

Fiscal Year 2002
Archaeological Site Monitoring and Management
Activities Along the Colorado River in Grand Canyon
National Park.

CHAPTER ONE

EXECUTIVE SUMMARY

The River Corridor Monitoring Project (RCMP) is a cooperative program between Grand Canyon National Park and the Bureau of Reclamation, Interagency Acquisition Number 98-AA-40-0130, and between Grand Canyon National Park and Northern Arizona University (NAU), CA 120099009. This report fulfills an annual requirement of the Programmatic Agreement (PA) on cultural resources [U.S. Department of the Interior, 1994 #365]. This report addresses National Register eligible historic properties affected by the operations of Glen Canyon Dam. All work completed and recommendations for fiscal year 2003 have been completed under the guidance of the Monitoring and Remedial Action Plan (MRAP) [U.S. Department of the Interior, 1997 #366], as developed in 1994 and amended in 2000 [U.S. Department of the Interior, 2000 #482]. Future work will continue to be guided by the MRAP until the Historic Preservation Plan (HPP) is completed.

In FY2002, one NPS trip funded through the Bureau of Reclamation (BOR) was completed. This trip occurred in April, 2002 and included RCMP staff and Zuni Conservation Program (ZCP) members. The trip completed site monitoring activities, and checkdam monitoring and maintenance. RCMP staff also accompanied one GCMRC-sponsored remote sensing trip and anticipate a follow-up trip in September, 2002.

RCMP staff members participated in three Cooperative River Trips (CRT) sponsored by the Colorado River Fund. Activities on these trips included RCMP monitoring, and collaborative efforts to obliterate multiple social trailing and complete revegetation projects. These projects were conducted at archaeological sites along the river corridor. One additional CRT trip was completed with non-RCMP, NPS staff. Three total station maps at river corridor archaeological sites were completed.

NAU's main responsibilities included redesigning the RCMP database. This redesign is intended to streamline the monitoring and remedial action process and provide a wider variety of methods for analyzing RCMP data. NAU archaeologist Nancy Andrews has been working closely with a database consultant from 7K Information Technologies, to improve upon our current database system. One excavation report has been completed by NAU personnel, and two are still pending.

Public outreach included two very diverse projects. RCMP staff participated in two of the Grand Canyon Field Institute's "Hands on Archaeology" field schools. These classes teach the fundamentals of cultural resource identification, survey, and site recording. RCMP staff also participated in all of the public scoping meetings for the Colorado River Management Plan. These meetings allowed staff to educate the public and answer questions related to the protection and preservation of cultural resources along the river corridor.

RCMP staff members have also been involved in the ongoing NAGPRA consultation at site C:13:386. Members of the Paiute and Zuni tribes discussed the situation with RCMP staff on the April 2002 river trip and had an opportunity to view the site. It was determined that a brush lining on top of the feature may allow for the entrapment of sediment and slow down the loss of the soil matrix surrounding the feature.

The work plan for FY2003 will include monitoring at 92 sites, and monitoring and maintenance at the 27 sites with checkdams including continued data collection of selected cross-sections. Medium format photography will be completed at five river corridor sites prior to the anticipated January experimental flow. Laboratory work will include continued database cleaning, application testing, database documentation, and plotting sites on orthophotos. It is anticipated that public outreach will consist of continued involvement with the Grand Canyon Field Institute, Colorado River Management Plan, and Grand Canyon River Guides Training Seminar.

CHAPTER TWO

IMPACTS TO CULTURAL RESOURCES

According to the Glen Canyon Dam Environmental Impact Statement, the existence and operation of Glen Canyon Dam has had an effect on the historic properties along the Colorado River corridor [U.S. Department of the Interior, 1995 #129]. For the past ten years, the River Corridor Monitoring Project has identified, inspected, analyzed, and evaluated the effects of these impacts on archaeological sites along the river corridor. Guidance and direction for impact assessment comes from the Programmatic Agreement [U.S. Department of the Interior, 1994 #365], Draft Historic Preservation Plan [U.S. Department of the Interior, 1997 #289], and the Monitoring and Remedial Actions Plan [U.S. Department of the Interior, 1997 #366], [U.S. Department of the Interior, 2000 #482]. Supporting legislation includes the National Historic Preservation Act (NHPA) (16 U.S.C. 470) passed in 1966 and the Grand Canyon Protection Act of 1992 (GCPA). As the result of knowledge gained through periodic monitoring, actions have been taken to preserve some of the archaeological sites *in situ* and to retrieve information from other sites where imminent loss is probable.

Since the initiation of archaeological site monitoring along the river corridor in 1992 [Coder, 1994a #12], a distinction has been made between those impacts deriving from geological processes and those that result from human behavior. The RCMP has come to call these two kinds of impacts “physical” and “visitor-related.” The primary reason for the distinction is that the NPS is primarily responsible, under Section 110 of NHPA, to alleviate any damage done to river corridor sites by visitors to Grand Canyon National Park. In contrast, the BOR is responsible, under Section 106 of NHPA, for physical impacts resulting from the significant environmental changes that have occurred to the river system due to placement and operation of the Dam. These impacts are cumulative, difficult and costly to quantify, and are not easily distinguished from physical impacts unrelated to dam operations. Additionally, the BOR is responsible for impacts due to changing patterns of visitation due to dam operations.

RCMP archaeologists qualitatively assess impacts to sites via repeat observations (monitoring). The degree of impact is categorized as “present” or “absent”, with physical erosion further characterized as “active” or “inactive”. Active erosion is defined as obvious, recent movement, disturbance, or rearrangement of sediments or artifacts on-site. Inactive erosion is defined as a (less obvious) perception that past geophysical processes are discernable at the site but are not presently at work. See Appendix A, FY2002 RCMP Monitor Form, for the types of physical and visitor-related impacts recorded by observers, and refer to the FY01 RCMP annual report for type definitions [Dierker, 2001:4,8 #459].

FY2002 Monitoring Sample

RCMP archaeologists monitored 42 sites in FY2002. Each site was monitored once, therefore the number of monitoring episodes is equal to 42. The sites were selected for monitoring based upon the severity of impacts, site condition, and the scheduled monitoring frequency for that site. Table 1 lists the sites monitored in FY2002 along with other pertinent information.

Table 1. Sites Monitored in FY2002 (N = 42 Sites)

Site Number	Reach	Drainage Type	Property Type
A:15:005	10	River	Structure-Thermal Feature Complex
A:15:020	10	Terrace	Roaster Complex
A:16:004	10	Terrace	Structure-Thermal Feature Complex
B:14:105	7	River	Small Structure
B:15:138	7	River	Thermal Feature
C:02:096	1	River	Structure-Thermal Feature Complex
C:05:007	3	No Drainage	Rockart
C:09:050	4	Side Canyon	Special Activity Locus
C:13:006	4	River	Small Structure
C:13:009	5	River	Pueblo
C:13:010	5	River	Pueblo
C:13:069	5	Terrace	Small Structure
C:13:070	5	River	Small Structure
C:13:098	5	River	Historic Structure
C:13:099	5	River	Structure-Thermal Feature Complex
C:13:100	5	River	Pueblo
C:13:273	5	River	Roaster Complex
C:13:291	5	River	Small Structure
C:13:321	5	River	Roaster Complex
C:13:343	5	Side Canyon	Small Structure
C:13:347	5	River	Small Structure
C:13:349	5	Terrace	Historic Structure
C:13:360	5	No Drainage	Small Structure
C:13:371	5	Side Canyon	Structure-Thermal Feature Complex
C:13:386	5	Terrace	Small Structure
C:13:387	5	River	Small Structure
G:02:100	12	No Drainage	Historic Structure
G:02:101	12	No Drainage	Historic Structure
G:02:103	12	Terrace	Rockart
G:02:108	12	No Drainage	Historic Structure
G:03:003	10	River	Roaster Complex
G:03:004	10	River	Roaster Complex
G:03:020	10	River	Roaster Complex
G:03:030	10	Terrace	Roaster Complex
G:03:034	10	River	Roaster Complex
G:03:041	10	River	Roaster Complex
G:03:043	10	River	Thermal Feature
G:03:044	10	River	Structure-Thermal Feature Complex
G:03:057	11	Terrace	Thermal Feature
G:03:064	10	River	Roaster Complex
G:03:072	11	River	Roaster Complex
G:03:080	11	River	Structure-Thermal Feature Complex

The monitoring sample includes locations in Reaches 1, 3, 4, 5, 7, 10, 11, and 12. See Table 2, Designated River Reaches. Sixty nine percent of the sample is within Reaches 5 and 10. Reaches 5 and 10 have the highest site density in the project area, due primarily to the open and alluviated stretches of canyon found within these Reaches [Fairley, 1994:16-20 #17].

Table 2. Designated River Reaches as per [Schmidt, 1990 #275]

Reach	Name	Mileage
0	Glen Canyon	-15.5 to 0
1	Permian Section	0 to 11.3
2	Supai Gorge	11.3 to 22.6
3	Redwall Gorge	22.6 to 35.9
4	Lower Marble Canyon	35.9 to 61.5
5	Furnace Flats	61.5 to 77.4
6	Upper Granite Gorge	77.4 to 117.8
7	Ailes	117.8 to 125.5
8	Middle Granite Gorge	125.5 to 139.9
9	Muav Gorge	139.9 to 159.9
10	Lower Canyon	159.9 to 213.8
11	Lower Granite Gorge	213.8 to 235.0
12	Lake Mead	235.0 to 278.0

Sites with structures (pueblo, small structure, historic structure, or structure with thermal feature) comprise 60% of the sample. Roasting/thermal features or complexes comprise 33% of the sample. As depicted in Figure 1, most of the structures are located in Reach 5 (miles 61.5 to 77.4) while roasting features are the predominant property type in Reach 10 (miles 159.9 to 213.8).

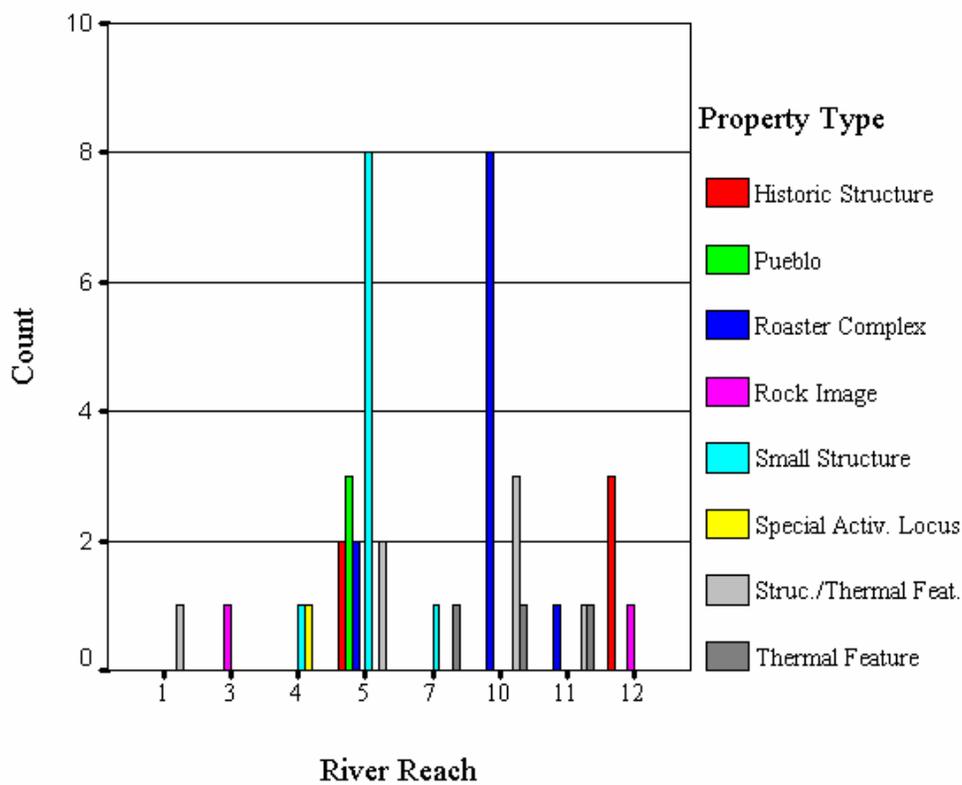


Figure 1. Sites Monitored in FY2002 by River Reach and Property Type (N = 42 Sites)

River-based drainages, which feed into the Colorado River, are the dominant drainage type in the sample (59.5%). Terrace-based drainages, which finger out onto alluvial terraces above the river, represent 21.4% of the sample (Figure 2).

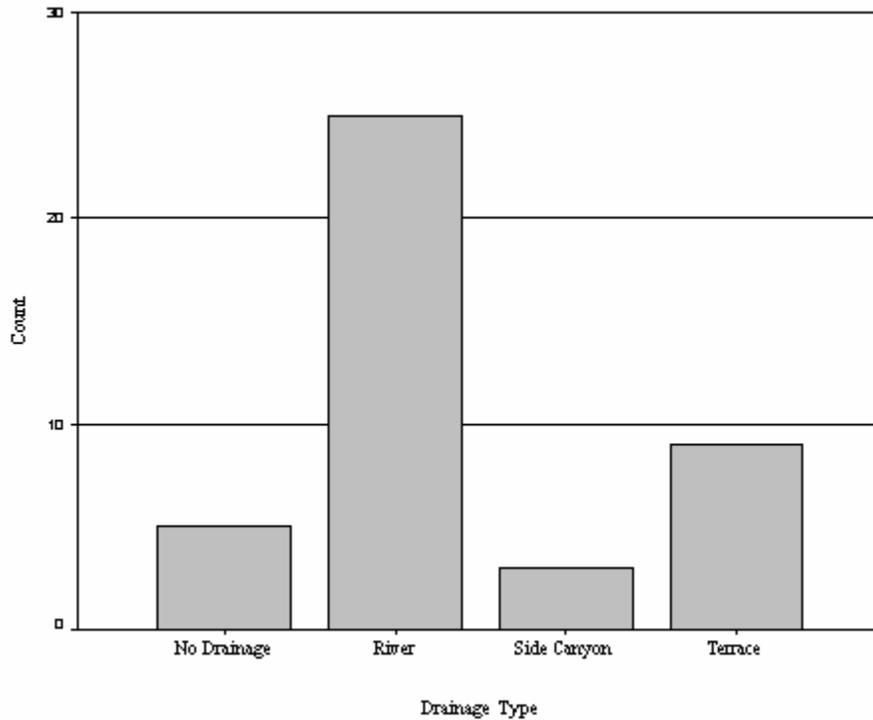


Figure 2. Sites Monitored in FY2002 by Drainage Type (N = 42 Sites)

When a channel becomes river-based, it adjusts to a lower base-level and erosion increases [Leap, 2000b:5-1 #457]. The drainage type distribution in Figure 2 reflects that sites with increased erosion are monitored more frequently (annually or semiannually) and the most heavily impacted sites are those that have river-based drainages.

Impacts by Reach

Figure 3 shows the distribution of physical and visitor-related impacts by reach at the 42 monitored sites. It is apparent from this stacked bar graph that (1) sites within reaches 5 and 10 continue to experience the majority of both physical and visitor-related impacts, and (2) physical impact frequency exceeds visitor impact frequency in 4 of the 7 reaches (reaches 4, 5, 10, and 11).

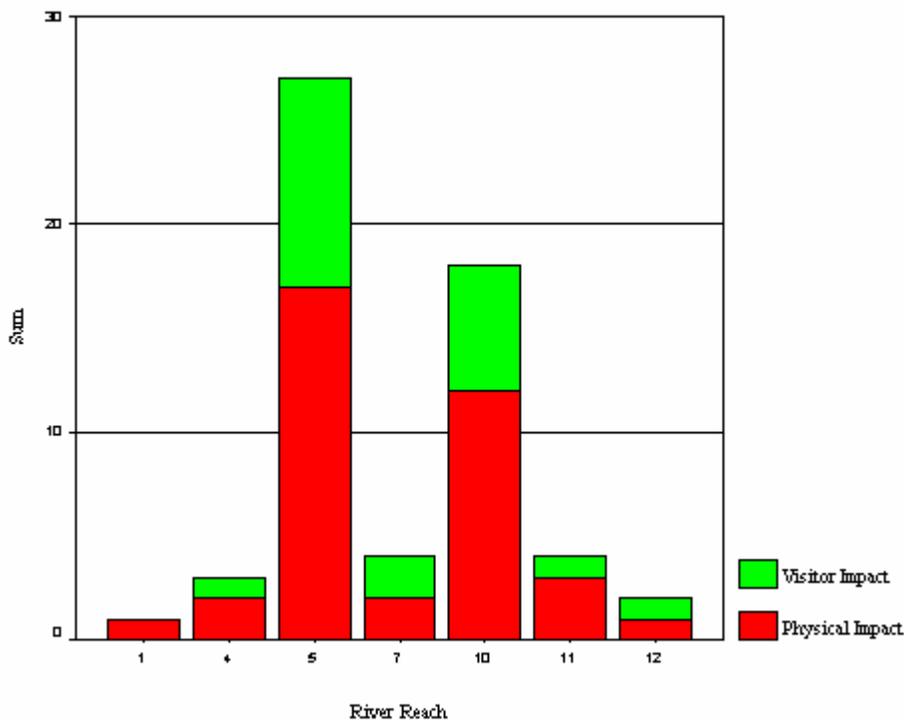


Figure 3. Visitor and Physical Impact Frequencies at 42 Monitored Sites

Analysis of Questions 16 and 24 on the monitoring form (see Appendix A FY2002 RCMP Monitor Form) indicate that 83% of the recorded physical impacts appear to be new impacts that have occurred since the last monitoring visit (in this case one year). In contrast, 20% of the recorded visitor-related impacts appear to be within the last year. As expected, most new impacts occur in Reaches 5 and 10.

As discussed previously, RCMP archaeologists distinguish between “active” erosion and erosion that is present but “inactive” (at the time of monitoring). For FY2002, 88% of the sampled sites exhibit “active” erosion and 25% exhibit “inactive” erosion. Recall that a single site can have the presence of both “active” and “inactive” erosion.

Figure 4 (Count of Active Erosion FY1991-2001) indicates the frequency of active physical impacts observed at the 42 sites over an eleven-year period (from FY1991-2001). The bottom graph depicts the same information, but for a single year (FY2002). Surface erosion, gullyng, and eolian/alluvial erosion or deposition remain the most frequently observed active impacts over time and in the present fiscal year. The rank order of impact type, however, is different for the two time periods. When comparing the previous eleven years to the current year it is apparent that arroyo cutting and bank slump have “switched places” in the rank order. The observed frequency of active arroyo cutting exceeded the observed frequency of active bank slump in FY2002, unlike the pattern for the previous eleven years. The reason for this change has yet to be determined. Additionally, the proportionate increase in eolian/alluvial erosion or deposition in FY2002 as compared to the previous eleven years is significant. It is possible that this phenomenon is related to drought conditions, less vegetation, and subsequent active eolian processes.

