038	Roaster Complex	☑	2	Biennial	Active	None	Poor	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness, Total station map update, Assessment - data recovery
G:03:041	Roaster Complex	☑	3	Annual	Active	None	Fair	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness
G:03:043	Thermal Feature	☐	2	Biennial	Active	None	Fair		Carbon samples	Data recovery

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:055	Thermal Feature	☑	2	3-5 Years	Active	None	Fair			
G:03:060	Roaster Complex	☐	3	3-5 Years	Active	None	Fair			C14 sample
G:03:064	Roaster Complex	☑	8	Annual	Active	None	Poor	Medium format photos	Carbon samples	Data recovery, Tribal participation

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:067	Roasting Feature	☐	6	Biennial	Potentially Active	Active	Good	Trail work		GRCA trail maintenance
G:03:072	Roaster Complex	☑	6	Annual	Active	None	Good	Checkdams, Checkdam maintenance		Data recovery, Checkdam maintenance, Quantify checkdam effectiveness, Total station map update
G:03:076	Roasting Feature	☐	2	3-5 Years	Potentially Active	None	Poor			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:080	Structure-Thermal Feature Complex	☐	7	Annual	Active	Active	Fair	Medium format photos		GRCA obliterate trail, GRCA retrail, Tribal participation, Assessment - drainage, Close site

Appendix F

SITES WITH TERRACE-BASED DRAINAGES

Appendix F: Sites with terrace-based drainages

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:004	Roasting Feature	☐	3	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:15:020	Roaster Complex	☐	3	3-5 Years	Potentially Active	None	Excellent			Assessment - drainage
A:15:022	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:028	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage
A:15:031	Thermal Feature	☑	2	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:15:032	Thermal Feature	☑	1	3-5 Years	Potentially Active	None	Good			C14 sample, Assessment - drainage
A:15:035	Roasting Feature	☐	3	3-5 Years	Active	None	Poor			C14 sample

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:038	Thermal Feature	☐	1	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:15:040	Thermal Feature	☐	4	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:15:051	Roasting Feature	☐	3	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:16:004	Structure-Thermal Feature Complex	☐	6	Biennial	Active	Active	Fair			Assessment - preservation treatment, GRCA obliterate trail, close site

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:157	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
A:16:160	Roaster Complex	☐	2	3-5 Years	Potentially Active	Active	Good	Obliterate trail		GRCA trail maintenance, Assessment - drainage
A:16:161	Small Structure	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage
A:16:171	Roaster Complex	☐	2	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:176	Roasting Feature	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage
A:16:184	Thermal Feature	☐	1	Inactive	Potentially Active	None	Excellent			Medium format photographs
B:10:111	Roaster Complex	☐	3	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
B:10:237	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Fair			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:11:272	Roasting Feature	☑	8	Biennial	Potentially Active	None	Fair	Retrail		Assessment - drainage, GRCA trail maintenance
B:11:277	Thermal Feature	☐	2	3-5 Years	Active	None	Good			Assessment - drainage
B:11:281	Thermal Feature	☐	2	Biennial	Active	None	Fair			Assessment - drainage
B:14:095	Roaster Complex	☐	3	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:14:107	Thermal Feature	☑	3	3-5 Years	Active	None	Good	Checkdams, Checkdam maintenance		Checkdam maintenance, Quantify checkdam effectiveness
B:15:096	Special Activity Locus	☐	7	Inactive	Potentially Active	None	Good			Medium format photographs
C:05:037	Thermal Feature	☐	5	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
C:06:006	Artifact Scatter	☐	3	3-5 Years	Potentially Active	None	Fair			Assessment - drainage, Tribal participation, GRCA trail maintenance

