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**GLEN CANYON ENVIRONMENTAL
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**FY96 GLEN CANYON ENVIRONMENTAL STUDIES
MONITORING OF ARCHAEOLOGICAL SITES
FROM GLEN CANYON DAM TO THE PARIA RIVER RIFFLE**

AUGUST 9, 1996

**Tim W. Burchett
Glen Canyon National Recreation Area**

with contributions by

**Christopher M. Coder
and
Lisa M. Leap
Grand Canyon National Park**

**National Park Service
Resource Management Division
Glen Canyon National Recreation Area
P.O. Box 1507
Page, Arizona 86040**

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ABSTRACT

On various days between October 5, 1995 and July 9, 1996, 56 monitoring episodes were conducted to record physical and human impacts at 53 locations between Glen Canyon Dam and the Paria River riffle. Glen Canyon NRA personnel included Archaeologists Tim W. Burchett, Christine Goetze, and Nancy Mueller. Other Glen Canyon NRA personnel included Joseph Garrotto, Angie Leach, and O.J. Redhair.

Sites are accessible by boat on day trips. Film retrieval and replacement every 34 days at the camera locations continued. This effort is recording on a daily basis terrace cutbank erosion at sites C:2:38 and C:2:100.

Part of the long-term monitoring program includes the implementation of management assessments and recommendations to protect and preserve site information. To facilitate the recommendations, a stabilization workshop for the application of remedial actions such as traditional erosion control methods was held in spring FY95. Following the training, a remedial action plan identifying a limited number of sites most appropriate for immediate remedial action and including field methods was to be submitted to all signatories this fiscal year. This was begun, and is scheduled for completion in FY97.

The monitoring efforts in FY96 document the continuing degradation of archaeological resources by a number of physical and human impacts, and there is a general increase in those impacts. For those monitoring locations associated with river-based drainages, there has been a considerable increase in almost all impact types since the last monitoring episode in FY95, whereas at the monitoring locations associated with terrace-based streams there have been relatively few increases in erosion. Surface erosion and eolian/alluvial erosion are effecting sites with river-based drainages and terrace-based drainages about equally. Arroyo cutting and side canyon erosion effect more sites with river-based drainages than those with terrace-based drainages. FY96 is the first monitoring session that has recorded decreases in physical impacts in Glen Canyon NRA. Decreases in five physical impact categories are noted at six sites.

All site types exhibited human impacts about equally, and they have increased since FY95. This is different from FY95 where only artifact scatters and sites with roasters/hearths had increases in visitor impacts.

Site-specific summaries of previous monitoring results and the results of the FY96 monitoring effort are provided to illustrate the ongoing impacts present. Management actions and a management summary are presented. Eighteen monitoring locations are recommended for some form, or combination of, remedial action. These methods include retrailing, obliterating trails, planting vegetation, installing check dams, and stabilization. Four measures suggested to protect site integrity are: mapping, surface collection of the entire site, subsurface testing, and data recovery. Some form, or combination of, data collection is recommended at 32 monitoring locations.

A project assessment including the FY97 work plan are provided. The FY97 work plan includes monitoring activities, site mapping, continuing terrestrial photogrammetry, and remedial actions. For FY97, 36 locations will be monitored, 34 once and 2 twice for a total of 38 monitoring episodes. Monitoring activities are scheduled to begin in October FY97 following the end of the visitor season.

One site (C:2:99) has been chosen for instrument mapping based on newly exposed cultural remains. Film retrieval and replacement every 34 days at two camera locations will continue. A remedial action plan identifying a limited number of sites most appropriate for immediate remedial action and including field methods will be submitted to all signatories. A assessment of the effectiveness of the monitoring program since its beginning is provided.