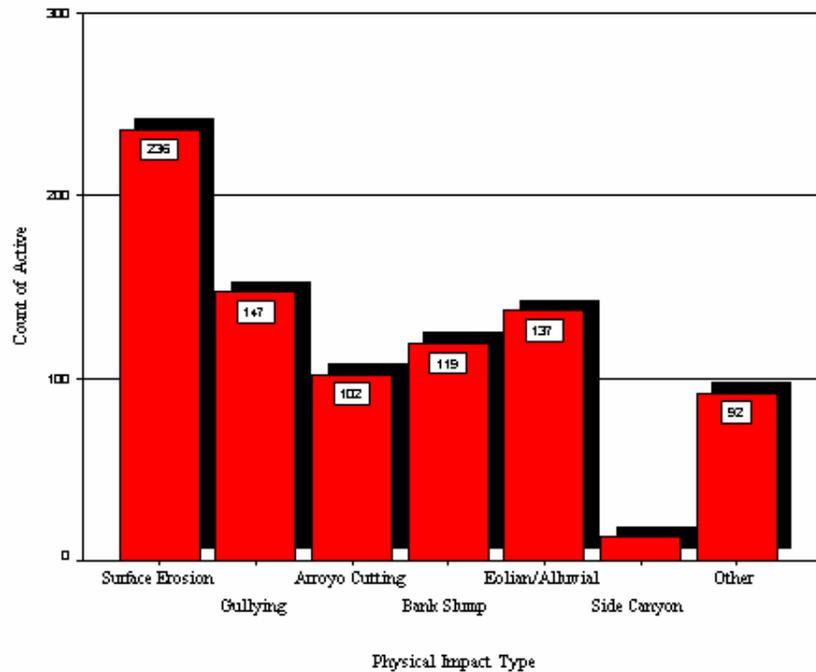


Figure 4. Count of Active Erosion at 42 Sites Monitored from FY1991 – 2001
(N = 42 Sites and 378 Observations)

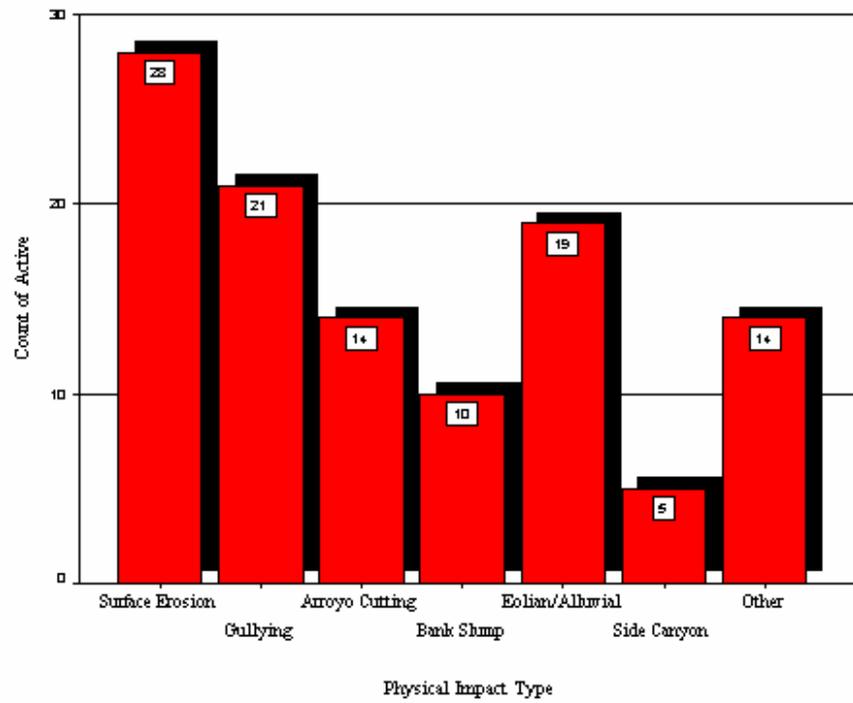


Figure 5. Count of Active Erosion at 42 Sites Monitored in FY2002
(N = 42 Sites and 42 Observations)

Correlations between Selected Categorical Variables

Figure 6 is a contingency table used to test the relationship between active arroyo cutting and active bank slump at the 42 sampled sites, using the chi-squared statistic (χ^2). The null hypothesis states that there is no relationship between these variables, namely that bank slump is the same with respect to a given arroyo cutting value. Since the critical value of χ^2 at the $\alpha = .01$ significance level for $df = 1$ is equal to 6.63, and the test statistic of 10.86 exceeds this critical value, we can reject the null hypothesis. We can alternatively say that there is a strong correlation between arroyo cutting and bank slump.

Arroyo Cutting x Bank Slump Crosstabulation

		Bank Slump		Total	
		Absent	Present		
Arroyo Cutting	Absent	Count	22	2	24
		Expected Count	17.7	6.3	24.0
	Present	Count	6	8	14
		Expected Count	10.3	3.7	14.0
Total		Count	28	10	38
		Expected Count	28.0	10.0	38.0

Figure 6. Frequency Distribution of Active Arroyo Cutting and Bank Slump at 42 Sites Monitored in FY2002
($\chi^2 = 10.86$, $df = 1$, $\alpha = .01$)

When bank slump is tested against side canyon erosion using the chi-squared statistic, the null hypothesis is again rejected (Figure 7 below). The null hypothesis states that there is no relationship between bank slump and side canyon erosion. Since the critical value of χ^2 at the $\alpha = .01$ significance level for $df = 1$ is equal to 6.63, and the test statistic of 12.52 exceeds 6.63, we can confidently say that there is a strong relationship between bank slump and side canyon erosion at the 42 sites.

Bank Slump x Side Canyon Erosion Crosstabulation

		Side Canyon Erosion		Total	
		Absent	Present		
Bank Slump	Absent	Count	28	0	28
		Expected Count	25.1	2.9	28.0
	Present	Count	6	4	10
		Expected Count	8.9	1.1	10.0
Total		Count	34	4	38
		Expected Count	34.0	4.0	38.0

Figure 7. Frequency Distribution of Active Side Canyon Erosion and Bank Slump at 42 Sites Monitored in FY2002
($\chi^2 = 12.52$, $df = 1$, $\alpha = .01$)

It makes intuitive sense that bank slump and either arroyo cutting or side canyon erosion would correlate. It is easy to imagine that where there is active arroyo cutting (or side canyon erosion) there would be active bank slump, and conversely, where there is no active arroyo cutting (or side canyon erosion) there would be no active bank slump.

Arroyo cutting and side canyon erosion, however, are not correlated (see Figure 8). The null hypothesis states that there is no relationship between arroyo cutting and side canyon erosion. The critical value of χ^2 at the $\alpha = .01$ significance level for $df = 1$ is equal to 6.63. A χ^2 of 6.63 must be exceeded in order to reject the hypothesis. The test statistic of 2.80 is less than 6.63, therefore we cannot reject the null hypotheses. There is no evidence to indicate a relationship between arroyo cutting and side canyon erosion, and these two processes may be independent of each other.

Arroyo Cutting x Side Canyon Erosion Crosstabulation

		Side Canyon Erosion		Total	
		Absent	Present		
Arroyo Cutting	Absent	Count	23	1	24
		Expected Count	21.5	2.5	24.0
	Present	Count	11	3	14
		Expected Count	12.5	1.5	14.0
Total		Count	34	4	38
		Expected Count	34.0	4.0	38.0

Figure 8. Frequency Distribution of Active Arroyo Cutting and Side Canyon Erosion at 42 Sites Monitored in FY2002

$$\chi^2 = 2.80, df = 1, \alpha = .05$$

Summary of Impacts to Cultural Resources

RCMP archaeologists continue to document the presence and relative severity of erosion and human impacts at archaeological sites along the Colorado River corridor. This chapter summarizes the year's findings related to the 42 sites monitored during FY2002. The raw data from this year's monitoring is always available to any authorized PA Signatories for their scrutiny and/or analysis. Please contact Nancy Andrews at the RCMP office, 823 N. San Francisco St., Flagstaff, AZ 86001, telephone 928-226-0162, email Nancy.Andrews@nau.edu for any data requests.

Over half of the FY2002 monitor sample (N = 42 sites) consists of structures. The majority of the sites have river-based drainages within or near the site boundary. Monitors observed the presence of physical impacts (surface erosion, arroyo cutting, etc.) at 92% of the sampled sites. This percentage is within the 83% - 95% range observed over the past nine years. Approximately 88% of the sites exhibited active erosion, with 83% of them having new impacts recorded since last monitoring. As discussed in Chapter five, integration of the RCMP monitoring database will allow more accurate and efficient long-term comparisons of erosional variables at any subset of sites. An initial attempt at long-term comparison was made in Figure 4, which depicts the frequency distribution of various erosional variables at 42 sites over an 11-year period (from FY1991 – FY2001).

The crosstabulations of arroyo cutting, bank slump, and side canyon erosion provide verification of monitoring field observations. The crosstabs indicate that bank slump strongly correlates with both arroyo cutting and side canyon erosion. It is expected that where there is active arroyo cutting and side canyon erosion, there would be active bank slump. There does not appear to be a relationship between arroyo cutting and side canyon erosion, perhaps because these processes are independent of one another.

The next chapter discusses each of the 42 monitored sites individually. Chapter 4 includes a discussion of the previous archaeological work conducted at each site, a summary table of remedial actions completed by RCMP staff to-date, and the current monitoring recommendations.

CHAPTER THREE

SITE SPECIFIC MONITORING RECOMMENDATIONS

As identified within the Programmatic Agreement, the MRAP calls for monitoring historic properties within the area of potential effect and the implementation of remedial actions for treating sites subject to impact (U.S. Department of the Interior, et al. 1994). The following chapter details all 42 sites monitored in FY02. Each site retains aspects of integrity and is National Register eligible.

In fiscal year 2002, 42 sites were monitored. Of these sites, two had schedules reduced and two had schedules either discontinued or placed on the inactive monitoring list. Discontinued sites have been determined to be out of the Area of Potential Effect (APE). Inactive sites have a record of stability through time though located within the APE. Site maps with areas of impact are included in Appendix B.

A:15:005 Structure-Thermal Feature Complex Biennial 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 groundstone. Charcoal concentrations are also identifiable on the surface. Locus C contains two roasting features and sparsely scattered artifacts. Artifacts include flakes, charcoal, groundstone and several brown ware sherds. This site may be associated with late prehistoric-early historic Pai or Paiute use.

Previous Work

R. 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 - FY00, and FY02 (Coder, et al. 1994a, Coder, et al. 1995b, Kunde 1998, Leap, et al. 1997, Leap, et al. 1996, Leap, et al. 1998, [Leap, 2000 #356]). In FY97 GCMRC personnel completed a total station map of Locus C and trail work was conducted by GRCA staff. GRCA continues minor trail maintenance on an as needed basis (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, the Zuni Conservation Program's personnel assessed the site for checkdam work. Upon assessment, five checkdams were installed in an active gully near Feature 1 (Kunde 1999b). This site was also included in the studies conducted by K. Thompson and A. Potochnik [Thompson, 2000 #278]. The February 2000 CRT trip assessed this location for revegetation and trail work to deter continued visitation and destruction of the roasting features by trailing. However, the trail work completed by the GRCA trail crew in FY97 has successfully deterred visitation.

Summary of RCMP Work Implemented

Remedial Actions	Date Completed
Total Station Map	02/28/1996
MF Photos	03/04/1997
Trail Work	01/01/1997
Total Station Remap	09/01/1998
Checkdams	11/20/1998

Recommendations

The features are unchanged since last monitored. Locus A and B were not monitored in 2002. RCMP personnel recommend annual checkdam monitoring and maintenance, and continued biennial site monitoring.

A:15:020 Roaster Complex Four-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 rock shelter with a large midden below it. Two Hopi sherds were found on the surface. The site is located on an alluvial terrace. FY98 monitors identified newly exposed chert projectile point tips in the midden and pecked stones were also identified at Feature 4.

Previous Work

The site was originally recorded during the river corridor survey (Fairley, et al. 1994) and monitored in FY93, FY94, FY98, and FY02 (Coder, et al. 1994a, Coder, et al. 1995a, Leap, et al. 1998).

Monitoring Recommendations

Eolian erosion is active inside the rockshelter/midden. Ash has been exposed at Feature 1 due to active rodent burrowing. All features have abundant cryptogamic soil though less vegetation has grown since last monitored in FY97. RCMP personnel will continue site monitoring every four years.

**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 groundstone; an ephemeral basalt wall on top of a limestone cliff; a shelter with two meter 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 by 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 Sandstone rock ledges, and a flattened basalt outcrop.

Previous Work

The site was originally recorded by R. Euler in 1975 and was recorded and mapped in more detail by NPS survey personnel in January 1991 (Fairley, et al. 1994). The site was monitored in FY92, FY93, FY94, FY96, FY98, FY00, and FY02 (Coder, et al. 1994a, Coder, et al. 1995a, Coder, et al. 1994b, Leap, et al. 1996, Leap, et al. 1998, [Leap, 2000b #457]). This site was also included in the studies conducted by K. Thompson and A. Potochnik [Thompson, 2000 #278].

Monitoring Recommendations

Gullies present on-site show signs of increased vegetation growth. Collection piles were dispersed. Trailing is present through Features 2, 3, 7 and 8. RCMP personnel will continue biennial site monitoring and complete an assessment for CRT trail obliteration.

**B:14:105 Small Structure
Biennial Schedule**

This Pueblo II 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 seven sherds. Three roasting features are present below the shelter as well as a single course wall, two meters long. A new circular hearth/cist feature (Feature 6) was identified in FY00.

Previous Work

Archaeologists recorded the site in 1990 (Fairley, et al. 1994) and the RCMP staff monitored it in FY92, FY93, FY94, FY96, FY98, FY00, and FY02 (Coder, et al. 1994b, Coder, 1994 #11, Coder, 1995 #10, Leap, 1996 #25, Leap, 1998 #195, [Leap, 2000b #457]). During the 1996 research flow, scientists used the camp below this site and severely trampled the site area (including camping on-site and rearranging artifacts). RCMP staff recommended trail obliteration work in FY96 and completed it in FY98. Planting vegetation was recommended in FY98 because the trails had become small river-based gullies. FY98 monitors also recommended checking the trail work during regularly scheduled 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 K. Thompson and A. Potochnik

(Thompson 2000 #278). FY2000 monitors recommended trail work due to the entrenchment of the trail into a gully from the beach up to the site. CRT personnel completed revegetation work in November, 2001 to block access to the site from the beach below.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Obliterate Trail	10/18/1997
Plant Vegetation	11/11/2001

Monitoring Recommendations

There is surface erosion at Feature 6, and the gully continues to be active with more sediment eroding from the drainage. An old trail adjacent to Feature 4 is now entrenched with headward migration present. Increased deflation is present at the Feature 2 roaster. Features 1, 3, and 5 are unchanged. NPS personnel will continue regular trail monitoring and maintenance. RCMP staff will continue biennial site monitoring.

**B:15:138 Thermal Feature
Annual Schedule**

RCMP archaeologist identified and recorded this site in April 1997 (Leap 1997a). 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 and near the site due to its proximity to Blacktail Canyon, a popular side canyon hiked by river runners.

Previous Work

RCMP staff recorded the site in 1997 and have monitored the site annually since it was recorded (Leap, et al. 1997a, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 1997a). 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 river runners coming back 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 seven meters of the area was treated and all work was photographed. FY99 monitors recommended planting vegetation. The GRCA Revegetation crew suggested that four to five people could collect and plant seed and bunch grasses if a revegetation project is to be implemented. Also, dead brush placed on top of the newly planted grass will propagate vegetation growth. In November 2001 a crew of CRT personnel conducted trail obliteration and revegetation.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Trail Work	04/20/1997
Total Station Map	09/17/1997
Trail Work	03/01/1999
Plant Vegetation	11/11/2001
Trail Work	11/11/2001

Monitoring Recommendations

The slab-lining at Feature 2 is again recommended for data recovery. This recommendation stands for the last three years. Data recovery is the only alternative to a total loss of information. It is possible that data recovery could be conducted on a CRT-sponsored river trip. The gully at Feature 2 has been active.

Increased surface erosion is present at both Feature 1 and 2. NPS personnel will conduct trail monitoring and maintenance. RCMP personnel will continue annual site monitoring.

**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 an ephemeral 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 meters downstream of Locus A under a west-facing Kaibab Limestone overhang. An arroyo flows beneath the overhang dripline, exposing layers of river-deposited silt/sand inter-bedded 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 (O'Connor, et al. 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 date from 4567-4125 B.P. FY97 monitors recorded a partially mineralized, worked stick in Locus A. FY97 monitors discovered new lithics and a Moenkopi Corrugated sherd eroding from Locus B. FY00 monitors recorded a point base, charcoal and other lithic debitage on the arroyo floor not previously identified.

Previous Work

Archaeologists originally recorded the site in 1991 (Fairley, et al. 1994) and the RCMP staff have monitored annually since FY95 (Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). Monitoring staff recommended checkdam installation in FY96. In FY97 the RCMP and ZCT 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, FY99, FY00, and FY01 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. Carbon samples were returned and Feature 2 dates 3220 +/- 80 BP and Feature 9 dates 3560 +/- 70 BP. This site was included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). The cultural PEP panel had data recovery discussions while at this site.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	10/28/1996
Carbon Samples	02/22/1999

Monitoring Recommendations

Features 1, 2, 3, 5, 6, and 9 all exhibit erosion due to bank slump and deepening of the arroyo cut. The arroyo continues to be active. All features have been directly impacted by arroyo cutting. Although data recovery is recommended annually, it has yet to be implemented to due monetary constraints. Until then, monitoring staff recommend profiling the arroyo walls and sampling as a priority to full scale data recovery. RCMP personnel will continue annual site monitoring.

**C:05:007 Rock Art
Inactive Schedule**

C:05:007 represents a 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 1990 (Fairley, et al. 1994) and monitored by RCMP staff in FY95 (Coder, et al. 1995b). Medium format photography of the image was completed in FY97 (Leap 1997b).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	02/21/1997

Monitoring Recommendations

The site was monitored in FY02 after reports of vandalism to the tree containing the incscription. An ARPA investigation has begun in coordination with GRCA law enforcement personnel. RCMP personnel recommend removal or covering of the graffiti using light sandpaper and light charcoal on a CRT trip. This site will continue to be monitored by river patrol and officially monitored on an as-needed basis.

C:09:050 Special Activity Locus**Annual Schedule**

The site originally consisted of a single complete Tusayan Black-on-Red mug/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 J. Balsom subsequently collected the vessel, and several others from the same locale, on a later episode. 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 and semi-annually from FY93 through FY00, then annually in FY01 and FY02 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). Medium format photographs of the pot cache were taken in FY95 and FY98 (Leap 1995a, Leap and Kunde 1998a). Hereford et al. included this site in their geomorphic map of the Nankoweap area (Hereford, et al. 1996b). 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 1997a). After stabilization, a total station map was completed of the entire site.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	03/28/1995
Checkdams	04/14/1997
Total Station Map	04/22/1997
MF Photos	04/18/1998

Monitoring Recommendations

The western portion of the slope where the vessels eroded from is very unstable. Sheet wash is active and there is no vegetation present to curtail this activity. The fire-cracked rock is unchanged. Andres Cheama from the ZCT noted that the NPS should plant grass seeds and possibly cacti on the slope for further stabilization. NPS revegetation crews could plant cactus on the slope on a future NPS river trip. CRT personnel in November, 2001 discussed moving the camp location and planting vegetation to deter visitation from the camp to the site. RCMP personnel recommend continued annual checkdam monitoring/maintenance, and annual site monitoring.