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:09:061	Small Structure	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage
C:09:065	Historic Structure	☐	1	3-5 Years	Potentially Active	None	Excellent			
C:09:067	Small Structure	☐	1	3-5 Years	Potentially Active	None	Good			Assessment - drainage
C:09:068	Artifact Scatter	☐	2	3-5 Years	Potentially Active	None	Good			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:09:084	Artifact Scatter	☐	2	3-5 Years	Active	None	Fair			Site documentation
C:13:005	Roaster Complex	☐	5	Inactive	Potentially Active	Active	Fair	GRCA trail maintenance, Checkdams, Obliterate trail		GRCA trail maintenance, Quantify checkdam effectiveness, Checkdam maintenance
C:13:006	Small Structure	☑	10	Annual	Active	None	Fair	Checkdams, Checkdam maintenance, Plant vegetation, Medium format photos		Assessment - preservation treatment, Checkdam maintenance, Assessment - drainage, Quantify checkdam effectiveness
C:13:069	Small Structure	☑	5	Annual	Active	Active	Fair	Checkdams, Checkdam maintenance, Medium format photos	Carbon sample	Quantify checkdam effectiveness, Checkdam maintenance, Assessment - preservation treatment, Assessment - data recovery

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:274	Small Structure	☐	2	3-5 Years	Potentially Active	None	Good			Assessment -drainage
C:13:323	Thermal Feature	☐	2	3-5 Years	Active	None	Poor		Carbon sample	Assessment - drainage
C:13:325	Roasting Feature	☐	2	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
C:13:327	Roasting Feature	☑	2	Biennial	Active	Active	Fair	Retrail, Obliterate trails, Checkdams	Carbon samples	GRCA trail maintenance, Checkdam maintenance, Quantify checkdam effectiveness

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:329	Small Structure	☐	5	Biennial	Active	None	Good			Assessment - drainage
C:13:336	Thermal Feature	☐	5	3-5 Years	Potentially Active	None	Good	Checkdams		GRCA trail maintenance, Quantify checkdam effectiveness, Checkdam maintenance, Total station base map
C:13:344	Roasting Feature	☐	1	3-5 Years	Potentially Active	None	Fair			Testing
C:13:346	Small Structure	☑	2	3-5 Years	Active	None	Good	Checkdams, Checkdam maintenance		Checkdam maintenance, Quantify checkdam effectiveness, Site documentation

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:348	Artifact Scatter	☑	2	Biennial	Active	None	Good	Checkdams		Checkdam maintenance, Quantify checkdam effectiveness
C:13:349	Historic Structure	☑	7	Annual	Active	None	Fair	Medium format photos	Data recovery	Data recovery, Site documentation
C:13:350	Roasting Feature	☐	3	Inactive	Potentially Active	None	Fair		Carbon sample	Testing
C:13:352	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Fair			Assessment - drainage

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:358	Roasting Feature	☐	1	Inactive	Potentially Active	None	Poor			Testing
C:13:365	Small Structure	☑	5	3-5 Years	Potentially Active	None	Fair	Medium format photos	Test	Assessment - drainage
C:13:370	Small Structure	☐	1	3-5 Years	Potentially Active	None	Fair			
C:13:379	Small Structure	☐	5	3-5 Years	Active	None	Fair			Site documentation, Assessment - preservation treatment

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:385	Small Structure	☐	4	Biennial	Potentially Active	None	Fair			Assessment - drainage, Assessment - preservation treatment
C:13:386	Small Structure	☐	4	Biennial	Potentially Active	None	Fair			Data recovery
G:02:009	Historic Structure	☐	2	3-5 Years	Potentially Active	None	Fair			GRCA obliterate trail, Tribal participation, Assessment - drainage
G:02:103	Rockart	☐	1	Inactive	Potentially Active	None	Excellent			Medium format photographs, GRCA trail maintenance, Tribal participation

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:02:105	Historic Structure	☐	1	3-5 Years	Potentially Active	None	Excellent			GRCA trail maintenance, Tribal participation, Assessment - drainage
G:03:026	Roaster Complex	☑	9	3-5 Years	Active	Active	Good	Checkdams, Checkdam maintenance, Obliterate trails, Retrail, Plant vegetation, Total station plots on Hereford map	Carbon samples at Features 2, 3 and 8	Checkdam maintenance, Quantify checkdam effectiveness, Total station map update, GRCA trail maintenance, Tribal participation
G:03:029	Roaster Complex	☐	2	3-5 Years	Potentially Active	None	Fair			Assessment - drainage
G:03:030	Roaster Complex	☑	2	Biennial	Active	None	Good			Checkdam installation, Total station base map