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I. INTRODUCTION

An Environmental Impact Statement (EIS) evaluated the effects of the preferred action and other alternatives concerning the operation of the Glen Canyon Dam on the downstream environmental and ecological resources and historic properties of Glen Canyon and Grand Canyon (BOR). The preferred action and other alternatives were options that could be implemented for the purpose of minimizing adverse impacts on the downstream environmental and cultural resources and Native American interests in Glen and Grand Canyons.

To reach these objectives, several agencies conducted a survey to identify and evaluate the cultural resources present within Glen and Grand Canyons. The survey gathered information on the numbers, types, location, National Register eligibility, physical condition, and extant and potential impact agents (Fairley et al. 1991:1) of 475 cultural properties (Fairley et al. 1991:268).

Following this survey, a monitoring and remedial action plan was developed for managing the effects of Glen Canyon Dam operations on historic properties within the Area of Potential Effects (APE) and for carrying out remedial actions to address the effects of continuing identification, inspection, analysis, evaluation and remedial protection actions, as necessary, for the preservation of the cultural properties within the river corridor.

Pursuant to that monitoring and remedial action plan, this document reports the results of the FY96 monitoring and remedial action activities conducted in Glen Canyon National Recreation Area (NRA) in Reach 0 from Glen Canyon Dam to the Paria River riffle. The objectives and scope-of-work for FY96 were based on the results and recommendations of the FY91 survey and FY92-95 monitoring activities. They included: 1) continued monitoring of physical and human impacts and updating the monitoring data base for the sites in reach 0 from the Glen Canyon Dam to the Paria River riffle; 2) detailed site mapping using total station equipment; 3) continued terrestrial photogrammetry; and 4) remedial actions.

Table 1 presents the 69 locations monitored by Glen Canyon NRA in Reach 0. Fifty-three archaeological sites are present from Glen Canyon Dam down to River Mile 1.6 Right Bank below Lees Ferry. Fifty-one sites have 1 monitoring location, site C:2:11 has 12 monitoring locations, and site C:2:60 has 6 monitoring locations. In FY96, 53 locations were monitored once and 3 locations were monitored twice.

Section II presents some overall trends in physical and human impacts to the cultural resources. Section III presents site-specific results and recommendations including previous impact evaluations, current impact evaluations, and recommendations for continued monitoring, remedial actions, and data recovery. Section IV presents management actions taken in FY96. Section V is a management summary, including site-specific measures to reduce impacts and measures to protect site integrity. Section VI is an overall project assessment and includes the FY97 work plan and monitoring form updates. Appendix A is the modified field form to be put to use in FY97.

Table 1. Sixty-nine locations are monitored by Glen Canyon NRA in Reach 0. Fifty-three archaeological sites are present from Glen Canyon Dam down to River Mile 1.6 Right Bank below Lees Ferry. Fifty-one sites have 1 monitoring location, site C:2:11 has 12 monitoring locations, and site C:2:60 has 6 monitoring locations. NN = Navajo Nation, GLCA = Glen Canyon NRA. Fifty-four locations are scheduled to be monitored in FY97 (*).

AZ Site Number, Feature	FY96 Monitor	Monitoring Schedule	Land Owner
C:2:11, Feature 1 *		3-5 years	GLCA
Feature 3 *	x	Annual	GLCA, NN
Feature 4 *	x	Annual	GLCA
Feature 5	x	Biennial	NN
Feature 6 *	x	Annual	NN
Feature 11 *		3-5 years	GLCA
Feature 12 *	x	Annual	GLCA
Feature 13 *		3-5 years	GLCA
Feature 14 *	x	Annual	GLCA, NN
Feature 17	x	Biennial	GLCA
Feature 20 *		3-5 years	GLCA
Feature 21	x	Biennial	GLCA
C:2:12 *		3-5 years	NN
C:2:13 *	x	Annual	GLCA
C:2:32 *	x	Annual	GLCA
C:2:33	x	Biennial	GLCA
C:2:35 *	x	Annual	GLCA
C:2:36 *		3-5 years	GLCA
C:2:37	x	Biennial	GLCA
C:2:38 *	x	Semiannual	GLCA
C:2:39	x	Biennial	GLCA
C:2:40	x	Biennial	GLCA
C:2:41 *		3-5 years	NN
C:2:48	x	Biennial	NN