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. Due to active erosion in the dune area, several additional features have been exposed and 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. Groundstone is present though no formal tools have been observed.

Previous Work

The site was recorded in the early 1960s, 1965, and 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 annual from FY95 to FY02 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). In FY95 a stationary camera was placed across from the site (Coder, et al. 1995b), but was removed after FY96 because the photographs only showed stochastic changes, not the moderate changes observed during monitoring episodes (Leap, et al. 1996b). In FY95 the Zuni Conservation Program 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. 1996b), and medium format photographs were taken prior to the Beach Habitat Building Flow (BHBF) in 1996. Twelve checkdams were built in the two active gully systems and jute mat was laid in the deflated dune areas (Leap, et al. 1996b). Additional vegetation work was completed at this site in FY97. In FY97 and FY99 Zuni Conservation Program personnel conducted minor maintenance on some of the original checks. Increased sediment deposition demonstrated at this site is a result of checkdam construction. It was determined that grass plugs and additional seed should be collected from the slope directly across 60 Mile drainage from this site. Grass plugs could then be transplanted on-site to further anchor and secure the dune area. This area was researched by Thompson and others in 1998 and 1999 (Thompson and Potochnik 2000). Annual checkdam monitoring resulted in maintenance at two checkdams and construction of one new checkdam in FY2000 (Leap and Kunde 2000b). CRT personnel planted cacti and grasses in November, 2001. This site is part of Joel Pederson's remote sensing project through the GCMRC with results due to be completed in 2003.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Checkdams	02/16/1996
MF Photos	02/16/1996
Total Station Map	08/27/1996
Plant Vegetation	02/22/1997
Plant Vegetation	04/15/1997
Checkdam Maintenance	11/11/1998
Identified Seeds to Replant	02/01/2000
Plant Vegetation	11/06/2001

Monitoring Recommendations

Transplanting vegetation is only a stop-gap measure. Data recovery is recommended for the heavy artifact concentration. Surface artifacts are eroding, though there appears to be a lot of intact buried material. The J. Pederson project may aid in determining rates of erosion at this site. RCMP personnel will continue annual checkdam monitoring/maintenance and annual site monitoring.

C:13:009 Pueblo Biennial Schedule

C:13:009 is an extensive prehistoric habitation area containing structures and water control features, with numerous and diverse artifacts. The site occupies both sides of a major side canyon and 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. Features include eight room and roomblock features, six alignment features of terracing and checkdams, three hearths or roasting features, four cist features, a cluster of four possible shrines, a cluster of four to six cists or mealing bins/processing stations, two rows of upright slabs with numerous artifacts, two middens, and a 4 room roomblock measuring 16 by 4 meters.

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), while C:13:009 corresponds with the GRCA Locus B (downstream of side canyon). Sherd collections were 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, FY99, FY01 and FY02 (Coder, et al. 1994b, Coder, et al. 1995a, Leap, et al. 1997a, Leap, et al. 2000a, [Dierker, 2001 #459]). Additional monitoring research was conducted at this site during the research flow of 1996 (Balsom and Larralde 1996) including medium format photography. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). FY01 monitoring staff identified a new slab-lined cist eroding out of the cutbank one meter north of Feature 10. The site was mapped with a total station on a CRT trip in February, 2002. FY02 mapping staff identified two additional roomblock features, one at each locus.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	02/18/1996
MF Photos	04/28/1996
Total Station Map	02/21/2002
Site Documentation	02/21/2002

Monitoring Recommendations

Although the site was mapped with a total station, data recovery is still recommended for Features 3, 10, 11, 14, and 20 before data is lost. These features are located on a steep cutbank adjacent to the small Colorado River side channel. Visitation is apparent and collection piles were dispersed. RCMP personnel will continue biennial site monitoring.

C:13:010 Pueblo Annual Schedule

This is a large, multi-component 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 one to four room masonry structures, a pueblo, cists/hearth, and rubble/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/room remains. Testing results suggest the site may have had two to three occupations, including use by Pueblo I and Pueblo II Puebloan; ceramics also suggest a late prehistoric-early historic Hopi connection. For details consult the 1984 excavation report (Jones 1986) and Miller et al. 2001 draft. The site contains numerous river-based drainages.

Previous Work

Archaeologists conducted data recovery at this site in 1984 (Jones 1986) 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 monitored the site annually since FY95 (Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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, see Miller et. al. Draft, 2001. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). Since 1999, RCMP staff have annually recommended completion of a phased data recovery project.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
*Close Site	01/01/1985
Data Recovery	04/28/1998
MF Photos	04/28/1998
Data Recovery	02/01/1999

* Closure by Park.

Monitoring Recommendations

Although the site is officially closed, monitoring data show visitation continues at this highly fragile site. Features at this site continue to be subjected to active eolian deposition and erosion, active gullying and arroyo cutting, active surface erosion and channel initiation. The phased data recovery approach continues to be recommended. RCMP personnel will continue annual site monitoring.

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 a 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 this site in 1990 (Fairley, et al. 1994), and monitoring occurred in FY93, and annually since FY95 (Coder, et al. 1994b, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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, et al. 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 in FY97. See Hereford (Hereford, et al. 1993)[Hereford, 1996 # 19] for photogrammetric topography mapping of the immediate area. Maintenance work on the checkdams was completed in FY99 (Hubbard 1999b). Monitoring staff observed that human impacts were high, and included distinct trails, trail-caused erosion, and minimal on-site camping. This site is at particular risk due to the adjacent river camp that is highly used, especially during the May to October season. Backpackers throughout the year also use the area and a major trail cuts directly through the site. CRT personnel conducted extensive trail obliteration work here in November 2001.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	02/19/1996
Checkdams	02/24/1997
Total Station Map	04/24/1997
Checkdam Maintenance	FY99
Trail Work	11/08/2001

Monitoring Recommendations

The drainage adjacent to Features 1 and 2 has been very active. Checkdam maintenance was required and a large extension arm was constructed at Checkdam 4 to redirect runoff away from Features 1 and 2. Data recovery is recommended again as a salvage recovery for Features 1 and 2. Features 3, 4, and 5 are unchanged. Feature 6 has minor visitor-related impacts. RCMP personnel will continue annual checkdam monitoring/maintenance, as well as annual site monitoring.

C:13:070 Small Structures Annual Schedule

This site has four loci (A-D) and is situated on a highly dissected 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 (prehistoric) 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 Grand Canyon.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	03/31/1995
Total Station Map	07/31/1997
Carbon Samples	02/01/1999
Trail Work	11/08/2001

Previous Work

The site was originally recorded in 1973 and re-recorded in 1991 by NPS personnel (Fairley, et al. 1994). The site was monitored in previous years by GRCA, and more recently monitored under the RCMP: semi-annually from FY94 – FY96 and annually from FY97 to the present (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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-meter square. 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 and Kunde 1997b). Upon further assessment in FY97 and FY99 with the ZCT personnel, it was determined that installing checks "would be a time consuming, expensive and a 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) in Locus D. Carbon samples from Locus D have dates of 870 +/- 60 BP and 790 +/- 60 BP. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). The PEP participants stopped at this location in March, 2000. Trail obliteration work was completed on a CRT trip in November 2001 (see Figure 9).



Figure 9. Trail Obliteration Work Completed at C:13:070 on a CRT trip.

Monitoring Recommendations

Active gullying and arroyo cutting are present. The channel at Locus D continues to downcut. Surface erosion is minor at Loci B and C. Artifacts at Locus A have been rearranged to create an alignment. Data recovery at Locus D has been a recommendation since FY99. RCMP personnel will continue annual site monitoring due to the likelihood of identifying newly exposed cultural materials.

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 tailings 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/board bed frame in the northeast corner. A canvas tent probably formed the upper walls and roof. About four meters 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 in 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). RCMP staff monitored the site semiannually from FY93 to FY98 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d). In FY98 the schedule was changed to annual, and this schedule continues (Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). See Hereford (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 have maintained the trails in the area. From FY93 to the present monitors have observed visitor impacts (trailing and collection piles). Trail work was completed at this site in FY97. It has been suggested that C:13:098 be considered for an

education and interpretation stop along the river corridor. Visitation to this site has resulted in impacts to the adjacent sites and increased gullying in places where incipient trailing exists. The creation of a loop trail around this site is one possible remedy to visitation issues.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	03/30/1995
MF Photos	09/15/1995
MF Photos	02/17/1996
MF Photos	04/27/1996
MF Photos	02/28/1998
Trail Work	02/25/1999
Trail Maintenance	02/25/1999

Monitoring Recommendations

The wood of the cabin is beginning to slump in on itself as building materials deteriorate. Surface erosion continues to expose more artifacts in the artifact concentration area. The prehistoric cist is unchanged since 2001. CRT personnel completed trail obliteration work in the area of the Palisades camp. This work should be monitored and maintained. RCMP personnel will continue annual site monitoring.

C:13:099 Structure-Thermal Feature Complex Semiannual 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 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, RCMP staff discovered numerous lithics and sherds eroding from the active arroyo and scattered throughout the drainage system. An assemblage of forty sherds suggests an Early-mid Pueblo II Puebloan 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 on-site in the early 1990s. Dates range from 140 years B.P. to 1410 years B.P. Additional samples taken during data recovery in FY99 show dates as early as A.D. 80. This report is being compiled by NAU.

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 monitored C:13:099 semiannually since FY93 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 and representatives from state and federal agencies, and tribal entities constructed 44 checkdams at C:13:099 (Leap and Coder 1995). 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 35mm 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. 1997a, Leap, et al. 1998d). Monitors recommended medium format photography and projects were completed in FY95, FY96 and FY98 and FY01 [Leap, 1995 #237; Leap, 1996b #25, (Leap, et al. 1998d). 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 K. Thompson and A. Potochnik (Thompson and Potochnik 2000). During FY2000 CRT river trips it was determined that planting arrowweed and grasses along the side of the trail that borders this site may aid in curtailing increased visitation. No checkdam maintenance was required in FY2000 though minor maintenance was completed in FY2001. J. Pederson has incorporated the river-based drainages at this site into his GCMRC-sponsored remote sensing project due to be completed in 2003. CRT personnel completed trail obliteration work in the area of the Palisades camp in November 2001. Checkdam maintenance was required in FY2001.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	03/30/1995
MF Photos	09/15/1995
Checkdams	09/15/1995
Trail Work	09/15/1995
MF Photos	02/17/1996
MF Photos	04/27/1996
Trail Work	04/15/1997
Checkdam Maintenance	02/22/1997
Total Station Map	07/27/1997
Checkdam Maintenance	02/26/1998
MF Photos	02/28/1998
Total Station Remap	09/01/1998
Data Recovery	04/17/1999
Checkdam Maintenance	10/16/2000
Plant Vegetation	11/07/2001
Trail Work	11/07/2001

Monitoring Recommendations

The river-based drainages have been active with alluvially transported sediments in the drainage. Bank slump is also present. Large slabs and artifacts have slumped into the drainage from Feature 3. RCMP monitors will continue supervision of data recovery recommended for Features 1 and 3. RCMP personnel recommend continued monitoring of previous trail obliteration and revegetation work. Annual checkdam monitoring/maintenance and semiannual site monitoring will also continue.

**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 two meters across and 50 cm deep. Lithics and ceramics are scattered down the slope directly above the drainage. There is a heavy groundstone concentration near Features 5 and 6.

Groundstone/tools include six manos, four metates/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 Sandstone 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/hearth eroding adjacent to 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, and annually since FY97 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 trail work. The area received further trail obliteration work in FY97 and surveyors completed a total station map in July 1997. Prior to completion of the total station map, RCMP staff used a photogrammetric topography map to plot additional features (Hereford, et al. 1996b). Monitors recommended medium format photography and projects were completed in FY95, FY96, FY98, and FY01 (Hereford, et al. 1993). 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 Conservation Program staff completed checkdam maintenance in February 1998. FY99 monitors again recommended data recovery at Features 5, 6, 9, and 11. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). Checkdam maintenance in FY2000 resulted in the alteration of four checkdams.

It was suggested by the GRCA Revegetation crew that intensive planting in this area between the trail and the site occur, filling in the dune with arrowweed and grasses to curtail future visitation. Checkdam maintenance was required in FY2001 though no maintenance was performed because this location is part of the GCMRC research. CRT personnel transplanted bunch grasses and cacti in the dune area near the camp and completed minor trail obliteration in November 2001. J. Pederson has incorporated the river-based drainages at this site into his GCMRC-sponsored remote sensing project due to be completed in 2003.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Checkdams	09/15/1995
Trail Work	09/15/1995
MF Photos	09/15/1995
Trail Work	10/15/1995
MF Photos	02/17/1996
MF Photos	04/27/1996
Trail Work	04/15/1997
Total Station Map	07/27/1997
Checkdam Maintenance	02/26/1998
MF Photos	02/28/1998
Checkdam Maintenance	10/16/2000

Monitoring Recommendations

Minor surface erosion is present at Features 2, 3, 7, 10, and 11. Features 6 and 9 have alluvial deposition. Feature 8 has active alluvial erosion. Although Feature 4 looks unchanged since last monitored, there is a large nickpoint present in the drainage just below the feature. This nickpoint may migrate upstream to the feature and cause impact. The river-based drainages have been active, transporting a lot of sediment downstream. Data recovery at Features 5, 6, 7, 8, and 9 continues to be a recommendation, as well as checkdam monitoring and maintenance. RCMP personnel will continue annual monitoring and trail maintenance.

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. AC-1 includes over 50 items of lithic debitage and about 15-25 ceramic items. AC-2 consists of seven flakes, ten sherds, and one piece of groundstone. 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 and Puebloan occupation. Radiocarbon dates taken from Feature 5 indicate an earlier occupation of AD 575 to AD 775.

Previous Work

Archaeologists recorded the site in 1990 (Fairley, et al. 1994) and the RCMP staff monitored it in FY93, FY95, FY96, FY97, FY98, FY99, FY00, and FY01 (Coder, et al. 1994b, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001

#459]). FY95 monitors recommended stabilization and retrailing. In FY95 RCMP staff conducted archaeological clearance work prior to a GRCA trail crew retrailing project (Leap 1995c). 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. In FY97 surveyors mapped the site with a total station instrument, RCMP staff conducted a data recovery assessment and archaeologists excavated Feature 5 (Yeatts 1998). FY99 monitors obliterated an access trail from the side canyon that directly impacted Feature 4. Because the Beamer Trail bisects the site, access and visitation are continued impacts. The GRCA trail crew maintains the trail in this area.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Test for Compliance	11/08/1994
Trail Work	02/26/1995
Total Station Map	08/30/1996
Data Recovery	02/23/1997
Trail Work	02/25/1999

Monitoring Recommendations

Vegetation growth has increased at Feature 1. Minor surface erosion is present at Feature 2. Although Feature 3 is unchanged, it is positioned on the edge of the cutbank. Data recovery is recommended because Feature 3 may slump in. Some slump adjacent to the fire-cracked rock has occurred recently. NPS trail maintenance will continue. Because Feature 1 is located next to a heavily used trail, annual site monitoring will continue.

C:13:291 Small Structure Annual Schedule

The site consists of standing walls of several structures and Dox Sandstone cists. Feature 1 is a two-meter long wall with a juniper post just downslope. Feature 2 was a slab-lined cist with a room exposed in a cutbank. FY95 monitors noted that Feature 2 was completely obliterated by the river-based arroyo. 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 nineteen 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 one meter in some areas. Apparently the site was constructed on a terrace, and has since been covered periodically by slope wash and fluvial sand. During the initial recording in 1988 a metate and mano were measured, documented and relocated. FY96 monitors discovered a Tusayan Whiteware/Sosi Black-on-White sherd below Feature 3. Artifacts indicate a Mid-late Pueblo II occupation. Feature 6, a cist, was located by M. Yeatts during a total station mapping project in FY97.

Previous Work

Archaeologists originally recorded the site in 1988 and again in 1990 (Fairley, et al. 1994) The RCMP staff monitored the site annually since FY92 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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. An additional effort included medium format photography during the research flow (Balsom and Larralde 1996). FY98 monitors recommended testing, data recovery, radiocarbon samples, and dendrochronology 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 K. Thompson and A. Potochnik (Thompson and Potochnik 2000). Continued on-site trailing has been attributed to river-runners walking from a nearby

camp to the Unkar Delta. In FY2000 the GRCA Revegetation crew planted seedlings in the area above Feature 5. CRT personnel rerouted the trail below the site, near the river in December, 2000. Orthographic photos from the NPS may enable better measurements to understand bank retreat rates.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	02/20/1996
MF Photos	04/30/1996
Trail Work	04/17/1997
Total Station Map	07/30/1997
Trail Work	02/27/1999
Data Recovery	02/27/1999
Identified Seeds to Replant	02/01/2000
Trail Work	12/09/2000

Monitoring Recommendations

Channel initiation of approximately ten centimeters occurs at Feature 5. This channel has passed through the trail obliteration work completed in December 2000, depositing new fill in the structure. Channel initiation of approximately five centimeters is present at Feature 3. Features 1 and 4 are located within an active arroyo and the features continue to be impacted, see Figure 10. A mano and metate have slumped downslope from Features 1 and 4. RCMP personnel recommend annual trail maintenance for the trail below the site especially after the proposed experimental flows. The recommendation for data recovery at Features 1, 3, and 4 continues, as does annual monitoring.



Figure 10. Continued Impact to Feature 1 through Active Gullying.

**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 a historic cabin (C:13:092) located south of this site. Ceramics, fire-cracked rock and a shaped Dox Sandstone "lid" were found on-site. Over thirty flakes are present in the roasting features, as well as groundstone including four mano fragments and two cobbles. Ceramic evidence includes several

Puebloan sherds ranging from A.D. 1050-1200, though specific cultural affiliation remains undetermined. This site may be associated with C:13:009.

Previous Work

Archaeologists originally recorded the site in 1989 and GRCA personnel monitored it until transferred to the RCMP. The RCMP staff have monitored the site annually since FY93 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 took medium format photography before and after the flood (Leap 1995b). These photos were replicated in FY00. See Hereford (Hereford, et al. 1993) for photogrammetric mapping used prior to the completion of a total station map of the site in FY97. FY97 and FY98 monitors recommended continued close monitoring of Feature 5 due to ongoing erosion. Data recovery has also been recommended at this vulnerable feature. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Test	02/18/1996
MF Photos	02/18/1996
MF Photos	04/28/1996
Total Station Map	09/01/1996

Monitoring Recommendations

Feature 5 continues to have eolian erosion. Deflation at Feature 1 has resulted in newly exposed sediments in the center of the feature. Minor eolian erosion and surface erosion have resulted in increased fire-cracked rock exposure at Feature 3. As Feature 5 continues to be extremely vulnerable to eolian and alluvial erosion, the feature continues to be recommended for data recovery. RCMP personnel will continue annual site monitoring.