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:032	Roaster Complex	☐	2	3-5 Years	Active	None	Good			Assessment - drainage
G:03:040	Roaster Complex	☑	5	Biennial	Active	None	Fair	Checkdams, Checkdam maintenance		Data recovery, Checkdam maintenance, Quantify checkdam effectiveness
G:03:042	Special Activity Locus	☐	4	Inactive	Potentially Active	None	Excellent			
G:03:044	Structure-Thermal Feature Complex	☐	7	Biennial	Active	None	Good			Assessment - drainage, Assessment - data recovery

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:052	Roaster Complex	☐	2	3-5 Years	Active	None	Fair	Obliterate trail		Assessment - drainage, GRCA trail maintenance
G:03:056	Roaster Complex	☐	1	3-5 Years	Active	None	Fair			Assessment - drainage
G:03:057	Thermal Feature	☐	2	Annual	Active	Active	Good			Assessment - date recovery, Assessment - drainage
G:03:058	Roasting Feature	☑	3	3-5 Years	Active	Active	Fair	Obliterate trail, Checkdams, Checkdam maintenance		Checkdam maintenance, Quantify checkdam effectiveness, GRCA trail maintenance

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:059	Thermal Feature	☑	1	Inactive	Potentially Active	None	Fair			Testing
G:03:062	Artifact Scatter	☐	2	Inactive	Potentially Active	Active	Fair			GRCA trail maintenance, Assessment - drainage
G:03:063	Thermal Feature	☐	2	3-5 Years	Active	None	Fair			Testing, Assessment - drainage

Appendix G

SITES WITH SIDE CANYON-BASED DRAINAGES

Appendix G: Sites with side canyon-based drainages

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:025	Special Activity Locus	☐	3	3-5 Years	Active	Active	Fair			
A:15:029	Thermal Feature	☐	1	3-5 Years	Potentially Active	None	Fair			
C:13:007	Small Structure	☐	5	Biennial	Active	Active	Fair	GRCA trail maintenance, plant vegetation, stabilization		GRCA trail maintenance
C:13:343	Small Structure	☑	6	Annual	Active	None	Fair		Testing, Surface collection	Data recovery
C:13:371	Structure-Thermal Feature Complex	☑	16	Semiannual	Active	None	Poor	Checkdams, Medium format photos	Carbon samples, Test	Checkdam maintenance, Quantify checkdam effectiveness, Data recovery

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:078	Small Structure	☐	1	Inactive	Potentially Active	None	Good			

Appendix H

SITES WITH NO DRAINAGES

Appendix H: Sites with no drainages

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:018	Rockart	☐	1	Inactive	Potentially Active	None	Good	Medium format photos		
A:15:021	Roasting Feature	☐	3	3-5 Years	Active	None	Good			Assessment - preservation treatment
A:15:026	Roaster Complex	☐	5	3-5 Years	Active	None	Fair			
A:15:027	Roasting Feature	☐	7	3-5 Years	Potentially Active	None	Good			
A:15:036	Thermal Feature	☐	1	Inactive	Potentially Active	None	Fair			Testing

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:15:042	Thermal Feature	☐	5	Inactive	Active	None	Poor	Obliterate trail, Retrail		
A:15:047	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Fair	Additional documentation		Testing
A:16:148	Roasting Feature	☐	3	Inactive	Potentially Active	None	Good			C14 sample
A:16:150	Roasting Feature	☐	1	Inactive	Potentially Active	None	Good			Assessment - preservation treatment
A:16:151	Roasting Feature	☐	6	3-5 Years	Potentially Active	Active	Good	Obliterate trail		Assessment - preservation treatment, GRCA trail maintenance
A:16:154	Structure-Thermal Feature Complex	☐	1	3-5 Years	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:155	Small Structure	☐	2	Inactive	Potentially Active	None	Fair			
A:16:159	Artifact Scatter	☐	9	3-5 Years	Active	Active	Fair	Medium format photos		
A:16:162	Small Structure	☐	3	Inactive	Potentially Active	None	Fair			Data recovery
A:16:163	Small Structure	☐	2	3-5 Years	Potentially Active	Active	Good	Medium format photos		GRCA trail maintenance
A:16:167	Roaster Complex	☐	4	3-5 Years	Potentially Active	Active	Good			Assessment - preservation treatment
A:16:172	Rockart	☐	1	Inactive	Potentially Active	None	Good	Medium format photos		