AZ Site Number, Feature	FY96 Monitor	Monitoring Schedule	Land Owner
C:2:50 *	x	Annual	GLCA
C:2:53	x	Biennial	GLCA
C:2:56 *		3-5 years	GLCA
C:2:57	x	Biennial	NN
C:2:58	x	Biennial	GLCA, NN
C:2:59		Discontinue	NN
C:2:60, Feature 1	x	Biennial	NN
Feature 2 *	x	Annual	NN
Feature 4 *		3-5 years	NN
Feature 6 *		3-5 years	NN
Feature 7 *		3-5 years	NN
Feature 8 *	x	Annual	NN
C:2:70	x	Biennial	GLCA
C:2:71 *	x	Biennial	GLCA
C:2:72 *	x	Annual	NN
C:2:73 *		3-5 years	GLCA
C:2:74	x	Biennial	GLCA
C:2:75 *	x	Annual	GLCA
C:2:76	x	Biennial	NN
C:2:77 *	x	Annual	GLCA
C:2:78 *	x	Annual	NN
C:2:79 *	x	Annual	GLCA
C:2:80	x	Biennial	GLCA
C:2:81 *	x	Semiannual	GLCA
C:2:82	x	Biennial	NN
C:2:83 *	x	Annual	NN
C:2:84	x	Biennial	GLCA

AZ Site Number, Feature	FY96 Monitor	Monitoring Schedule	Land Owner
C:2:86	x	Biennial	NN
C:2:87	x	Biennial	NN
C:2:88 *	x	Annual	GLCA
C:2:90	x	Biennial	NN
C:2:91 *	x	Annual	NN
C:2:95	x	Biennial	GLCA
C:2:99	x	Biennial	NN
C:2:100 *	x	Annual	NN
C:2:102 *		3-5 years	GLCA
C:2:103 *		3-5 years	GLCA
C:2:104	x	Biennial	GLCA
C:2:105	x	Biennial	GLCA
C:2:106	x	Biennial	NN
C:2:108	x	Biennial	NN
C:3:3	x	Biennial	GLCA
C:3:4	x	Biennial	GLCA
C:3:6	x	Biennial	GLCA
C:3:10	Excavated	Discontinue	GLCA
Totals	53	Discontinue = 1 Semiannual = 2 Annual = 21 Biennial = 31 3-5 years = 14	GLCA=40 NN=26 GLCA, NN=3

II. IMPACTS TO CULTURAL RESOURCES

Summary of Impacts

The monitoring efforts in FY96 document the continuing degradation of archaeological resources by a number of physical and human impacts, and there is a general increase in those impacts. Structural sites are probably less likely to be impacted by dam operations and/or river fluctuations, since they are usually located near the canyon walls and away from the terrace margins. Rock art and inscription panels are affected relatively less than other site types by impacts directly related to river fluctuations or dam operations, such as arroyo cutting, bank slumpage, and side canyon erosion.

For those monitoring locations associated with river-based drainages, there has been a considerable increase in almost all impact types since the last monitoring episode in FY95, whereas at the monitoring locations associated with terrace-based streams there have been relatively few increases in erosion. Surface erosion and eolian/alluvial erosion are affecting sites with river-based drainages and terrace-based drainages about equally. Arroyo cutting and side canyon erosion effect more sites with river-based drainages than those with terrace-based drainages.

FY96 is the first monitoring session that has recorded decreases in physical impacts in Glen Canyon NRA. Decreases in five physical impact categories are noted at six sites.

All site types exhibited human impacts about equally, and have increased since FY95. This is different from FY95 when only artifact scatters and sites with roasters/hearths had increases in visitor impacts.