C:13:343 Small Structure Biennial Schedule

This is a Pueblo II Kayenta/Virgin limited activity area consisting of a small, circular, Dox Sandstone slab-lined feature. At the top of a dune are two rock alignments; one measures four meters long and the other consists of two Dox Sandstone slabs. Artifacts consist of sherds, lithics, fire-cracked rock; and one chert scraper. Features 1 and 2 identified during the survey are no longer part of this site due to subsurface testing and a lack of cultural material. 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, FY99, FY00, and FY01 (Coder, et al. 1994b, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). Surveyors completed a total station map in FY97 (Leap, et al. 1997a). FY95, FY97 and FY99 monitors recommended testing at this site. RCMP staff tested Features 1 and 2 in FY99 and confirmed that the "probable cists" were naturally formed during a debris flow. RCMP staff performed a 100% surface collection of a 5 x 18 meter area on-site. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	01/01/1997
Surface Collection	02/20/1999
Test for Feature Significance	02/25/1999

Monitoring Recommendations

Active arroyo cutting and bank slump have resulted in the movement of artifacts. However, because surface collection occurred in FY99, no additional information is being lost. Monitors will pay particular attention to this area for newly exposed cultural materials. Feature 3 has minor surface erosion, but impacts to the feature are not threatening the integrity of the site. Monitoring has been reduced from annual to biennial.

**C:13:347 Small structure
Annual Schedule**

This site consists of a masonry wall and metate eroding out of a steep arroyo. Artifacts observed on-site include a serpentine pipe fragment and a large Black Mesa Black-on-White sherd. 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, and annually since FY98 (Coder, et al. 1994b, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). FY94 monitors discovered a serpentine pipe bowl fragment eroding from the arroyo next to the wall. Monitors collected the pipe bowl fragment and curated it at the South Rim in FY94. FY95 monitors discovered a Black Mesa Black-on-White sherd eroding from the same location. 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. ZCP staff and RCMP staff assessed the site for preservation action in FY97 and determined that data recovery was appropriate. Surveyors completed a total station map for this site in FY97 (Leap, et al. 1997a). FY98 monitors recommended data recovery before more artifacts and information was lost. 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. A report on the findings is still in progress. The large Black Mesa Black-on-White sherd was collected during exploratory testing in FY99 due to its vulnerable position in the arroyo. FY98, FY99, and FY00 monitors recommended more extensive data recovery.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	02/19/1996
Total Station Map	04/25/1997
Total Station Remap	09/01/1998
Test for Feature Significance	02/26/1999

Monitoring Recommendations

The slabs of the wall appear unchanged. The arroyo has been active and additional slabs are now exposed at the base of the arroyo, suggesting either portions of the upper courses fell prior to site recording, or that the wall extends out to the arroyo floor. The recommendation for data recovery still stands. RCMP personnel will continue annual site monitoring.

**C:13:349 Historic Structure/Prehistoric Component
Annual Schedule**

This multi-component site consists of a historic cabin/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 fire-cracked rock midden/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 monitored annually since FY93 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). A profile was examined at this site to better understand flood and debris flows along the terrace (Hereford, et al. 1993) and incorporated into the Lower Tanner section of that report. The site was photographed with a medium format camera in FY96, FY97, and FY98 (Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d). 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 Program in FY97. Stabilization was determined to be inappropriate at this location due to the maturity of the arroyo. Feature 2 was completely excavated in FY99 (Kunde 1998b). The report detailing the results will be disseminated upon completion of artifact analysis by NAU. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Carbon Samples	03/25/1992
MF Photos	02/18/1996
MF Photos	02/24/1997
Total Station Map	06/08/1997
MF Photos	03/01/1998
Total Station Remap	09/01/1998
Data Recovery	02/01/1999

Monitoring Recommendations

Minor surface erosion and eolian erosion are active at Features 1 and 3. The main arroyo continues to slump and collapse through erosion of the arroyo walls. The drainage north of the main arroyo has been minorly active, evidenced by beaten down grasses, although pepper plant that has gone to seed is upright in the drainage. RCMP personnel will continue annual site monitoring.

C:13:360 Small Structure Inactive 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 monitored in FY97 and FY02 (Leap, et al. 1997).

Monitoring Recommendations

The structure is well protected by the Tapeats Sandstone cliff. A dripline is present but falls on the salt-encrusted sediment without causing any rills or incising. The erosion does not impact the features, therefore the schedule has been changed from five years to inactive.

C:13:371 Structure-Thermal Feature Complex Semiannual Schedule

This is a mid-late Pueblo II Puebloan habitation area situated on a debris fan and on both sides of an unnamed side canyon. It consists of several rockshelters, some with dry-laid masonry walls, possible room rubble, several fire-cracked rock concentrations, and a lithic/ceramic scatter. Feature 1 consists of two small rock overhangs each with two to three 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 fire-cracked rock concentrations, one three meters in diameter and the other three by five meters with artifacts. Feature 7 is a fire-cracked rock 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. An overhang shelter with roasting feature was also identified on the talus slope above the site. Redwall and Kaibab Chert flakes are in the overhang and charcoal is present inter-mixed in the roaster with fire-cracked rock.

Previous Work

Archaeologists recorded the site in 1990 (Fairley, et al. 1994) and the RCMP staff monitored it semi-annually since FY92 (Coder, et al. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). Monitors recommended a combination of data recovery, testing, planting vegetation, and installing checkdams since FY94 (Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a). FY94 monitors recommended total station mapping and collecting charcoal. In FY95 monitors recommended checkdams and planting vegetation. In FY96 Zuni Conservation Program staff, GRCA trail crew, and RCMP personnel constructed three checkdams adjacent to Features 3 and 5 (Leap 1996a). 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 Feature 2 dates ranging between AD 1665 and 1950 and a Feature 4 age range between AD 1445 and 1655 (Leap, et al. 1998d). 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 Beach Habitat Building Flow (BHBF) research flow (Leap, et al. 1996b). FY98 monitors recommended testing Feature 6 and 7, collecting a charcoal sample at Feature 3 and full data recovery of Feature 2. FY98 monitors replicated medium format photos taken during the 1996 research flow (Leap, et al. 1998d). Zuni Conservation Program staff completed checkdam maintenance at Checkdam 2 in FY99. FY99 monitors noted that Checkdams 1 and 3 were in stable condition. FY00 monitors replicated medium format photographs taken prior to and following the 1996 research flow. Shoreline photographs continue to be duplicated annually. No checkdam maintenance was required in FY00 or FY01. Minor checkdam maintenance was completed in FY02.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	01/01/1996
Test for Feature Significance	02/17/1996
Carbon Samples	02/17/1996
MF Photos	02/17/1996
MF Photos	04/27/1996
Total Station Remap	01/01/1998
MF Photos	04/18/1998
Checkdams	11/01/1998

Monitoring Recommendations

Features 1, 3, 5, 6, and 7 appear stable. Feature 2 shows signs of downcutting on the northeast side. The gully northeast of Feature 2 has deepened to 15 centimeters. Channel incising continues at this drainage.

Data recovery is again recommended for Features 2 and 3. Monitoring and maintenance of the 3 checkdams will continue annually by the Zuni Conservation Program personnel. RCMP personnel will continue semiannual site monitoring.

C:13:386 Small Structure Semiannual Schedule

The site consists of a slab-lined cist, a structure consisting of two upright sandstone slabs with a two-handed mano and trough metate. A pecked stone is also present. Two Deadmans Black-on-Red partial bowls, a Sosi Black-on-White ladle, and seed bowl have eroded from a dune between the cist and the activity area. The site dates around A.D. 1050 -1100 based on the presence of the ceramic types. The site is on a dune slope just above the mesquite and driftwood zone. Eolian erosion continues to uncover more cultural material. Structure 2 consists of two upright Dox Sandstone slabs at the base of a Dox outcrop overlooking the dune where Structure 1 is located. There are no other slabs in the area and the positioning of the two slabs parallel to one another suggests they are a cultural manifestation, likely the remains of a structure. While recording Structure 2, an artifact concentration was observed five meters west of the structure. Artifacts include a two-handed mano, a sandstone metate, one upright Dox Sandstone slab, and a hammerstone. This concentration area also overlooks the dune where the cist and ceramic vessels are located. During the survey, archaeologists identified the slab-lined cist as the only feature at this site and cultural affiliation was unknown.

Previous Work

This site was originally recorded in 1991 (Fairley, et al. 1994) and monitored in FY93, FY94, FY96, FY98 and then semiannually beginning in FY00 after discovery of the vessels (Coder, et al. 1994b, Coder, et al. 1995a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, [Dierker, 2001 #459]). During the course of their geomorphological investigations, K. Thompson and A. Potochnik identified the first exposed vessel eroding from a dune in a region not known to be actively eroding. Thompson and Potochnik reported their find and a vague location of where the vessel was located. On the RCMP 2000-1 river trip, two archaeologists and three monitoring assistants stopped to identify the location and classification of the vessel. The newly identified bowl was photographed with black and white and color slide film and left in the position in which it was found. In addition to the bowl, a mano and 2 sandstone slabs were identified with the vessel.

Less than 30 days later, this site was monitored during the 2000-2 river trip. Archaeologists discovered the bowl had eroded down the dune and fallen into the drainage at the base of the dune. A large amount of sand had also eroded from the dune face to reveal additional slabs, what appeared to be the other portion of the Deadmans Black-on-Red bowl and a complete Sosi Black-on-White ladle. The fragile context of these vessels (sitting fully exposed on the dune) and the rapid nature in which the erosion occurred caused the archaeologists to rebury the two vessels, on-site, away from the dune edge in a more stable location. Prior to reburial, the vessels were photographed with color slide and black-and-white film with scale.

Discovery of the two ceramic vessels has allowed the RCMP to identify cultural affiliation of the site as Kayenta Puebloan and the occupation date to be approximately AD 1050 – 1100. This has contributed greatly to a better understanding of occupations of this terrace along the river corridor. Function of the site can also be inferred from the presence of food processing tools.

Monitoring in FY02 lead to the discovery of human remains eroding from the same dune face where the ceramic vessels were located. NAGPRA affiliation letters were sent to all PA tribes, initiating the NAGPRA process. In April, 2002, monitoring staff and one member each from the Pueblo of Zuni and the Paiute Tribe assessed the erosion of the burial. Logs and brush were placed over the burial in an attempt to decrease further eolian erosion by trapping sediments.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Stabilized dune	11/08/2001
Stabilized dune	04/28/2002

Monitoring Recommendations

The burial was further exposed since last monitored. Structure 1 also shows signs of redistribution of sands due to the dune activity, though integrity of this structure is not threatened. Structure 2 and the second artifact concentration are unchanged. RCMP personnel will continue to assess the success of stabilization efforts. Semiannual monitoring and consultation with tribal members will also continue.

C:13:387 Small Structure**Biennial 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 Puebloan cultural affiliation.

Previous Work

Archaeologists recorded the site in October 1991 (Fairley, et al. 1994) and the RCMP staff monitored it in FY96, FY97, and FY02 (Leap, et al. 1997, Leap, et al. 1996). FY96 monitors recommended checkdam installation, however an assessment by Zuni Conservation Program personnel in FY97 determined that none would be effective. RCMP staff took detailed measurements and photographs of two metates impacted by the active arroyo in FY97.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Documentation of Eroding Metates	09/14/1997

Monitoring Recommendations

Features 1, 2, and 6 are unchanged since last photographed in 1994. Features 3 and 4 also look good. Feature 5 has increased surface erosion and bank slump. Eolian erosion is also present. RCMP personnel recommend continued biennial site monitoring.

G:02:100 Historic Structure**Five-year Schedule**

G:02:100 is a historic site known as "Bridge Canyon City". It was established by Reclamation engineers 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 habitation of a small town. The "city" exhibits a lot of work taken place 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 in the wilderness. All this effort went for naught however because 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

This site was recorded in April 1991 and monitored in FY95, FY99, and FY02 ([Coder, 1995b #99], [Leap, 2000b #457]).

Monitoring Recommendations

Monitoring was completed on the December, 2001 CRT trip. Visitation is extensive and cultural materials are being collected. Collection piles are present and the hot water heater has been moved. There is a small pot hole at Feature 6. RCMP personnel recommend considering the interpretive potential of this site with

the Hualapai Tribe. Tribal members may not be aware of the extent of visitation at this site. RCMP personnel will continue site monitoring on a five year schedule.

**G:02:101 Historic Structure
Discontinued 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 in the rock near river level.

Previous Work

This site was recorded in April 1991 and was monitored in FY95, FY99, and FY02 ([Coder, 1995b #99], [Leap, 2000b #457]).

Monitoring Recommendations

Monitoring was completed on the December, 2001 CRT trip. The site has experienced visitor-related impacts, evidenced by the movement of artifacts and the wooden door. The site is outside any potential impact from dam operations and monitoring will be discontinued.

**G:02:103 Historic Plaque
Five-year 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 a historic site in April 1991 [Fairley, 1994 #17]. The site has been monitored in FY95 and FY02 ([Coder, 1995b #99]).

Monitoring Recommendations

Monitoring was completed on the December, 2001 CRT trip. Visitor-related impacts to the Cenotaph include bashing of the plaque. It appears that visitors have also tried to pry the plaque from the cliff face. Several photographs were taken to document impacts. RCMP personnel will continue site monitoring on a five year schedule.

**G:02:108 Historic Structure
Five-year Schedule**

G:02:108 is another engineering site associated with the Bridge Canyon Dam project. It is located on a series of narrow benches adjacent to the river in a very constricted section of the canyon. The site consists typically 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.

Previous Work

This site was initially recorded by NPS survey personnel accompanied by members of the Hualapai Tribe in March 1992. The site has been monitored in FY95, FY99, and FY02 ([Coder, 1995b #99], [Leap, 2000a #356]).

Monitoring Recommendations

Monitoring was completed on the December, 2001 CRT trip. A small gully is present on the upstream edge of Feature 1, though it does not appear to be active due to continued drought conditions. This gully is a river-based drainage. Continue monitoring every five years due to the presence of a river-based drainage.

G:03:003 Roaster Complex Annual Schedule

The rockshelter (Feature 1) was originally recorded by G. Gumerman and R. Euler on 9/4/69, and the GRCA survey crew added four roasting features (Features 2-5) in 1991 [Fairley, 1994 #17]. 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 groundstone 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, lithics, and ceramics. 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. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 (Thompson, et al. 1996). At this time the Zuni Conservation Program personnel also assessed the site for checkdam installation (Leap 1996a). Three checkdams were built in the river-based drainage downstream of the site (Leap 1996a, Leap, et al. 1996b). They were placed in this drainage at the suggestion of K. Thompson and K. Burke in FY96. Thompson and Burke felt that according to 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 ZCT staff and RCMP staff constructed ten 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 (Leap, et al. 2000a). The new checkdams need to be mapped on the 1993 Hereford map with a total station. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). Checkdam maintenance occurred in FY00 and FY01.

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 big horn sheep that 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 L. Jackson and L. Leap requesting river runners and researchers to minimize their impact to the area (Jackson and Leap 1996 Summer). Trail obliteration from the drainage to the site by CRT personnel occurred in November 2001. The lower drainage at this site is part of J. Pederson's GCMRC-sponsored remote sensing project due to be completed in 2003.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	04/04/1995
Trail Work	03/03/1996
Checkdams	03/03/1996
Total Station Map	03/03/1996
Trail Maintenance	04/26/1997
Checkdam Maintenance	04/26/1999
Checkdam Maintenance	04/28/2000
Checkdam Maintenance	10/25/2000
Plant Vegetation	11/17/2001
Trail Maintenance	11/17/2001

Monitoring Recommendations

The center feature inside the roasting feature, Feature 2 is much more pronounced. Deflation and surface erosion are active at Feature 2. Features 3, 4, and 5 are unchanged. The drainage where the checkdams are located looks very good and no maintenance was required. Trailing to Feature 1 continues to be a problem. Rodent burrows are now exposing portions of Feature 3 from the modern ground surface to approximately seven centimeters down, through fire-cracked rock. Trail work from the main drainage looks good and is deterring visitation. In the future, NPS may consider planting vegetation to further deter visitation. All work will involve tribal consultation. RCMP personnel will continue annual site monitoring and yearly checkdam monitoring/maintenance.

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 prehistoric 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/Paiute. A fire-cracked rock 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. Feature 8 was completely excavated in November, 2000. 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 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. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]).

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 (Bullets 1995 Summer). 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. 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 K. Thompson and A. Potochnik (Thompson and Potochnik 2000). The features were mapped with a total station instrument in FY00 in preparation for data recovery work with the GRCA Fee Demo program. Data recovery occurred in 11/2000 on a Colorado River Fund river trip [Hubbard, 2001 #473].

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Trail Work	01/01/1995
Trail Work	01/01/1997
MF Photos	03/04/1997
Total Station Map	10/01/2000
Data Recovery	11/18/2000
Trail Work	11/18/2000
Trail Work	05/04/2002

Monitoring Recommendations

Feature 1 has no physical impacts. The midden area continues to have surface erosion. All other features are unchanged since last monitored. Due to continued visitor-related impacts, this site may be turned over to the NPS backcountry office for monitoring and treatment, until then RCMP monitoring staff will continue monitoring the site annually.

G:03:020 Roaster Complex

Annual Schedule

The site is comprised of 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, and 6. 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 manos, charcoal, a few flakes, and several pecked processing stones. Feature 3 is an eroding roasting pit with a discernable 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 fire-cracked rock area with bone. Features 7, 8, and 9 were all thermal features. Feature 7 was recorded during the survey and Features 8 and 9 were exposed in FY98 and FY99, respectively. All three features were excavated in FY99 [Dierker, 2002 #479]. Cultural affiliation is unknown, but presumed to be Pai and or Paiute.

Previous Work

The site was originally recorded in 1978 by R. 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. 1994b, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). Zuni Conservation Program 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. 1997a). This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000). In the spring of FY99 Features 7, 8 and 9 were excavated. After excavations, trail were obliterated. Mapping rate, depth and width of these drainages through time could provide excellent data on the progression and rate of erosional processes effecting cultural resources at this location. Cross sections profiles of the small gullies south of Feature 2 have been taken to aid in determining rates of change at this site. Consultation with F. Nials (Personal communication, 2000) and J. Pederson (Personal communication, 2001) have resulted in the recommendation of a water diversion bar above the gullies to redirect runoff away from Feature 2.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	08/06/1997
Trail Work	11/21/1998
Data Recovery	02/01/1999
Trail Work	02/01/1999

Monitoring Recommendations

Features 5 and 6 are stable with no signs of surface erosion. Cryptogamic soils are abundant and have anchored fire-cracked rock at both features. There are several piping holes at Feature 1 and increased exposure of fire-cracked rock with slump of artifacts downslope. Headward migration of the gully at Feature 2 has resulted in only 2.5 meters between the headcut and the lip of the center depression at Feature 2, see Figure 11. A gully west of Feature 2 is almost to the talus slope, and joining with the east gully, threatening to surround and isolate Feature 2. Data recovery has been recommended at Features 2 since November 1998. Joel Pederson's work may be very useful at this location. RCMP personnel will continue annual site monitoring.



Figure 11. Continued Headward Migration of Gully toward the Center of Feature 2.