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
A:16:185	Special Activity Locus	☐	3	3-5 Years	Potentially Active	Active	Fair			Tribal participation
B:09:314	Small Structure	☐	1	3-5 Years	Potentially Active	None	Good			C14 sample
B:09:316	Small Structure	☐	4	3-5 Years	Potentially Active	None	Fair			
B:09:317	Roasting Feature	☐	7	Biennial	Potentially Active	Active	Good	Obliterate trail		GRCA trail maintenance, Tribal participation
B:10:224	Thermal Feature	☐	7	3-5 Years	Active	None	Fair			Data recovery, Tribal participation
B:10:225	Small Structure	☐	4	3-5 Years	Potentially Active	None	Fair			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:10:227	Artifact Scatter	☐	3	Inactive	Potentially Active	Active	Excellent			
B:10:260	Thermal Feature	☐	1	Inactive	Potentially Active	None	Good			
B:10:262	Small Structure	☐	1	Inactive	Potentially Active	Active	Poor			
B:11:278	Small Structure	☐	1	3-5 Years	Potentially Active	None	Poor		Test	
B:11:280	Small Structure	☐	1	Inactive	Potentially Active	None	Poor			
B:11:282	Structure-Thermal Feature Complex	☐	7	3-5 Years	Potentially Active	Active	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:11:283	Small Structure	☐	1	Inactive	Potentially Active	None	Good			
B:11:284	Small Structure	☐	2	Inactive	Potentially Active	None	Fair	Medium format photos	Test	
B:13:001	Small Structure	☐	1	3-5 Years	Active	None	Good			
B:14:093	Thermal Feature	☐	4	3-5 Years	Active	None	Good			Assessment - preservation treatment
B:14:108	Artifact Scatter	☐	3	3-5 Years	Potentially Active	None	Fair			
B:15:097	Artifact Scatter	☐	2	3-5 Years	Potentially Active	Active	Good	Artifact inventory		

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:15:119	Artifact Scatter	☐	2	3-5 Years	Potentially Active	None	Fair			
B:15:120	Small Structure	☐	3	3-5 Years	Potentially Active	None	Fair			Testing
B:15:122	Small Structure	☐	1	Inactive	Potentially Active	Active	Poor			Testing, Tribal participation
B:15:124	Rockart	☐	6	Inactive	Potentially Active	None	Good	Medium format photos		
B:15:127	Roasting Feature	☐	2	3-5 Years	Potentially Active	None	Good			
B:15:128	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:15:134	Small Structure	☐	1	Inactive	Potentially Active	None	Good			
B:15:135	Small Structure	☐	4	3-5 Years	Potentially Active	None	Good			
B:15:139	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Good			
B:16:003	Small Structure	☐	4	Inactive	Potentially Active	Active	Good			GRCA trail maintenance, Tribal participation
B:16:257	Small Structure	☐	2	Inactive	Potentially Active	None	Fair			
B:16:258	Small Structure	☐	1	Inactive	Potentially Active	None	Fair			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
B:16:259	Roasting Feature	☐	4	3-5 Years	Active	Active	Good			
B:16:261	Small Structure	☐	2	Inactive	Potentially Active	Active	Fair			
B:16:262	Historic Structure	☐	3	Inactive	Potentially Active	None	Excellent			
B:16:364	Artifact Scatter	☐	2	Inactive	Active	Active	Fair			
C:02:094	Historic Structure	☐	6	Biennial	Active	Active	Good	Graffiti removal, Medium format photos		Testing, Tribal participation, Assessment - preservation treatment
C:05:004	Artifact Scatter	☐	4	Inactive	Potentially Active	Active	Fair	Artifact inventory		

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:05:007	Rockart	☐	1	Inactive	Potentially Active	None	Excellent	Medium format photos		
C:05:009	Small Structure	☐	1	Inactive	Potentially Active	None	Excellent			
C:05:039	Special Activity Locus	☐	2	Inactive	Potentially Active	None	Good			Medium format photographs
C:06:002	Rockart	☐	5	Inactive	Potentially Active	None	Poor	Medium format photos		
C:06:004	Rockart	☐	4	Inactive	Potentially Active	None	Excellent	Medium format photos		
C:06:005	Rockart	☐	5	Inactive	Potentially Active	None	Excellent	Graffiti removal, Medium format photos		