Physical Impacts

The FY95 monitoring program resulted in 53 monitoring locations being inspected. Of these, 57% (N=30) received physical impacts since the last monitoring session. Physical impacts include surface erosion, gullies, arroyo cutting, bank slumpage, eolian/alluvial erosion, side canyon erosion, animal-caused erosion such as trailing and burrowing, and other impacts such as spalling and root/plant growth.

Table 2 summarizes these physical impacts. The table shows that 66.1% (N=37) of the monitoring locations exhibit surface erosion, and another 21.4% (N=12) exhibit an increase in surface erosion since the last monitoring episode. Gullying is impacting 42.9% (N=24) of the monitoring locations, and at 14.3% (N=8) of the monitoring locations, gullying has increased since the last monitoring episode.

Table 2. Physical impacts at 53 monitoring locations inspected during FY96 within Glen Canyon NRA. Three locations were monitored twice, equalling 56 monitoring episodes.

	Present	Increase	Decrease	Absent	Totals
Surface Erosion (0-10 cm)	37/66.1	12/21.4	2/3.6	5/8.9	56/100.0
Gullyng (10-100 cm)	24/42.9	8/14.3	1/1.8	23/41.1	56/100.0
Arroyo Cutting (> 1 m)	13/23.2	7/12.5	1/1.8	35/62.5	56/100.0
Bank Slumpage	6/10.7	9/16.1	1/1.8	40/71.4	56/100.0
Eolian/Alluvial Erosion/Deposition	29/51.8	11/19.6	1/1.8	15/26.8	56/100.0
Side Canyon Erosion	6/10.7	3/5.4	0/0.0	47/83.9	56/100.0
Animal-Caused Erosion (Trailing, Burrowing)	14/25.0	7/12.5	0/0.0	35/62.5	56/100.0
Other Physical Impacts (Spalling, Roots)	6/10.7	1/1.8	0/0.0	49/87.5	56/100.0

Arroyo cutting occurred at 23.2% (N=13) of the monitoring locations, and increased at 12.5% (N=7) since the last monitoring episode. The same trend is true for bank slumpage, eolian/alluvial erosion, side canyon erosion, and other impacts such as animal-caused erosion, spalling, and root/plant growth. There is a general increase in the amount of erosion since the last monitoring episode. However, at 6 sites, there is also evidence of a decrease in 5 physical impact types.

Table 3 presents the various physical impacts at the 22 monitoring locations inspected in FY96 within Glen Canyon NRA that contain structures and/or storage features. All types of erosion are present, and increases in various types of physical impacts occur at 12 monitoring locations. Surface erosion effects 63.6% (N=14) of the monitoring locations. Eolian/alluvial erosion effects 50.0% (N=11) of the monitoring locations. Animal-caused erosion (36.4%, N=8) and gullyng (27.3%, N=6) effect about the same number of monitoring locations.

Bank slumpage and side canyon erosion effect only 4.5% (N=1). These last two impacts, thought to be most closely related to river fluctuations and/or dam operations, along with arroyo cutting, effect relatively few structures and/or storage features, while surface erosion, eolian/alluvial erosion, and animal-caused erosion effect more structures and/or storage features. This pattern was also noted in FY95 (Burchett 1995:7), and as discussed there, it is probably because these kinds of features are usually located in relatively protected topographic situations, next to the cliff face away from the river and/or in rockshelters or overhangs. This may also suggest that structural sites are probably less likely to be impacted by dam operations and/or river fluctuations.

Table 3. Physical impacts at the 22 monitoring locations with structures and storage features inspected during FY96 within Glen Canyon NRA.