G:03:030 Roaster Complex Biennial Schedule

This is a roaster complex with seven roasting or hearth features and flakes. Locus A contains Feature 1, a conical-shaped roaster with fire-cracked rock, Feature 2, a hearth feature of limestone filled with fire-cracked rock, and Feature 3, a low, circular wall built up along the base of a large boulder. Locus B has 5 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 two-meter cluster of fire-cracked rock. Feature 8 consists of another cluster of fire-cracked rock, five meters west of Feature 7. 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 monitored in FY96, FY98, FY00, and FY02 (Leap, et al. 1996, Leap, et al. 1998, [Leap, 2000b #457]). Locus A was mapped with a total station in FY97. In FY96 checkdams were recommended and an assessment for stabilization completed in FY99 (Hubbard 1999b).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	09/25/1997

Monitoring Recommendations

Features 1, 2, 3, 4, 6, 7, and 8 are unchanged. Feature 5 has active rodent burrowing and eolian deposition. The arroyo adjacent to Feature 2 has not been active and no headcut advancement has occurred. Site changes are minimal due to lack of any precipitation. Biennial monitoring will continue.

G:03:034 Roaster Complex Annual 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/fire features (one of which, 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 ten Shinarump Grayware 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, FY99, FY01, and FY02 (Coder, et al. 1995a, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 2000a, [Dierker, 2001 #459]). 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 stability of the feature.

Monitoring Recommendations

Active surface erosion and gullying are present at Feature 9. Feature 8 has minimal animal disturbance. Feature 7 has experienced a loss of vegetation. Feature 2 has active downslope movement of rock. Features 1, 3, 4, 5, and 6 are unchanged. RCMP personnel will continue annual site monitoring due to the active drainage at Feature 9.

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 on-site. The late prehistoric-early historic Pai site appears to have been a temporary hunting camp, based on the absence of grinding implements and the abundance of bone.

Previous Work

Archaeologists recorded the site in 1991 (Fairley, et al. 1994) and the RCMP staff monitored it in FY96, FY98, FY99, FY00, FY01, and FY02 (Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Dierker, 2001 #459]). The RCMP staff recommended stabilization in FY96. In FY97 the site was assessed for checkdams and Zuni Conservation Program 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. 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 K. Thompson and A. Potochnik (Thompson and Potochnik 2000). Checkdam monitoring resulted in the maintenance of checkdams in FY00 and FY01. The drainage with the checkdams and an adjacent drainage were extensively mapped in March 2002 by J. Pederson as part of a GCMRC-sponsored remote sensing project due to be completed in 2003.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Total Station Map	06/16/1997
Checkdams	04/25/1997
Checkdam Maintenance	11/21/1998
Trail Work	03/07/1999
Checkdam Maintenance	04/28/2000
Checkdam Maintenance	10/25/2000

Monitoring Recommendations

The gully at Feature 3 has been active. Features 1 and 2 are unchanged. RCMP personnel will continue annual site monitoring as well as checkdam monitoring/maintenance.

**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 groundstone. No ceramics were recorded on the site. One thick biface/scrapper 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, FY98, FY00, and FY02 (Coder, et al. 1995a, Leap, et al. 1998, [Leap, 2000b #457]). See Hereford for photogrammetric mapping conducted in this area. Hereford also collected charcoal from a isolated hearth located near the site's upstream side. The radiocarbon dates from this sample indicated a date of 830 B.P. (+/- 100 years). FY98 monitors recommended data recovery at Features 4 and 5.

Monitoring Recommendations

Most impacts are caused by animal burrowing though they do not directly impact the features. Data recovery continues to be recommended for Features 4 and 5. RCMP personnel recommend continued biennial site monitoring due to the potential for new features to be exposed in the side canyon drainage.

**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 (19th 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 and then biennially in FY00 and FY02 (Coder, et al. 1994a, Coder, et al. 1995a, Coder, et al. 1995b, Coder, et al. 1994b, Leap, et al. 1997, Leap, et al. 1996, Leap, et al. 1998, [Leap, 2000b #457]). FY96 monitoring staff recommended checkdam installation in the Locus B drainages. An assessment for checkdam installation was completed in FY97, yet because the drainages appeared stable, checkdams were not necessary.

Monitoring Recommendations

No change was noted at Locus A. The arroyo cut at Locus B has been very active since 1996. There are several new nickpoints. Bank slump and eolian deposition are active. The vegetation is completely gone. Locus B is in poor condition and it is recommended that this portion of the site be mapped in greater detail and that the drainages be reassessed for checkdam installation. Biennial monitoring will continue.

**G:03:057 Thermal Feature
Five-year Schedule**

The site consists of a Tapeats Sandstone rockshelter containing a large, eroding fire-cracked rock feature, a charcoal scatter, an ash stain, and a scatter of lithics, sherds, and groundstone. 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 multi-component occupation of the site: possibly early Basketmaker III-Pueblo I Formative and late prehistoric-early historic Paiute. The fire-cracked rock 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) and monitored in FY97, FY99, FY00, and FY02 (Leap, et al. 1997, [Leap, 2000 #356], [Leap, 2000b #457]).

Monitoring Recommendations

Some minor rilling in the artifact scatter is apparent. The site monitoring schedule will be changed from biennial to every five years due to the high degree of protection under a Tapeats Sandstone ledge.

**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 groundstone. Lithics include a flake drill and a reworked Elko Corner-Notched projectile point. The ceramic assemblage suggests a multi-component site: Pueblo I-III Formative and late prehistoric-early historic Pai/Paiute. This could be one of the most informative sites in 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/fire-cracked rock scatters exposed by the river-based arroyo. FY98 monitors discovered new fire-cracked rock 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, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Leap, 2000b #457], [Dierker, 2001 #459]). In FY93 archaeologists collected radiocarbon samples resulting in a range of dates from 170 +/- 50 BP to 2670 +/- 140 BP. 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. FY96 monitors also recommended either an attempt at stabilization or full site excavation. FY98 monitors recommended obliterating trails caused from five 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. These samples are curated at the South Rim collections facility. The samples will be sent for dating in the near future. This site was also included in the studies conducted by K. Thompson and A. Potochnik (Thompson and Potochnik 2000).

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	04/04/1995
Total Station Map	01/01/1998
Carbon Samples	03/06/1999
Trail Work	03/07/1999

Monitoring Recommendations

The arroyos remain very active exposing artifacts and features. Data recovery should be considered in consultation with tribal members. Annual monitoring will continue, due to the constant exposure of cultural materials and the continued advancement of gullies and arroyos.

**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 groundstone, 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 multi-component site, with both late Pueblo I-early Pueblo II Virgin occupation 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 groundstone.

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. 1994b, Coder, et al. 1995b, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Leap, 2000b #457], [Dierker, 2001 #459]). 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. 1997a). In FY99 checkdam maintenance resulted in building two new checkdams and altering one original checkdam (Leap, et al. 2000a). Minor to moderate alluvial deposition as a result of building checkdams is evident in two of the four drainages with checkdams. Data recovery has been recommended at Features 11, 12, and 14. Checkdam monitoring resulted in maintenance work at Checkdam 16 and construction of one new checkdam in FY00 (Leap and Kunde 2000b). Checkdam maintenance was also performed in FY01. The drainages on-site were extensively mapped by J. Pederson in March 2002 as part of a GCMRC-sponsored remote sensing project due to be completed in 2003.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
Checkdams	03/05/1997
Total Station Map	03/05/1997
Total Station Remap	09/01/1998
Checkdam Maintenance	11/22/1998
Checkdam Maintenance	04/29/2000
Checkdam Maintenance	10/26/2000

Monitoring Recommendations

Feature 14 looks good though the drainage with Checkdams 5 and 6 has been active. Feature 11 is completely covered with eolian blown sands. Features 8 and 15 have heavy cryptogamic soils and annual grasses cover the features. Features 4, 6, and 12 are unchanged. Feature 3 has surface erosion. It is

recommended that a charcoal sample be taken at Feature 3. RCMP personnel will continue annual site monitoring as well as checkdam monitoring/maintenance.

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, groundstone, 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), monitored once in FY92 and FY93, and annually since FY95 (Coder, et al. 1994b, Coder, et al. 1995b, Coder, et al. 1994a, Leap, et al. 1997a, Leap, et al. 1996b, Leap, et al. 1998d, Leap and Kunde 2000b, Leap, et al. 2000a, [Leap, 2000b #457], [Dierker, 2001 #459]). 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. In 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 river runners and Hualapai river-runners who make the uprun. FY99 monitoring staff 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.

Summary of RCMP Work Implemented

Remedial Action	Date Completed
MF Photos	03/05/1997

Monitoring Recommendations

Feature 8 is unchanged though the large burrow holes are beginning to fill in through eolian deposition. Feature 5 has increased vegetation. Features 1, 2, 3, 4, 6, 7 and 9 are unchanged. RCMP personnel will continue annual site monitoring due to the potential for visitor-related impacts. The Hualapai Cultural office should be consulted regarding maintaining trails to the rock art panel or obliterating all trails.

CHAPTER FOUR

EROSION CONTROL STRUCTURES

Erosion control structures, called checkdams, have been constructed at 29 sites within the APE as a means of controlling accelerated erosion. These checkdams are monitored and maintained annually under the guidance of Zuni Conservation Program (ZCP) personnel. The following chapter outlines the history and development of checkdams in the Grand Canyon as a method for slowing down erosion at historic properties adversely effected by dam operations. FY02 monitoring results and assessments for the construction of additional checkdams are also included.

Checkdams have been utilized both prehistorically and historically in Grand Canyon. Several sites along the river corridor contain prehistoric structures that appear to have been used to control runoff to agricultural fields [Fairley, 1994 #17]. Today, the RCMP utilizes traditional tribal checkdam designs to control runoff that adversely effect National Register eligible cultural resources along the river corridor. This project developed out of a three day workshop sponsored by the BOR and NPS in May 1995.

Area of Potential Effect

The river corridor area of potential effect (APE) has been defined as (1) the old high water zone (OHWZ) [U.S. Department of the Interior, 1995 #129], from the river up to the approximate level of 300,000 cfs, the historic predam high flow; (2) up to the 256,000 cfs level ([Loveless, 1999 #382]) due to actual dam operation constraints; and (3) the Holocene terraces containing predam alluvium ([Doelle, 2000 #461]). Although the actual definition of the APE is in dispute, the fact remains that eroding cultural resources are contained within all three of these locations.

The APE encompasses areas beginning at Lees Ferry and continuing downstream to Separation Canyon at river mile 239.5. The area is currently managed as a potential wilderness area with access controlled through a permit system for private, commercial, and scientific uses. The APE is accessible via hiking, boating, or helicopter.

Precipitation in the area is characterized by two rainy seasons, one during winter months and a second during summer months. These seasonal rains are highly localized. Rain gauges at river level occur at Lees Ferry and Phantom Ranch only.

Vegetation along the river corridor consists of a transition between Mohave and Sonoran Desert species. Inner canyon climatic variability drives the frequency and intensity of plant species, with Sonoran being the most diverse [Warren, 1982 #484]. The river corridor plant community has been divided into two categories, the Old High Water Zone (OHWZ) and the riparian zone. The OHWZ consists of plant communities able to survive the periodic inundation by the predam Colorado River. These plants could withstand the flood and scour of the river and thrived in the area above the 100,000 cfs level. Examples of this type of vegetation include catclaw, mesquite, and hackberry. With the alteration of flood frequency, many other plants are beginning to move into the OHWZ, including cacti, brittle bush, creosote, cholla, and ocotillo [Carothers, 1991 #483].

The New High Water Zone (NHWZ) or riparian zone, consists of native and non-native woody plants such as willow, tamarisk, and arrowweed. In many cases, the mesquite of the OHWZ are migrating downslope to the riparian zone. The riparian zone consists of dense stands of vegetation often situated on sediment deposits associated with side canyon debris flows. Between these dense vegetative stands, plants grow on dunes and between rocks.

The sites with erosion control structures share many contextual similarities. All are located in deposits of predam alluvium. This depositional context includes sand, silt, and gravel transported by the Colorado River or its tributaries. Many of the sites also have an eolian component where winds move existing sands across the site surface. It has been suggested that eolian transport, in the absence of high-water flows, is the only means of redistributing sediments from the mouths of drainages to the higher reaches of the stream

channel [Thompson, 2000 #278]. Of the 29 total sites with erosion control structures, 18 have drainages that reach the Colorado River, 9 have drainages that disperse out on the alluvial terrace, and two have drainages that drain into adjacent side-canyons.

Summary of Erosion Along the River Corridor

Erosion in the Southwestern United States follows a cyclical pattern of deposition and erosion [Leopold, 1951 #485]. Analysis of aerial photos from 1965 and 1992 by Thompson and Potochnik show a dramatic increase in erosion, particularly between 1973 and 1984 [Thompson, 2000 #278]. During this time, new gullies developed and many of the pre-existing gullies developed into arroyos [Thompson, 2000 #278]. Hereford et al [Hereford, 1993 #20] also identified a cycle of erosion along the river corridor beginning in approximately 1973 and lasting until 1984.

Monitoring by RCMP staff within the project area revealed the ongoing and unchecked erosion of significant cultural resources within and adjacent to ephemeral tributary gullies. Although these ephemeral gullies are a critical component in the cycle of erosion and deposition in Grand Canyon, since the emplacement of the dam these gullies continue to downgrade and erode. Predam flood flows once plugged the mouths of gullies reaching the river and provided for eolian transport and deposition in gullies on the upper alluvial terraces. Current dam operations do not provide for sediment redeposition along the river bank, nor have experimental flows been high enough to effectively deposit sediment on existing and newly exposed cultural resources.

RCMP Erosion Control along the River Corridor

Through long term monitoring, RCMP staff have determined that accelerated rates of erosion within the APE were beginning to expose a higher number of cultural resources than had previously been identified [Fairley, 1994 #17], [Coder, 1994a #12], [Coder, 1994b #11], [Coder, 1995a #10], [Coder, 1995b #99]. It was determined that some form of treatment would be necessary to slow the erosion at archaeological sites. As a result, the BOR and NPS sponsored a three-day stabilization workshop in May 1995. The RCMP staff presented the impacts identified through monitoring to PA members, and options for treatment to these sites were discussed. PA members listened to treatment options from geologists, geomorphologists, archaeologists, trail crew personnel and tribal members in an effort to select remedial actions acceptable to all participants. Upon completion of the stabilization workshop, it was determined that traditional Zuni style checkdams would be constructed at sites with accelerated erosion under the guidance of members of the ZCP. The intent of these structures is to slow the erosional process, redirect runoff, and to facilitate deposition within gullies. The checkdams are intended to stabilize existing drainages, to prevent enlargement of rills and gullies, and slow the downstream erosion of sediment.

Since September 1995, the ZCP has accompanied RCMP staff into the field to direct checkdam monitoring, maintenance, and construction projects. Checkdams consist of rock linings, brush linings, rock checkdams, log and rock checkdams, rock and brush checkdams, and water diversion structures.

Information recorded during checkdam construction includes checkdam number, checkdam type, dimensions, construction materials, the amount of materials, and photographs of the drainage before and after checkdam construction as show in Figure 12 on the following page. Checkdam monitoring data includes an overall description of the drainage as it pertains to activity and any comments provided by ZCP staff.

When checkdam construction is recommended by monitoring staff, drainage assessments are first completed and construction occurs under the guidance of ZCP staff. ZCP staff also participate in checkdam monitoring, an important process in preventing structure failure and the continued re-evaluation of structure types within specific geomorphological contexts (see [Gellis, 1995 #336]).

In order to measure volumetric change in gullies, 27 total station maps exist for the 29 sites with checkdams. It was the intent of the RCMP monitoring staff to use repeat total station mapping as a method for measuring the amount of sediment being deposited or eroding in drainages to determine the

effectiveness of checkdams. All the total station maps contain detailed (.25m contour intervals) topographic information pertaining to the gullies and surrounding area. Remapping was scheduled to occur at decadal intervals. However, at the request of the Bureau of Reclamation in FY99 the total station remapping project was terminated.

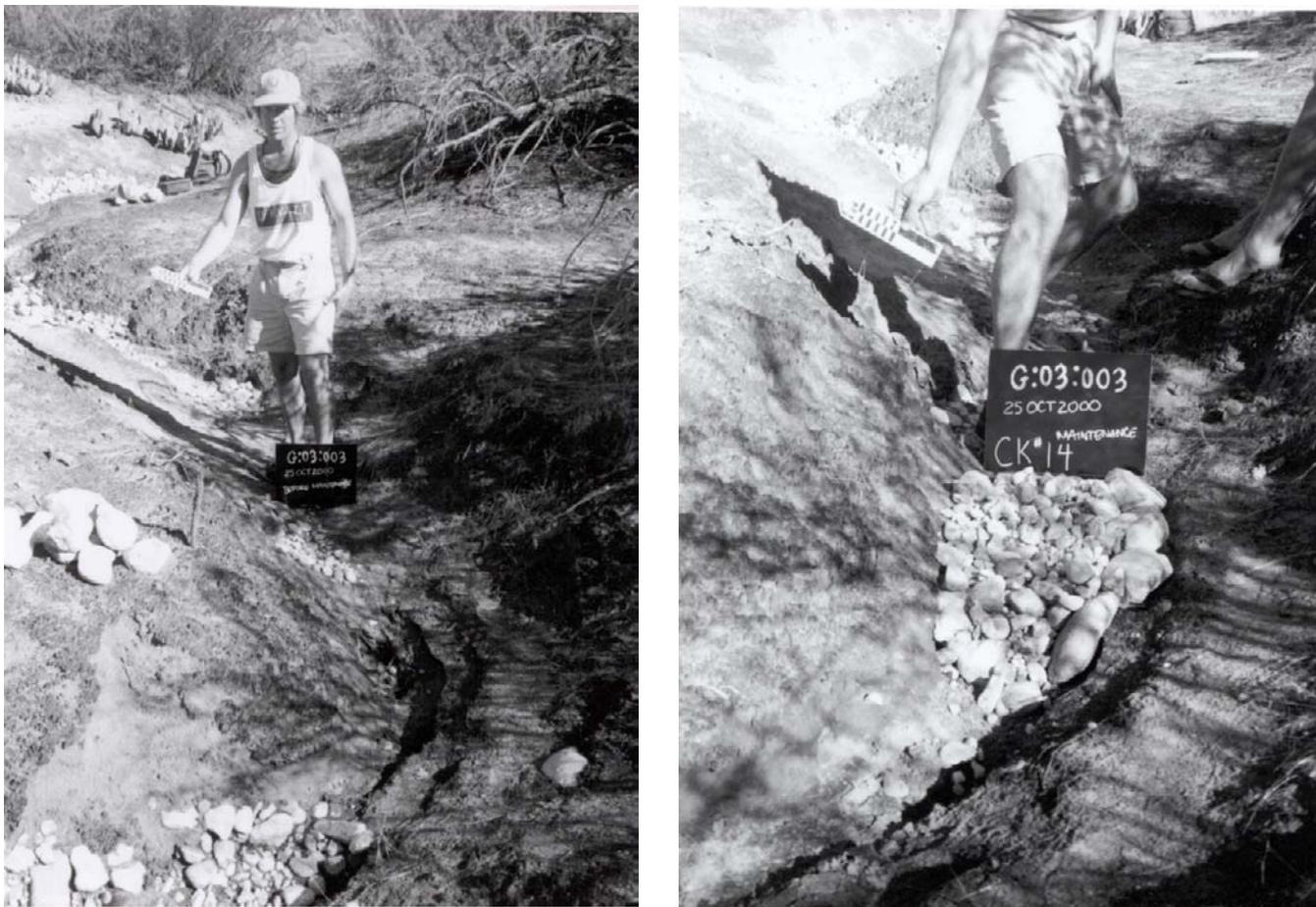


Figure 12. Main Drainage at G:03:003 Before and After Construction of a New Checkdam.