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:06:008	Small Structure	☐	2	Inactive	Potentially Active	None	Fair			Testing, Tribal participation
C:06:010	Small Structure	☐	2	Inactive	Potentially Active	None	Fair			
C:09:005	Pueblo	☐	1	Inactive	Potentially Active	None	Fair			
C:09:030	Special Activity Locus	☐	2	Inactive	Potentially Active	Active	Good	Retrail, Obliterate trail, Medium format photos		GRCA trail maintenance
C:09:050	Special Activity Locus	☑	15	Semiannual	Active	None	Good	Checkdams, Medium format photos		Checkdam maintenance
C:09:051	Pueblo	☑	10	Biennial	Active	None	Good	Obliterate trail, Retrail, Medium format photos	Data recovery	GRCA trail maintenance

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:09:052	Artifact Scatter	☐	9	3-5 Years	Potentially Active	None	Good	Obliterate trail		
C:09:053	Small Structure	☐	4	3-5 Years	Potentially Active	None	Good			
C:09:056	Artifact Scatter	☐	1	Inactive	Potentially Active	None	Excellent			
C:09:062	Small Structure	☐	1	Inactive	Potentially Active	None	Good			
C:09:069	Structure-Thermal Feature Complex	☐	5	Inactive	Potentially Active	None	Good		Test	
C:09:072	Small Structure	☐	2	3-5 Years	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:09:073	Small Structure	☐	1	Inactive	Potentially Active	None	Fair			
C:09:082	Roasting Feature	☐	8	3-5 Years	Active	None	Fair			
C:13:033	Small Structure	☐	1	Inactive	Potentially Active	None	Poor			
C:13:092	Historic Structure	☐	7	3-5 Years	Potentially Active	None	Fair			GRCA trail maintenance
C:13:101	Structure-Thermal Feature Complex	☐	5	3-5 Years	Potentially Active	None	Fair	Obliterate Trail		
C:13:131	Historic Structure	☐	3	Inactive	Potentially Active	Active	Poor			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:322	Rockart	☐	4	Inactive	Potentially Active	None	Fair	Medium format photos		
C:13:324	Thermal Feature	☐	1	Inactive	Potentially Active	Active	Fair	Obliterate trail, Plant vegetation	Carbon samples	
C:13:326	Thermal Feature	☐	1	Inactive	Potentially Active	None	Poor		Carbon samples	
C:13:335	Thermal Feature	☐	2	Inactive	Potentially Active	None	Good			Testing
C:13:337	Roasting Feature	☐	1	3-5 Years	Potentially Active	None	Good			
C:13:338	Roaster Complex	☑	2	3-5 Years	Potentially Active	None	Good	Retrail	Carbon samples, Data recovery	

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:340	Roasting Feature	☐	2	3-5 Years	Active	None	Good	Retrail, Obliterate trail		GRCA trail maintenance
C:13:342	Historic Structure	☐	5	3-5 Years	Potentially Active	Active	Poor		Artifact sample collected	Medium format photographs, Site documentation
C:13:353	Small Structure	☐	1	Inactive	Potentially Active	None	Poor			
C:13:354	Small Structure	☐	4	3-5 Years	Potentially Active	None	Poor			Site documentation, Medium format photographs, Assessment - preservation treatment
C:13:360	Small Structure	☐	1	3-5 Years	Potentially Active	None	Poor			
C:13:361	Small Structure	☐	1	Inactive	Potentially Active	None	Fair			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:362	Small Structure	☐	1	3-5 Years	Potentially Active	Active	Fair	Obliterate trail		GRCA trail maintenance
C:13:363	Small Structure	☐	1	Inactive	Potentially Active	None	Fair			
C:13:364	Small Structure	☐	2	Inactive	Potentially Active	None	Poor			
C:13:372	Roasting Feature	☐	1	Inactive	Potentially Active	None	Excellent			
C:13:373	Thermal Feature	☐	1	3-5 Years	Active	None	Fair			Assessment - preservation treatment
C:13:377	Artifact Scatter	☐	1	3-5 Years	Active	Active	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
C:13:384	Thermal Feature	☑	5	Inactive	Active	None	Good		Carbon samples	
C:13:389	Structure-Thermal Feature Complex	☐	4	3-5 Years	Active	Active	Fair			Data recovery
C:13:393	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Good			
G:02:001	Artifact Scatter	☐	1	Inactive	Potentially Active	None	Good			
G:02:100	Historic Structure	☐	2	3-5 Years	Potentially Active	None	Excellent			Tribal participation
G:02:101	Historic Structure	☐	2	3-5 Years	Potentially Active	None	Good			Tribal participation