	Present	Increase	Decrease	Absent	Totals
Surface Erosion (0-10 cm)	14/63.6	4/18.2	0/0.0	4/18.2	22/100.0
Gullyng (10-100 cm)	6/27.3	3/13.6	0/0.0	13/59.1	22/100.0
Arroyo Cutting (> 1 m)	3/13.6	1/4.5	0/0.0	18/81.9	22/100.0
Bank Slumpage	1/4.6	1/4.6	0/0.0	20/90.8	22/100.0
Eolian/Alluvial Erosion/Deposition	11/50.0	2/9.1	0/0.0	9/40.9	22/100.0
Side Canyon Erosion	1/4.5	0/0.0	0/0.0	21/95.5	22/100.0
Animal-Caused Erosion (Trailing, Burrowing)	8/36.4	1/4.5	0/0.0	13/59.1	22/100.0
Other Physical Impacts (Spalling, Roots)	4/18.2	0/0.0	0/0.0	18/81.8	22/100.0

Table 4 presents the physical impacts at the 30 monitoring locations with artifact scatters inspected during FY96. The table indicates three groups. Similar frequencies of monitoring locations are effected by 1) surface erosion, gullyng, and eolian/alluvial erosion; by 2) arroyo cutting and animal-caused erosion; and by 3) bank slumpage and side canyon erosion. There has been an increase in all physical impact types, particularly in surface erosion, bank slumpage, eolian/alluvial erosion, and arroyo cutting. At the same time, 6 sites exhibit decreases in some kinds of physical impacts.

Twelve monitoring locations inspected in FY96 have roasters, hearths, or thermal features. Table 5 presents physical impacts at those locations. Surface erosion and eolian/alluvial erosion are impacting more sites than any other physical impact type. Bank slumpage and side canyon erosion, represented at relatively few sites, are though to be related to dam operations and river fluctuations. Finally, there has been an increase in the amount of every physical impact type except spalling and root/plant impact.

During FY96, 15 monitoring locations within Glen Canyon NRA contained rock art or historic inscriptions. Table 6 presents physical impacts at those locations. Wind and rain erosion to the panel surfaces effects 86.7% (N=13). Eolian/alluvial erosion effect 26.7% (N=4). Animals effect 20% (N=3). Bank slumpage effects certain areas of 13.3% (N=2) of the locations. The panels themselves are not being impacted by bank slumpage, but other areas of the sites are. Gullyng, arroyo cutting, and side canyon erosion are each effecting one site that has rock art. As noted in FY95 (Burchett 1995:9), it appears that rock art and inscription panels are effected relatively less by impacts directly related to river fluctuations or dam operations, such as arroyo cutting, bank slumpage, and side canyon erosion. There have been no increases in impacts to rock art.

Table 4. Physical impacts at 30 monitoring locations with artifact scatters inspected during FY96 within Glen Canyon NRA.

	Present	Increase	Decrease	Absent	Totals
Surface Erosion (0-10 cm)	21/70.0	7/23.3	2/6.7	0/0.0	30/100.0
Gullyng (10-100 cm)	18/60.1	4/13.3	1/3.3	7/23.3	30/100.0
Arroyo Cutting (> 1 m)	9/30.0	5/16.7	1/3.3	15/50.0	30/100.0
Bank Slumpage	3/10.0	6/20.0	1/3.3	20/66.7	30/100.0
Eolian/Alluvial Erosion/Deposition	17/56.7	6/20.0	1/3.3	6/20.0	30/100.0
Side Canyon Erosion	4/13.3	3/10.0	0/0.0	23/76.7	30/100.0
Animal-Caused Erosion (Trailing, Burrowing)	10/33.3	3/10.0	0/0.0	17/56.7	30/100.0
Other Physical Impacts (Spalling, Roots)	0/0.0	1/3.3	0/0.0	29/96.7	30/100.0

Table 5. Physical impacts at 12 monitoring locations with roasters/hearths inspected in FY96 within Glen Canyon NRA.