In the absence of new total station maps, erosion control success and failures have been based on the presence or absence of structure breaching. Beginning in FY01, RCMP staff, with assistance from geoarchaeologist Fred Nials, established cross-section profiles at eight locations [Dierker, 2001 #459]. All but one of these profiles are located in drainages containing checkdams. RCMP staff anticipate that measurements at these locations will provide data on erosion/deposition changes. A GCMRC-sponsored remote sensing project mapped portions of nine sites within the project area. RCMP staff hope these maps will provide the RCMP with volumetric change data.

Monitoring and Maintenance Data

Erosion control structures are monitored annually. In the course of monitoring, ZCP staff determine whether or not maintenance or additional construction is necessary. Figure 13 presents the 254 existing checkdams as they were constructed in each fiscal year and the number of checkdams where maintenance was required. It should be noted that in FY95, all checkdam construction occurred at two sites, C:13:099 and C:13:100 [Leap, 1995 #27].

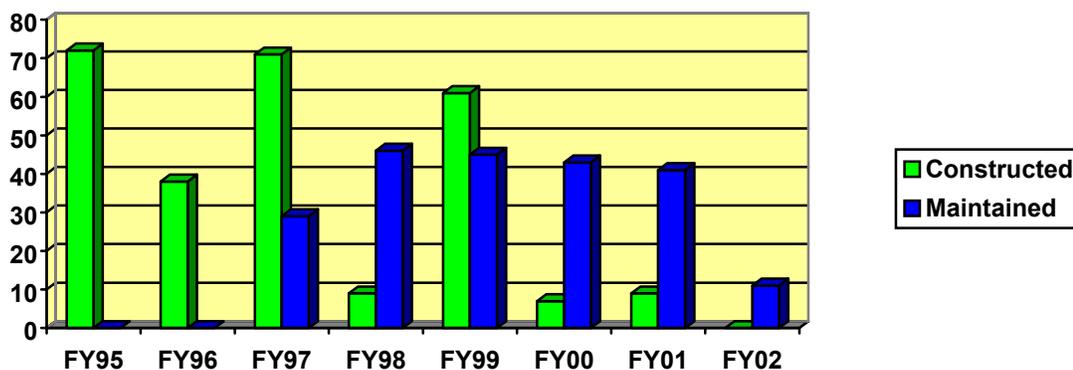


Figure 13. Number of Checkdams Constructed and Maintained by Fiscal Year.

Since initial construction, 119 of the 254 checkdams, or 47% have required no maintenance of any sort. Figure 14 shows the total number of checkdams and the number of checkdams without maintenance, by drainage type. It is anticipated that current research relating to checkdams will provide additional support for the construction and maintenance of certain checkdam types in specific contexts. Until this research is completed in April 2003, maintenance of existing checkdams and new construction at nine specific locations has been halted.

It should be expected that checkdams located in river-based drainages require the most amount of maintenance. River-based drainages are actively eroding to the lowered base-level of the Colorado River [Hereford, 1993 #20]. The presence of nickpoints, or changes in elevation within the drainage channel, indicates active channel deepening and widening. Twenty-one nickpoint treatments have been required at eight sites. No nickpoint treatments have occurred at terrace or side canyon-based drainages.

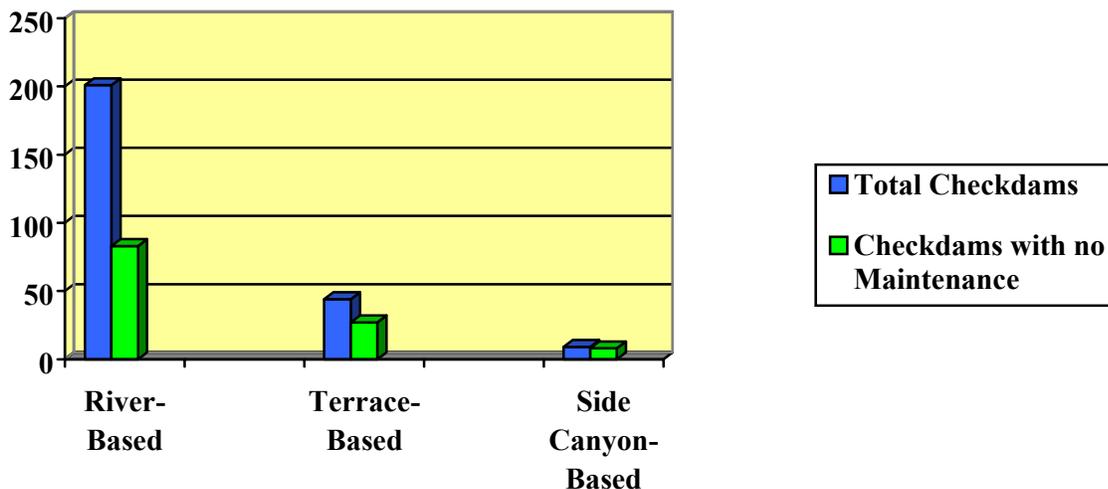


Figure 14. Number of Checkdams Constructed and Maintained by Drainage Type.

Of the existing 254 checkdams, a total of 135 existing checkdams have required maintenance at some point since their original construction. Figure 15 shows the percentage of sites with maintenance episodes. The majority of checkdams, 83, have needed only one maintenance episode. Two maintenance episodes have occurred at 33 checkdams, three maintenance episodes at 17 checkdams, and two checkdams have required four maintenance episodes, one at Palisades, the other at Granite Park.

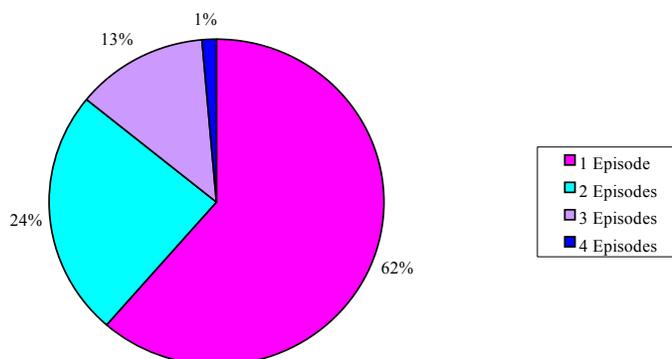


Figure 15. Percentage of Checkdams Maintained by Number of Maintenance Episodes.

Summary

At the close of fiscal year 2002, 29 sites containing 254 checkdams exist within the APE. All these structures were monitored by RCMP and ZCP staff between April 24 and May 6, 2002. After eight years of construction and maintenance of checkdams along the Colorado River corridor, the following generalizations can be made.

Structure Type

The original checkdam recommendation at the Palisades Delta resulted in the construction of over 70 structures in river-based drainages at two sites [Leap, 1995 #27]. A variety of structure types were built at Palisades. Many of these structures were constructed using large sandstone and limestone rocks with logs placed parallel within the channel bed spanning across to each bank. Though little or no runoff occurred for the first two years, the third year resulted in the breaching of many checkdams at the Palisades Delta. Once deposition behind existing checkdams occurred, flows were pushed outward towards the banks resulting in structure breaching. During the next maintenance episode, logs were removed from the majority of the checkdams and gravels were used in their place. The centers of rock checkdams were also lowered to create a more channelized pathway for runoff. Much of this maintenance work occurred to prevent future breaching rather than as a result of actual structural failure.

A total of 43 structure types have been reevaluated and changed following observation of effectiveness in specific geomorphic contexts. The majority of these changes have included the removal of logs, lowering the center heights, or the change from rock checkdams to rock linings.

In situations where drainage catchments are large, and drainages themselves are extensive, the presence of checkdams may have increased the velocity of runoff and increased erosion. In these instances, rock linings rather than checkdams are the best structure type to slow velocity while allowing for the deposition of suspended sediments within the runoff.

Depositional Context

Researchers may be placing undue emphasis on the drainage type in predicting success or failure of erosion control structures [Hereford, 1993 #20]. Preliminary observations suggest that depositional context and checkdam type are more important factors in predicting success rates of structures. Checkdams constructed in soils consisting of a combination of silt and sand, rather than just sand, tend to be breached less often.

Checkdams constructed in soils capped by a cryptogamic crust are even less vulnerable to structural failure. Preliminary results also indicate that salt in sediments may also influence catchment runoff and channel flows by regulating vegetation types and the ability of soils to absorb surface water [Lindsey, 1999 #393]. Only the checkdams located on the Palisades Delta have required maintenance due to piping activity in drainage walls.

Conclusions

Overall, attempts to control or reduce erosion in drainages by constructing erosion control structures along the Colorado River have been successful. No archaeological features have been lost where erosion control structures have been constructed.

Unfortunately, no national or regional checkdam database exists to enable cultural resource specialists and geomorphologists to learn from the experiences of others. In this vain, the continued guidance of the ZCP is crucial. Working together, we have been able to fine-tune erosion control techniques to fit within the unique context of the Colorado River Corridor. Continued checkdam monitoring and maintenance insures for the proper construction type and may prevent future structure failures [Gellis, 1995 #336]. Predicting rates or volume of sediment deposition and erosion, however, can only occur with detailed remote sensing at these locations.

FY02 MONITORING AND MAINTENANCE

The following information was gathered during FY02 annual checkdam monitoring and maintenance work. The sites included in the GCMRC-sponsored remote sensing project were not monitored at the request of J. Pederson, University of Utah (USU) principal investigaor. These sites will be revisited and remapped by USU in October, 2002.

In Fiscal Year 2002, only seven of the 29 sites required checkdam maintenance. Recommendations for additional sites with checkdams and cross-section placement follows this section.

Additional analysis of the 254 individual checkdams is beyond the scope of this chapter, though Appendix C presents checkdam construction, type, and maintenance data for each site along with geomorphological setting, soil descriptions, and drainage types.

A:15:005- 5 Checkdams, River-based drainage

No rain was noted and the checkdams all look good. No work was necessary.

A:16:149- 7 Checkdams, River-based drainage

The headcut at Checkdam 7 was filled in using 2 buckets of fist-sized and smaller rock. The rest of the checkdams show no change.

A:16:174- 6 Checkdams, River-based drainage

Checkdam 3 required ½ a bucket of gravel and rock for a nickpoint treatment. The rest of the checkdams show no change.

A:16:180- 7 Checkdams, River-based drainage

No rain was noted and the checkdams all look good. No work was necessary.

B:14:107- 1 Water diversion structure, Terrace-based drainage

No rain was noted and the water diversion structure looks good. No work was necessary.

C:02:101- 6 Checkdams, River-based drainage

A water diversion bar was constructed below Checkdam 11 to divert water away from Checkdams 13 and 14 which had been blown out since 2001. Three buckets of gravel and fist-sized rock were used.

C:09:050-1 Water diversion structure with 4 arms, Side Canyon-based drainage

No change was noted at the water diversion structure. No work was necessary.

C:13:005- 3 Checkdams, Terrace-based drainage

This site is monitored by the NPS backcountry office.

C:13:006- 18 Checkdams, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

C:13:069- 6 Checkdams, Terrace-based drainage

The drainage has been active through eolian processes and much of the channel is covered in fine sand. Checkdam 4 required maintenance, a large plunge pool developed below the log in the checkdam. The checkdam had been breached on the side closest to Features 1 and 2. The checkdam was rebuilt with a log arm to divert runoff back into the center of the main drainage, away from the features.

C:13:099- 50 Checkdams and 3 Cross sections, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

All three cross-sections, located in a river-based gully, were remapped. Profile 1 is above Checkdam 10, Profile 2 is located above Checkdam 13, and Profile 3 is above Checkdam 35N (see Appendix D). Checkdams 10 and 35N show slight increases in deposition (0.161 and 0.280 sq. m. respectively). A slight amount of erosion (0.013 sq. m.) was recorded above Checkdam 13.

C:13:100- 26 Checkdams, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

C:13:327- 4 Checkdams, Terrace-based drainage

No work was needed. The checkdams in the main drainage are covered with sand and sediment. Water drains through the large rock bar and off the cliff, creating a giant nickpoint where a lot of sediment is eroding away.

C:13:336- 5 Checkdams, Terrace-based drainage

No change was noted at any checkdams. No work was necessary.

C:13:346- 9 Checkdams, Terrace-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

C:13:348- 5 Checkdams, Terrace-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

C:13:359- 5 Checkdams, River-based drainage

No work was needed. The checkdams are unchanged and the drainage has been inactive.

C:13:371- 4 Checkdams, Side Canyon-based drainage

The drainage has been active. Checkdam 2, the basketweave checkdam, was breached and the drainage widened. The checkdam is sturdier than the eolian-deposited depositional context and water has been

diverted around it rather than through it. Maintenance involved taking rocks from the checkdam and lining the bank of the drainage.

C:13:381- 4 Checkdams, River-based drainage

No work was needed. The checkdams are unchanged and the drainage has been inactive.

G:03:002- 6 Checkdams, River-based drainage

No maintenance work was completed though Checkdam 2 has collapsed in a large nickpoint. A. Cheama recommends no work but monitoring the large nickpoint in the mesquite terrace as it is moving upstream. RCMP personnel recommend placement of a cross-section profile to track sediment deposition then placement of small checkdams in the drainage.

G:03:003- 18 Checkdams and 3 Cross sections, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

All three cross-sections located in the same river-based gully were remapped. Profile 1, the furthest upstream and above Checkdam 2 is shown in Figure 16. Profile 2 is located between Checkdams 8 and 9. Profile 3 is situated just above Checkdam 5 (see Appendix D). There was sediment deposition at all three cross-section locations. Checkdam 2 had 0.028 sq. m of deposition, the area between Checkdams 8 and 9 showed 0.621 sq. m. of deposition, and Checkdam 5 had 0.760 sq. m. of deposition.



Figure 16. Overview of Cross-Section 1 at G:03:003.

G:03:020-2 Cross sections

The unusual situation for this site is that there are no checkdams built here because the gullies and arroyos are too advanced. RCMP archaeologists are merely measuring changes in erosion/deposition at cross-section locations over time. Two profiles were placed in an active river-based gully last year. Only one cross-section, Profile 1, the furthest downstream, could be located because not all photographs were

available (see Appendix D). Repeat measurements at Profile 1 indicate a slight increase in deposition (0.116 sq. m.).

G:03:024- 13 Checkdams, River-based drainage

Vegetation is growing in the upper drainage and minor sediment deposition has occurred. Rocks were moved from the upstream portion of Checkdam 1 and filled in at Checkdams 10 and 11.

The lower drainage and Checkdams 3 and 14 required work. The Checkdams 4-9, below Checkdam 3 are blown out with sediment accumulated and reaching gradient. Because the drainage appears to have stabilized, no additional work was deemed necessary. Continue to monitor for additional downcutting or meandering. There appears to be a large amount of sediment accumulated even though the checkdams were blown out, as these rocks created a sort of rock lining in the drainage.

G:03:025- 4 Checkdams, River-based drainage

No work was needed. The checkdams are unchanged and the drainage has been inactive.

G:03:026- 6 Checkdams, River-based drainage

Voids at Checkdam 2 were filled with two buckets of rock. All other checkdams were unchanged.

G:03:038- 0 Checkdams, River-based drainage

The site was not visited as all checkdams were obliterated in FY99.

G:03:040- 2 Checkdams and 2 Cross sections, Terrace-based drainage

The drainage has not been active. The brush checkdams are doing well. No maintenance work was required.

These cross-sections, located above Checkdam 3 and below Checkdam 4, in a terrace-based gully, were not relocated because there were no previous photographs available. They will be measured in FY03.

G:03:041- 9 Checkdams, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

G:03:058- 7 Checkdams, Terrace-based drainage

The checkdams are working and all look good. The rock alignment constructed in FY00 is really holding sediment.

G:03:072- 13 Checkdams, River-based drainage

This site was not monitored at the request of J. Pederson and USU. The drainages on site are part of a GCMRC-sponsored remote sensing project.

CHECKDAM INSTALLATION RECOMMENDATIONS FOR FY2003

During the course of regular site monitoring activities, checkdam installation recommendations are sometimes made. When this recommendation occurs, an assessment for installation with ZCP staff takes place on the next checkdam monitoring trip. The following sites have assessments that confirm the recommendation for checkdam installation.

C:13:329

The drainage consists of unstable alluvial sediment with one large nickpoint near Feature 3. Overall, not much runoff has occurred in the gully. The nickpoint is approximately 75 centimeters deep. It is recommended that a water diversion bar be placed above the drainage to divert water into the mesquite adjacent to the drainage. Vegetation could also be planted in the drainage.

G:03:020

The large gully at Feature 2 continues to have headward migration. Another gully up canyon of the feature is beginning to also have headward migration. It is possible that the headcuts of these two gullies will meet and pedestal Feature 2. After discussions with F. Nials in FY2001 and J. Pederson in FY2002, it is recommended that a water diversion bar be constructed above the feature on the slope. It is intended that this feature will slow down runoff and curtail further loss of Feature 2.

G:03:030

In May of 1996 it was recommended to place checkdams in the gully near Feature 2 to deter accelerated erosion. It was recorded that the terrace-based gully was very active due to the presence of an increased number of nickpoints. A. Cheama assessed the site in November 1998. He noted that the gully near Feature 2 had the potential to be worked on successfully using checkdams. The work has yet to be completed.

G:03:056

The drainage system contains a gully, bisecting Features 1 and 2, consisting of alluvial sediment with four nickpoints. It is recommended that the gully be lined from the lower end of the drainage. Recommend 12 small rock checkdams and linings above the four nickpoints.

CROSS-SECTION INSTALLATION RECOMMENDATIONS FOR FY2003

Cross-section profiles are intended to aid in gathering data on erosional and depositional changes at specific locations in drainages. As more checkdam monitoring data is collected, cross-sections have been recommended at a number of places within the APE. The following sites have been recommended for cross-section profiles: B:11281, C:13:070, C:13:329, G:03:002 and G:03:057.

B:11:281

Three nickpoints each ~20cm deep are newly located at the gully located SE of Feature 1. This would be a very good gully to monitor by using cross-sections.

C:13:070

This site is a candidate for additional research on site relationships and geomorphic perspectives. Further, this location should be investigated from the perspective of alluvial deposition and erosion contrasted with old high water shoreline deposits. One approach may be to investigate how the terrace bank retreats at different flow levels and if river flows cause the arroyo mouths to change. This will be attempted by monitoring cross-section profiles.

C:13:329

Feature 2 is being impacted by active gullying. In 1996 the gullies appeared to be filling in. Today, they have downcut creating a nickpoint one meter deep. Three nickpoints are present adjacent to Feature 2. Recommend measuring gully entrenchment at this location. If the gully at Feature 2 moves westward, more cultural material may be exposed.