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:02:102	Historic Structure	☐	1	Inactive	Potentially Active	None	Good			
G:02:106	Historic Structure	☐	1	Inactive	Potentially Active	None	Good			
G:02:108	Historic Structure	☐	2	3-5 Years	Potentially Active	None	Good			Tribal participation
G:03:027	Special Activity Locus	☑	3	Inactive	Potentially Active	None	Good	Total station plots on Hereford map		Medium format photographs
G:03:037	Artifact Scatter	☐	1	3-5 Years	Potentially Active	None	Good			
G:03:046	Thermal Feature	☐	2	Inactive	Potentially Active	None	Fair			Testing

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:048	Artifact Scatter	☐	2	3-5 Years	Active	None	Good		Artfact sample collected	Assessment - preservation treatment
G:03:049	Artifact Scatter	☐	1	Inactive	Potentially Active	Active	Good			GRCA trail maintenance
G:03:053	Artifact Scatter	☐	1	Inactive	Potentially Active	None	Excellent			
G:03:065	Artifact Scatter	☐	2	3-5 Years	Active	None	Fair			
G:03:066	Roasting Feature	☐	4	Inactive	Potentially Active	None	Excellent			
G:03:071	Artifact Scatter	☐	2	3-5 Years	Potentially Active	None	Good			

Site Number	Property Type	Total Station Base Map	Site Visits	Monitor Schedule	Physical Activity	Visitor-related Activity	Site Condition	Preservation Options Completed	Recovery Options Completed	Synthesis Recommendations
G:03:073	Roaster Complex	☐	1	3-5 Years	Potentially Active	None	Fair			
G:03:077	Rockart	☐	3	Inactive	Potentially Active	None	Good	Medium format photos		GRCA trail maintenance
G:03:082	Small Structure	☐	3	Inactive	Potentially Active	None	Fair			
G:03:083	Artifact Scatter	☐	3	Inactive	Potentially Active	None	Excellent			Site documentation
G:03:085	Artifact Scatter	☐	4	Inactive	Potentially Active	None	Excellent			

Appendix I

SITES IN STABLE CONDITION

Appendix I: Sites in Stable Condition (n = 78)

Sites with river-based drainages	
A:15:037	
A:16:153	
B:10:229	
B:10:249	
B:10:261	
B:15:123	
C:09:031	
C:09:034	
C:13:003	
Sites with Terrace-based	
A:16:184	
B:15:096	
C:13:005	
C:13:350	
C:13:358	
G:02:103	
G:03:042	
G:03:059	
G:03:062	
G:03:078	
Sites with no drainages	
A:15:018	
A:15:036	
A:16:148	
A:16:150	
A:16:155	
A:16:162	
A:16:172	
B:10:227	
B:10:260	
B:10:262	
B:11:280	
B:11:283	
B:11:284	
B:15:122	
B:15:124	
B:15:134	
B:16:003	
B:16:257	
B:16:258	
B:16:261	
B:16:262	
C:05:004	

C:05:007	
C:05:009	
C:05:039	
C:06:002	
C:06:004	
C:06:005	
C:06:008	
C:06:010	
C:09:005	
C:09:030	
C:09:056	
C:09:062	
C:09:069	
C:09:073	
C:13:033	
C:13:131	
C:13:322	
C:13:324	
C:13:326	
C:13:335	
C:13:353	
C:13:361	
C:13:363	
C:13:364	
C:13:372	
G:02:001	
G:02:102	
G:02:106	
G:03:027	
G:03:046	
G:03:049	
G:03:053	
G:03:066	
G:03:077	
G:03:082	
G:03:083	
G:03:085	