G:03:002

A. Cheama recommended a cross-section be placed below Checkdam 2 to track sediment deposition. Depending on results of cross-section, as many as 14 small checks may be placed in the drainage. Although this site will not be monitored this year, it may be possible to complete cross-sections.

G:03:057

Minor surface erosion is occurring under the overhang within the fire-cracked rock, artifact and ash concentration areas. The gully observed in FY98 is now a small, shallow rill. Impacts are minimal. This is an excellent opportunity for further erosional research in the form of cross-sections. Similar to G:03:002, this site is not scheduled for monitoring, however if time allows, cross-sections will be completed this year.

CHAPTER FIVE

REMEDIAL ACTIONS IMPLEMENTED IN FY2002

Newly Exposed Site

B:16:911, a single roasting feature, is located in an alluvial deposit reworked via eolian processes. This site was recently exposed by a flash flood at Monument Creek (see Figure 17). The roasting feature is situated approximately 40 centimeters below the ground surface. It is composed of charred granite and schist cobbles, which form a shallow basin. The cobbles are burnt to varying degrees and average a size of 10 centimeters. The charcoal is mainly ashy with some larger pieces on the north end of the feature. A charcoal sample was collected from this location (see Figure 18). This date will provide a timeframe for when the feature was used and the fuel type, assuming there is no "old wood" problem. No artifacts are associated with this feature.

The site has been nominated to the National Register as a contributing element with the potential to yield important information (Criterion D). A memo was sent to SHPO for their concurrence. Site documentation includes information on a GRCA site form, an ASMIS form, a monitoring form, a carbon collection form, and a site map.

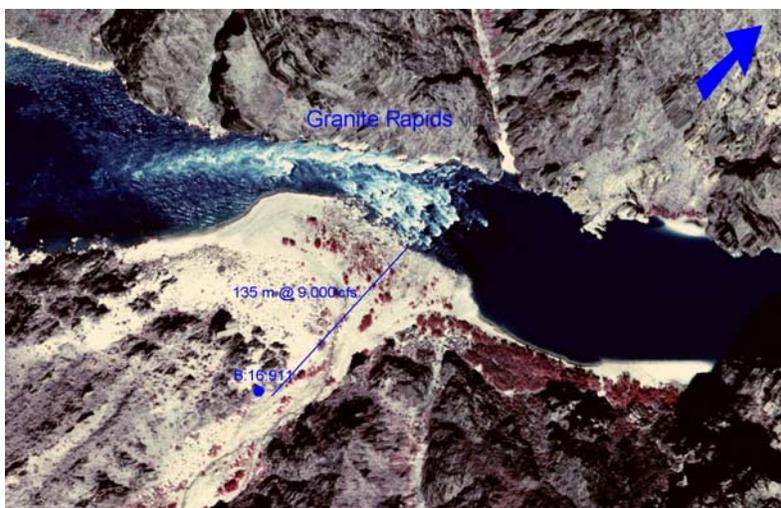


Figure 17 . Locational Map of B:16:911.

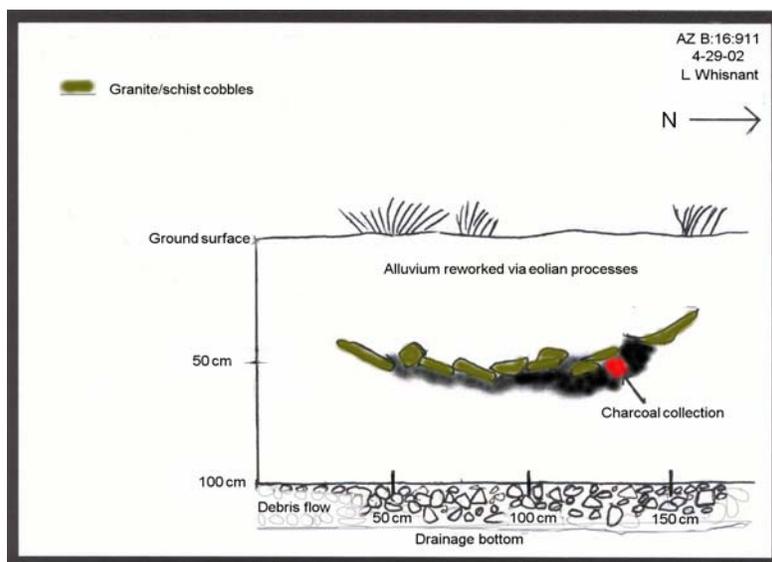


Figure 18 . Site Map/Profile of B:16:911.

Human Burial at C:13:386

Since the spring of 2000, C:13:386 has been slowly revealing the remains of a human burial. The history of correspondence from the Park to PA members regarding the findings began as early as May, 2000 (Leap RCMP #68 2000, Dierker RCMP #70,2001). Specific correspondence began in December 2001. What follows is the chain of events that occurred to conclude that this site contains the remains of a human burial.

C13:386 was initially recorded in 1991 as part of the archaeological inventory survey of the Colorado River corridor for the Glen Canyon Dam Environmental Impact Statement. It is located below Unkar Delta, river left (river mile 73.2). The site was identified as a single, isolated slab-lined cist on a dune slope. Monitoring of the site over the past 10 years has uncovered additional features that were not discovered during the initial site recording.

In the spring of 2000, a scientist notified the RCMP office of the presence a prehistoric bowl eroding from an alluvial dune (site C:13:386). In May 2000 Dierker and Leap visited this location and documented the findings – a partial bowl and a ladle were exposed from the dune. Measures were taken to fully document the items. They were reburied on-site in a more stable location. In December 2000, Leap visited the site on a river trip and noticed another partial bowl eroding from the same location. The item was properly documented and reburied in the same location as the other two items. All vessels were removed under the provisions provided under the Archaeological Resources Protection Act (43 CFR) and NPS responsibilities under the National Historic Preservation Act (section 110). At the time of their exposure it was not known they were associated funerary objects. See Figure 19.

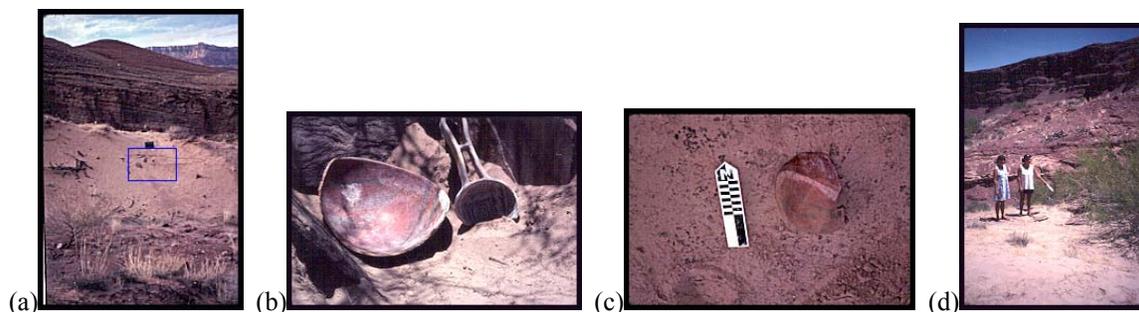


Figure 19. C:13:386 (a) location of the exposed materials: (b) two vessels exposed and reburied in May 2000: (c) vessel exposed and reburied in December 2000: (d) location of reburial, located 6 meters north of their origin.

On November 9, 2001 Dierker and Leap visited the site and a fourth vessel was exposed at the same location, but this time fragments of bone were exposed just below the fourth vessel and about 10 cm to the south of the vessel. Photographs were taken and the vessel and bone were disguised by covering them up with dune sand. A minor attempt was made to stabilize the dune below the newly exposed items by placing a moderately sized mesquite log below the items. See Figure 20.

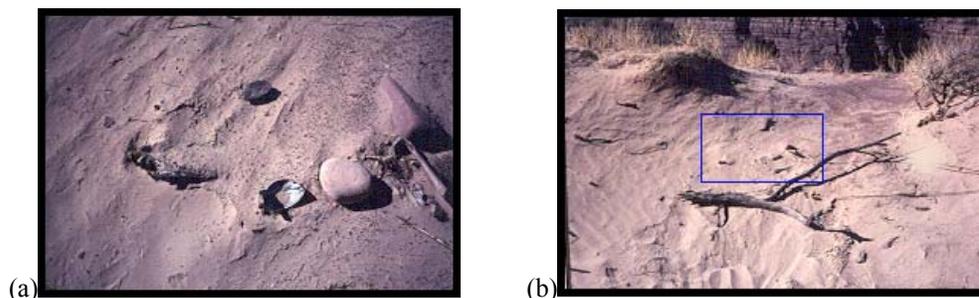


Figure 20. C:13:386 November 9, 2001 (a) exposure of a fourth vessel and probable human bone: (b) interim treatment of findings.

Site documentation and ceramic identification indicate ancestral Puebloan affiliation, dating to circa AD 1175. Vessels found in association with the remains include two bowls (San Juan Redware – probable Deadman’s Black on Red, dating AD 750 – 1075); a ladle (Tusayan Whiteware – Sosi Black on White, dating AD 1050 - 1200); and another bowl (Tusayan Whiteware – Flagstaff Black on White, dating AD 1150 – 1225).

Prior to the actual confirmation of human remains at the site, dated April 28, 2002, GRCA notified affiliated tribes of a possible burial (first notification dated Dec. 7, 2001; confirmation of meeting, Jan. 23, 2002; power point presentation of findings March 5, 2002; and follow-up memo from the presentation March 15, 2002). There was still no proof of a human burial, only suspicion. The March 15th memo included the Plan of Action (NAGPRA Section 10.5(e)) chosen.

The March 15, 2002 memo summarizes the discussions and decisions made at the March 5, 2002 informal NAGPRA consultation meeting, held prior to the Glen Canyon Dam Programmatic Agreement meeting in Flagstaff. The group decided that until it is certain an actual burial was exposed, NPS would proceed with informal consultation, and that determining cultural affiliation would be deferred. Tribal and federal meeting attendees also made it clear that NPS archaeologists must identify whether the material exposed is of human origin prior to any decisions relative to compliance with NAGPRA.

Several tribal representatives requested that, prior to disturbance of the area, tribal members participate in the form of informal field consultation (i.e., discussion of the previous findings, location of the buried vessels and identification of reburial locations) and prayer. Unfortunately only two tribal representatives attended the April 2002 trip (representatives from Paiute and Zuni).

Upon field evaluation of the site during the April river trip, we determined that excavation was unnecessary to confirm the presence of human remains. The remains were exposed enough to allow field staff to confirm that they are human in origin and situated in an archaeological feature. The exposed bone is a long bone, probable femur and it appears to be located in a slab-lined structure. The slabs are of Dox Sandstone. No collections were made and no destructive analyses occurred. Jan Balsom, Lisa Leap, Jennifer Dierker, Andres Cheama (Zuni representative) and Lawrence Snow (Paiute representative) concluded that the remains could be preserved in place until cultural affiliation is determined. Therefore, stabilization of the area took place during this same visit. The remains were covered with dead brush and some logs, covering approximately a 1.5 m area. This type of preservation will trap blowing sediments in the brush thus covering the remains through eolian processes. See Figure 21 for happenings on the April, 2002 river trip.



Figure 21. C:13:386 visit on April 29, 2001. (a) discussions with tribal representatives: (b) exposed long bone in a dox-lined feature and a fourth vessel: (c) stabilization with brush and logs.

The three vessels reburied 6 meters north of their original location are now considered funerary objects. Lawrence Snow, Paiute representative, expressed the desires of his tribe to stabilize the burial in place, if possible, and to reunite the vessels with the human remains. The Hopi Tribe has currently shared this same request. However, as Snow recognized by being there, reuniting the vessels with the remains would only cause additional erosion due to the fragile dune setting.

GRCA and tribal representatives made an effort to secure the burial in place. In the event that the stabilization work fails, the next step will be to determine cultural affiliation. Grand Canyon Research and

Monitoring Center (GCMRC) has agreed to complete a cultural affiliation study for the river corridor area. Until the completion of this study, we anticipate working with the tribes individually to begin identifying lines of evidence to determine cultural affiliation.

GRCA archaeologists feel it is in the best interest of all Glen Canyon Dam Programmatic Agreement members, in particular the tribes, the Bureau of Reclamation and National Park Service (federal land managers) to initiate discussions relative to inadvertent discoveries of human remains along the river corridor. Due to the nature of the corridor, it is inevitable that additional burials will be uncovered, whether accelerated by dam operations or not. The type of consultation that has taken place for AZ C:13:386 should "...lead to the establishment of a process for effectively carrying out the procedures, the determination of custody consistent with disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony" (NAGPRA: 43 CFR Part 10.5(f)).

Improvements to the RCMP Database

For the first time since the site inventory and monitoring program began, a professional database consultant was hired to assist with integration and design improvements to the project database. For ten years, a part-time NAU archaeologist has managed and maintained this database. The consultant was hired to normalize and integrate the existing database, and design a custom application for managing site activities. Before detailing the changes and improvements to the database, we present a brief history of the RCMP database.

History of the RCMP Database

This section provides a history of the RCMP survey, monitoring, and remedial action databases. The emphasis is on how and why the database evolved to accommodate the changing needs of a dynamic, innovative, and multi-faceted project. It helps to remember that during the 1980s personal computers were just coming into widespread use and it wasn't until the 1990s that PC-based relational database software became widely available [Hernandez, 1997:18-19 #481].

In 1989, during the planning stage of the survey, project staff selected the Intermountain Antiquities Computer System (IMACS) to record and document archaeological site information. IMACS, written in dBase III, was created in 1981 under the cooperative efforts of the University of Utah, Bureau of Land Management, and the U.S. Forest Service [Utah, 1982, Revised 1990 #480]. The Grand Canyon River Corridor Survey (GCRCS) adopted IMACS for its site data management because modified versions were already being used by NPS personnel in the Rocky Mountain Region and Glen Canyon National Recreation Area [Fairley, 1994 #17]. For the purposes of the GCRCS, the IMACS site form consisted of four separate parts: Part A: Administrative/Environmental Data; Part B – Prehistoric Data; Part C – Historic Data, and Part D – Rockart Data. In 1991, as the GCRCS fieldwork was drawing to a close and preliminary analyses were underway, Helen Fairley (then GCRCS project director), created a dBase III file called GCSITES. The GCSITES data consisted of summary data derived from the IMACS site forms, baseline site monitoring forms, and the combined knowledge of Ms. Fairley and crew members. These two databases (IMACS and GCSITES) became the core archaeological site information databases for the project.

In addition to site inventory, a "major portion of the GCRCS recording effort was devoted to gathering baseline monitoring information suitable for evaluating changes in site condition through time" [Fairley, 1994:147 #17]. There were few precedents for how this monitoring should be accomplished:

...there were no precedents to be found anywhere in the world regarding reliable methods for monitoring the condition of archeological 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 [Leap, 2000b:1-6 #457].

In addition to there being no reliable methods for monitoring archaeological site condition through time, there was certainly no archaeological site monitoring software available. GCRCS archaeologists instead modified an NPS-designed dBase III flat-file database that had been developed for “park-wide” backcountry use in 1989. The data collection instrument for this experimental, baseline monitoring phase was the modified backcountry monitoring form plus an additional data sheet tailored for assessing river-related impacts. The data sheets evolved into a 5-page monitor form, designed by H. Fairley, and used by RCMP from FY92-93.

While the core variables remained the same from FY90-93, there were problems with the FY92-93 monitoring form. The 5-page form was overly complex and too subjective, so after a two-year trial period this version of the field form was discontinued [Coder, 1994a:29 #12] and [Coder, 1994b:39 #11]. Let it be emphasized here that the project database up to this point, although considered “relational”, was nothing more than a basic file-based database management system. DBase, by Ashton-Tate, was one of the earliest PC-based relational database management systems to come on the market in the mid-1980s [Hernandez, 1997:18 #481].

At the risk of boring the reader, a brief explanation of flat-file (or file-based) systems versus relational database management systems (RDBMS) is in order. Basically, relational databases store data in *relations*, which are perceived by the user as tables [Hernandez, 1997:12-13 #481]. If the user is familiar with the relationships among the tables, she/he can access data in an almost unlimited number of ways. Flat-file databases usually store data in a single large table consisting of multiple subjects, or several smaller tables that are not linked one to another. Data redundancy, lack of consistency, and poor data integrity are common problems with flat-file databases.

By 1994 there was newer database software on the market and the RCMP project shifted to a software program called Paradox. Paradox was one of the earliest relational database software programs available for personal computers. Project archaeologists from both GLCA and GRCA had met in late FY93 to revise monitoring data collection procedures and redesign the monitor form. Dana Kline, at that time an NAU graduate student employed by RCMP, restructured the RCMP monitoring database into Paradox, with the help of Susan Gregg, Department of Anthropology faculty. The new structure consisted of four separate but linked files that corresponded to the major subject areas on the new monitoring field form (management information, physical impacts, visitor-related impacts, and recommendations). RCMP used the Paradox program through 1996, until MS Access became the new NPS standard. Relational database software continued to improve during the 1990s, and in FY97 the project databases were converted to MS Access. MS Access97 is the database management software currently in use by project staff, and is much more user-friendly than previous software versions.

In addition to site monitoring, RCMP archaeologists have conducted remedial action activities at archaeological sites along the river corridor since FY94. These activities are many and varied, and require extensive tracking and scheduling to insure that the most important work is being done first and the work proceeds in an efficient fashion. The database evolved to include tables for preservation and recovery activities, maintenance of checkdams, assessment of trail work, and information on specialized analyses. In summary, the RCMP database has grown in size and complexity since the inventory survey in 1990-91. Project staff have kept abreast of technological changes as database systems rapidly changed during the last twelve years, and look forward to using the improved application.

Database Changes and Improvements in FY02

Up until FY02, the RCMP database had grown “from the bottom up” as the needs and focus of the project changed and evolved. Finally, in FY02 the funds were available and the time was right to create a database structure “from the top down”. Part of the impetus for this long-needed improvement came from the observations and suggestions made by independent reviewers such as SWCA, Inc. and the Protocol Evaluation Panel [Neal, 2000 #394] [Doelle, 2000 #461]. Recommendations for database design improvements were also made in the FY99 RCMP Synthesis Report [Leap, 2000a #356]. RCMP staff did not implement all of these suggestions and improvements in FY02, but have made an excellent start.

Stan Mish, a database developer with 7K Information Technologies in Flagstaff, AZ, began working with the RCMP database manager, Nancy Andrews, in March 2002. Mr. Mish provided database application programming for archaeological site management tailored to the unique and specific needs of this project. All programming code was written in Visual Basic programming language for MS Access97 software, and can be migrated to other database programs in the future. Database development included site centric data viewing tools providing at-a-glance views of comprehensive site data and management history, management tools to include status, scheduling, and data analysis of ongoing monitoring and remediation activities, and integration with historical data.

Database development proceeded in four modules: site monitoring, site remediation, photo and map data integration, and project management. Other work included normalization of database structure, column mapping of historical monitoring and inventory data tables and various management activities into normalized table structure, design of relationships and/or migration for static site data, and building/deployment of data migration queries. In a nutshell, the new application facilitates long-term analysis of site inventory and monitoring data, and improves tracking and prioritization of monitoring and remedial action projects. The result will be quicker and easier access to data, less time spent maintaining the data, and better, more informed, management decisions.

CDROM Project

Under the cooperative agreement number IA98-AA-40-0103 (mod. #3) approximately 1,200 photographs from the RCMP archaeology collection were scanned by NAU's Bilby Research Center. This project began two years ago and extended into FY2003 due to additional funds from GCMRC

The goal is to begin scanning and storing, on CDROM, historical photographs relevant to the archaeological monitoring program and the archaeological photographs taken by the river corridor monitoring staff in the past 10 years. Priority was given to medium format photographs, photographs that exemplify preservation treatment, and historical photographs. These photos will be available to assist future projects and the work completed under the Historic Preservation Plan (in progress) as recommended by the PEP panel.

The main purpose for this task was to create a collection of photographs that is readily accessible for research projects and educational ventures. Storing these photographs on CDROM provides other benefits as well: database consolidation, versatility, physical storage and portability, consolidation with other data, and education.

Unfortunately funding ran out for this project and there are still approximately 8,000 photographs to be scanned. All photo information is stored in a MS Access97 database, though there are currently no digital photos to go with this information. All future photographs taken by the RCMP archaeologists will be scanned into the new system at the RCMP office.

Photographic Techniques used to Determine Geomorphological Processes Proximal to Cultural Sites

Under the cooperative agreement number IA98-AA-40-0130 (mod #2) NAU geomorphic researcher Mark Manone is conducting repeat photography research. Project completion is anticipated for the spring of FY2003.

Repeat photography using historical, modern, and daily images is valuable for identifying sediment deposition and or erosion on and around archaeological sites located in the Holocene deposit. The purpose of this study is to compare these three types of repeat photography methods to identify the possibility of visually quantifying sediment erosion or aggradation. Testing these methods will assist in future archaeological monitoring techniques and treatment efforts. This study will also create a preliminary, consolidated and comparative archaeological photographic database representing approximately 100 years of time.

SPONSORED RIVER TRIPS AND THE WORK COMPLETED

Cooperative River Trips

The majority of the monitoring and remedial work was completed on the Colorado River Fund-sponsored Cooperative River Trips (formally referred to as Colorado River Fund trips). The CRTs are funded by a percentage of the revenues generated by all commercial river outfitters. A selected outfitter runs each trip (providing boats, boatmen, food, etc.) and provides the labor necessary to perform rehabilitation on trails and beaches. The goal is to enhance visitor experiences. Park personnel participate by providing the locations that require rehabilitation, supervising the work, and completing the proper field documentation. Most of the work accomplished on these trips includes trail obliteration and/or retrailing, and revegetation. In FY02, much of the scheduled site monitoring was also completed.

This year NPS staff participated on three CRTs: Oct. 31 - Nov. 19, 2001; Dec. 6 - 12, 2001; and Feb. 15 - 27 (upper half only). On the October trip, 17 sites were monitored and 17 sites had remedial work completed. In December, monitoring was completed at 4 sites, and in February 3 sizeable sites (C:09:065, C:09:088 and C:13:009) were mapped with a total station. For more detail see the three CRT reports in Appendix E.

Grand Canyon Monitoring and Research Center

Jennifer Dierker participated on an 18 day river trip (February 15 to March 5, 2002) sponsored by GCMRC and supervised by Joel Pederson (Utah State University). For PA members this project is commonly referred to as the checkdam research project. The purposes of the trip were to test the effectiveness of using LIDAR and remote sensing to monitor eroding historic properties; analyze the effectiveness of previously constructed checkdams; and provide a research design and recommendations for future monitoring efforts.

Total station mapping was completed at nine sites (C:13:006, C:13:099, C:13:100, C:13:346, C:13:348, G:03:003, G:03:038, G:03:041 and G:03:072), and site monitoring occurred at 4 sites (G:03:003, G:03:020, G:03:041, and G:03:072). A follow up trip is scheduled for September – October, 2002. See Appendix F for a detailed trip report.

Bureau of Reclamation

A single NPS archaeology monitoring trip, funded through BOR, launched from Lees Ferry April 24 and took off the river at Diamond Creek May 6, 2002. Seventeen sites were monitored, trail obliteration was accomplished at site C:13:381, and checkdam maintenance occurred at seven of the 27 sites monitored (see Chapter 4 for checkdam results).

Summary

Of the 5 trips RCMP archaeologists participated on, several remedial actions were performed. In addition to the 42 sites monitored and the seven checkdam sites maintained, remedial work was completed at 18 sites. Once again, trail work exhibited the majority of work (10 locations). Following trail work, planting vegetation was performed at seven sites, and six sites received out of the ordinary preservation measures such as graffiti removal, increased photo documentation, reconstruction of a trail with retaining walls, and special burial protection measures. Three rather large sites were mapped with a total station on the Spring CRT. It is anticipated that these maps will not only be used for management purposes but also for interpretive uses.

Three sites were assessed for checkdam construction, but during on-site assessments checkdams were deemed as unnecessary. A fourth site was assessed for trail rerouting, however, rerouting the trail would only make the site more vulnerable. Appendix G lists the actions that were implemented site specifically. Included in the table are the dates of when the actions were initially recommended, when the site was assessed, and when the action (if assessed as necessary) was completed. At several sites the assessment and completion dates are the same.

CHAPTER SIX

SCOPE OF WORK FOR FY2003

Sites to Monitor and Associated Remedial Work

For Fiscal Year 2003, 92 sites are scheduled for monitoring. This is a larger number from last year because several sites that will be visited are from the 3 to 5 year monitoring schedule category.

There are 105 remedial actions recommended with some sites having multiple recommendations. The recommendations are as follows: four sites recommended for checkdams; nine sites recommended for planting vegetation; 15 sites recommended for trail work; and 14 sites recommended for some other form of preservation treatment. For data recovery options: 31 sites are recommended for data recovery; 32 sites are recommended for research (anthropologically or geomorphologically). See Appendix H for detailed descriptions of the work recommended. Priority will be given to the sites scheduled this year for monitoring (24 sites). This will ensure minimal impact to the site by not having repeated visits in one year.

Prior to any remedial work final assessments are completed by NPS specialists (such as trail crew personnel, botanists, or recreational specialists), Zuni Conservation Program personnel (for checkdam recommendations), and archaeologists (NPS or other agencies). After a final assessment is done, the work is either completed at that time or implementation is scheduled for a later date. Implementation of recommended work depends on time constraints and the type of work involved. For example, a data recovery recommendation involves detailed planning, time and money. However, if a site is recommended for trail obliteration, the work involved includes gathering materials in the area and completing written and photo documentation. The benefit to implementation of the recommended work at the time of the assessment is minimal site impact by reducing the number of visits to the site.

Total station mapping has been a treatment recommended since the initiation of checkdams (September 1995). However, since fiscal year 1999 the BOR has not funded this project. Fortunately, through the CRT we will be able to map some sites with a total station in FY03.

Table 3 summarizes the work to be accomplished this year. (Note, however, the recommendation *data recovery*, will not be implemented). Although a specific research design can be completed for each site, it is the belief of the BOR that until a research design is completed for the entire corridor, data recovery should be delayed. Statistical Research, Inc. will complete the river corridor research design in May 2003. For more detail on the site specific work recommended see Appendix H.

Table 3. Summary of Sites to Monitor in FY2003 and Remedial Work Recommended

Site Number	Property Type	New Drainage	Monitor Schedule	Additional Remedial Work
A:15:004	Roasting Feature	Terrace	5 years	
A:15:022	Roaster Complex	Terrace	5 years	
A:15:028	Roaster Complex	Terrace	5 years	
A:15:029	Thermal Feature	Terrace	5 years	
A:15:038	Thermal Feature	Terrace	5 years	
A:15:047	Artifact Scatter	Terrace	5 years	
A:16:148	Roasting Feature	No Drainage	4 years	
A:16:151	Roasting Feature	No Drainage	5 years	
A:16:154	Structure-Thermal Feature Complex	Terrace	5 years	
A:16:160	Roaster Complex	Terrace	5 years	Trail work
A:16:167	Roaster Complex	Terrace	5 years	Trail work
A:16:171	Roaster Complex	Terrace	5 years	
A:16:174	Roasting Feature	River	Biennial	Analyze bone fragments

Site Number	Property Type	New Drainage	Monitor Schedule	Additional Remedial Work
B:09:317	Roasting Feature	No Drainage	Biennial	
B:10:224	Thermal Feature	No Drainage	4 years	Data recovery
B:10:225	Small Structure	No Drainage	5 years	
B:10:237	Roaster Complex	Terrace	5 years	
B:11:275	Small Structure	River	5 years	
B:11:281	Thermal Feature	Terrace	Biennial	Geomorphic research
B:11:282	Structure-Thermal Feature Complex	No Drainage	4 years	
B:13:001	Small Structure	Terrace	5 years	
B:14:095	Roaster Complex	Terrace	4 years	
B:15:119	Artifact Scatter	No Drainage	5 years	
B:15:135	Small Structure	Terrace	5 years	
B:15:138	Thermal Feature	River	Annual	Data recovery
B:15:139	Artifact Scatter	Terrace	5 years	
C:02:094	Historic Structure	No Drainage	Biennial	Place sign, Test for subsurface material
C:02:096	Structure-Thermal Feature Complex	River	Annual	Profile and sample Locus B, Data recovery
C:05:007	Rockart	No Drainage	As needed	Remove graffiti
C:05:037	Thermal Feature	Terrace	4 years	
C:06:008	Small Structure	No Drainage	5 years	Test for subsurface material
C:09:030	Special Activity Locus	No Drainage	5 years	
C:09:031	Special Activity Locus	River	5 years	Trail work
C:09:034	Special Activity Locus	River	5 years	
C:09:050	Special Activity Locus	Side Canyon	Annual	Trail work
C:09:052	Artifact Scatter	No Drainage	Biennial	
C:09:062	Small Structure	No Drainage	5 years	
C:09:072	Small Structure	No Drainage	5 years	
C:09:084	Artifact Scatter	Terrace	5 years	
C:13:006	Small Structure	River	Annual	Data recovery
C:13:010	Pueblo	River	Annual	Total station map, Data recovery
C:13:033	Small Structure	No Drainage	5 years	
C:13:069	Small Structure	Terrace	Annual	Data recovery
C:13:070	Small Structure	River	Annual	Geomorphic research, Data recovery
C:13:098	Historic Structure	River	Annual	
C:13:099	Structure-Thermal Feature Complex	River	Semi Annual	Data recovery
C:13:100	Pueblo	River	Annual	Data recovery
C:13:101	Structure-Thermal Feature Complex	Terrace	5 years	
C:13:272	Small Structure	River	Biennial	
C:13:273	Roaster Complex	River	Annual	Data recovery
C:13:291	Small Structure	River	Annual	Trail work, Data recovery
C:13:321	Roaster Complex	River	Annual	Data recovery
C:13:327	Roasting Feature	Terrace	Biennial	Data recovery
C:13:329	Small Structure	Terrace	Biennial	Geomorphic research, Checkdams
C:13:333	Thermal Feature	River	4 years	Collect samples from Fea. 1 and 2

Site Number	Property Type	New Drainage	Monitor Schedule	Additional Remedial Work
C:13:336	Thermal Feature	Terrace	Biennial	Total station map
C:13:340	Roasting Feature	No Drainage	4 years	
C:13:347	Small Structure	River	Annual	Data recovery
C:13:348	Artifact Scatter	Terrace	4 years	
C:13:349	Historic Structure	Terrace	Annual	
C:13:352	Artifact Scatter	Terrace	4 years	
C:13:353	Small Structure	No Drainage	5 years	
C:13:354	Small Structure	No Drainage	5 years	
C:13:363	Small Structure	No Drainage	5 years	
C:13:364	Small Structure	No Drainage	5 years	
C:13:368	Artifact Scatter	River	5 years	Test for subsurface material
C:13:371	Structure-Thermal Feature Complex	Side Canyon	Annual	Data recovery
C:13:377	Artifact Scatter	Terrace	5 years	
C:13:379	Small Structure	Terrace	5 years	
C:13:381	Thermal Feature	River	5 years	
C:13:385	Small Structure	Terrace	Biennial	Artifact analysis
C:13:386	Small Structure	Terrace	Semi annual	
C:13:393	Artifact Scatter	Terrace	5 years	
G:03:003	Roaster Complex	River	Annual	Work with Hualapai on visitor issues, Plant vegetation, Update total station map
G:03:004	Roaster Complex	River	Annual	
G:03:020	Roaster Complex	River	Annual	Data recovery
G:03:024	Roaster Complex	River	Biennial	
G:03:028	Roaster Complex	River	Biennial	Data recovery
G:03:034	Roaster Complex	River	Annual	
G:03:038	Roaster Complex	River	Biennial	Plant vegetation, Total station map
G:03:040	Roaster Complex	Terrace	Biennial	Data recovery
G:03:041	Roaster Complex	River	Annual	
G:03:048	Artifact Scatter	No Drainage	4 years	
G:03:049	Artifact Scatter	No Drainage	5 years	
G:03:052	Roaster Complex	Terrace	5 years	Plant vegetation
G:03:064	Roaster Complex	River	Annual	Update total station map, Data recovery
G:03:065	Artifact Scatter	Terrace	5 years	
G:03:067	Roasting Feature	River	Biennial	
G:03:071	Artifact Scatter	No Drainage	4 years	
G:03:072	Roaster Complex	River	Annual	Collect sample from Fea. 3, Data recovery
G:03:077	Rockart	No Drainage	5 years	
G:03:080	Structure-Thermal Feature Complex	River	Annual	Work with Hualapai on visitor issues, Plant vegetation, Trail work

Annual checkdam maintenance has occurred since 1995 with the exception of last year. At the request of Joel Pederson, eight sites were not maintained due to the research being conducted. In the spring of 2003 all 27 sites will be monitored and maintained (Table 4).

Table 4. Sites with Checkdams (N = 27 Sites)

Site Number	Property Type	Drainage Type
A:15:005	Structure-Thermal Feature Complex	R&S
A:16:149	Thermal Feature	River
A:16:180	Roasting Feature	River
B:14:107	Thermal Feature	Terrace
C:02:101	Thermal Feature	River
C:09:050	Special Activity Locus	Side Canyon
C:13:006	Small Structure	R&S
C:13:069	Small Structure	Terrace
C:13:099	Structure-Thermal Feature Complex	River
C:13:100	Pueblo	River
C:13:327	Roasting Feature	Terrace
C:13:336	Thermal Feature	Terrace
C:13:346	Small Structure	Terrace
C:13:348	Artifact Scatter	Terrace
C:13:359	Small Structure	River
C:13:371	Structure-Thermal Feature Complex	Side Canyon
C:13:381	Thermal Feature	River
G:03:002	Roaster Complex	River
G:03:003	Roaster Complex	R&S
G:03:024	Roaster Complex	R&T
G:03:025	Roaster Complex	River
G:03:026	Roaster Complex	T&S
G:03:040	Roaster Complex	T&S
G:03:041	Roaster Complex	River
G:03:058	Roasting Feature	Terrace
G:03:067	Roasting Feature	River
G:03:072	Roaster Complex	R&S

Cross-section work will continue in FY2003 at C:13:099, G:03:003, G:03:020, and G:03:040. This work was initiated in April 2001 and will be used as supplemental information regarding the effectiveness of checkdams, illustrating volumetric change. Geomorphic specialists accompanying last year's trip suggested adding more sites to the list. If time allows, RCMP archaeologists will increase the number of cross sections this year. Possible sites to include are B:11:281, C:13:070, C:13:329, and possibly at G:03:002 and G:03:057 (These sites are not scheduled for monitoring this year. Cross-sections will be completed if time allows.).

An experimental flood is anticipated for January, 2003. Because the floods will not exceed the flows of the 1996 Beach Habitat Building Flows (BHBF), no additional on-site mitigation is necessary. Yet, RCMP archaeologists will take the opportunity to replicate 1996 medium format photographs taken before and after previous high flows at the following sites: B:15:124, C:13:099, C:13:100, C:13:291, and C:13:321.

River Trip Participation

There will be six river trips available to the RCMP archaeologists in FY2003, though five are scheduled for this fall. The River Commercial Outfitters will sponsor three CRT trips. In the past, RCMP archaeologists have completed trail work, vegetation projects, monitoring, and total station mapping. It is anticipated that this same type of work will be accomplished on the trips scheduled for this year.

One trip will be sponsored by the Arizona Water Protection agency, GRCA, and the Grand Canyon Wildlands Council (trips for tamarisk removal). This will be the first year for these trips so RCMP archaeologists are unable to completely plan the type of work to be completed on these trips. Furthermore, due to overlapping schedules, RCMP archaeologists will only participate on half of one trip.

Joel Pederson from the University of Utah (a GCMRC sponsored trip) will be on the river September-October 2002, to conduct the second portion of his research. An RCMP archaeologist will conduct monitoring at the sites Pederson will visit and will participate in the data collection at the selected sites.

For the past couple years the BOR has only funded one NPS archaeology river trip to monitor and maintain historic properties along the river corridor. In the absence of other trip options, RCMP archaeologists would be unable to complete the required/mandatory monitoring. Regardless, one NPS trip, funded through BOR, will launch in the spring with the main intent of monitoring the checkdam sites and completing any other work not completed on the previous trips.

Laboratory Work

In FY2002, major database reconstruction occurred, as mentioned in the previous chapter. Application testing, data migration/cleaning, data documentation, and design modification are the database management goals for FY2003. Along with these goals, the customary data entry, cleaning, and analysis of FY2003 monitoring and remedial action data will be performed. The NAU database manager will also work with the NAU Statistical Consulting Laboratory to identify long-term erosion and visitor impact trends at annually monitored sites.

NAU responsibilities also include completion of two excavation reports. These reports have been in the draft form for the past two years and it is anticipated that they will be completed this year. One excavation report was completed this year and will be disseminated to PA members with the final version of this report.

For the past two years NAU has been scanning site maps and making electronic updates on the maps. This allows for RCMP archaeologists to go into the field with an updated map to observe where the changes occurred in the past and identifying where impacts are occurring. Creating digital copies of changes (as different layers) on these site maps will show degradation or improvement of the site through time. It is one more form of data collection used to justify site treatment.

Although it has not been accomplished in the past two years, RCMP archaeologists are determined to plot the archaeological sites along the river corridor on orthophotos. Once this is completed, GCMRC and GRCA will have, readily accessible, georeferences of all the sites in the corridor. This will definitely enhance the working relationship between archaeologists and the GCMRC.

Educational Outreach

As in the past, RCMP archaeologists anticipate working with other programs outside of the river corridor monitoring program. The typical programs include the Grand Canyon Field Institute (holding two 1 week field trips a year) and the Guides Training Seminar (land-based and river-based seminars). Additional programs will include involvement in the Colorado River Management Plan, cultural resource orientations for researchers working along the river corridor, and working with the Arizona Department of Water Resources and the Arizona Water Protection Fund concerning checkdam research.