	Present	Increase	Absent	Totals
Surface Erosion (0-10 cm)	6/50.0	4/33.3	2/16.7	12/100.0
Gullyng (10-100 cm)	5/41.7	2/16.7	5/41.7	12/100.0
Arroyo Cutting (> 1 m)	4/33.3	2/16.7	6/50.0	12/100.0
Bank Slumpage	2/16.7	3/25.0	7/58.3	12/100.0
Eolian/Alluvial Erosion/Deposition	6/50.0	4/33.3	2/16.7	12/100.0
Side Canyon Erosion	2/16.7	1/8.3	9/75.0	12/100.0
Animal-Caused Erosion (Trailing, Burrowing)	3/25.0	3/25.0	6/50.0	12/100.0
Other Physical Impacts (Spalling, Roots)	0/0.0	0/0.0	12/100.0	12/100.0

Table 6. Physical impacts at 15 monitoring locations with rock art inspected during FY96 within Glen Canyon NRA.

	Present	Absent	Totals
Surface Erosion (0-10 cm)	13/86.7	2/13.3	15/100.0
Gullyng (10-100 cm)	1/6.7	14/93.3	15/100.0
Arroyo Cutting (> 1 m)	1/6.7	14/93.3	15/100.0
Bank Slumpage	2/13.3	13/86.7	15/100.0
Eolian/Alluvial Erosion/Deposition	4/26.7	11/73.3	15/100.0
Side Canyon Erosion	1/6.7	14/93.4	15/100.0
Animal-Caused Erosion (Trailing, Burrowing)	3/20.0	12/80.0	15/100.0
Other Physical Impacts (Spalling, Roots)	2/13.3	13/86.7	15/100.0

Of the 53 monitoring locations inspected in FY96, 49.1% (N=26) have river-based streams, draining to the Colorado River. Erosion of terrace-based streams occurs at 32.1% (N=17) of the monitoring locations. These have no relation to regulated flows since they do not reach the river, rather their effective base level is usually well above the river emptying onto a higher terrace. Both types of streams adversely impact archaeological sites, however.

Is there a relationship between stream type and the kinds of erosion impacting the sites? There seems to be. Table 7 is a cross tabulation of stream type versus the various kinds of erosional impacts. This table suggests that for sites with associated river-based drainages, surface erosion, gullyng, arroyo cutting, and eolian/alluvial erosion occur more frequently than bank slumpage, side canyon erosion, animal-caused erosion, and other physical impacts. The table also indicates that for those monitoring locations associated with river-based drainages, there has been a considerable increase in almost all impact types since the last monitoring episode in FY95, whereas at the monitoring locations associated with terrace-based streams there have been relatively few increases in erosion. These patterns were also noted in FY95 (Burchett 1995:10).

In addition, Table 7 suggests that for sites with associated terrace-based drainages, surface erosion, eolian/alluvial erosion, and gullyng occur more often than other physical impacts. Surface erosion and eolian/alluvial erosion are effecting sites with river-based drainages and terrace-based drainages about equally. Arroyo cutting and side canyon erosion effect more sites with river-based drainages than those with terrace-based drainages.

Table 7. Physical impacts versus stream type at the 53 monitoring locations inspected in FY96 within Glen Canyon NRA. The numbers in brackets indicate the number of sites showing an increase in the kinds of erosion specified. The numbers in paranthesis indicate the number of sites showing a decrease in the kinds of erosion specified. Ten of the 53 monitoring locations inspected in FY96 are associated with neither river-based or terrace-based drainages.

Frequencies	Stream Type	
	River-based (N=26)	Terrace-based (N=17)
Surface Erosion (0-10 cm)	15 [9] (2)	13 [2]
Gullying (10-100 cm)	14 [6] (1)	9 [2]
Arroyo Cutting (> 1 m)	10 [7] (1)	3
Bank Slumpage	4 [8] (1)	2 [1]
Eolian/Alluvial Erosion/Deposition	12 [8] (1)	11 [1]
Side Canyon Erosion	6 [3]	0
Animal-Caused Erosion (Trailing, Burrowing)	7 [6]	5 [1]
Other Physical Impacts (Spalling, Roots)	3 [1]	1

FY96 is the first monitoring session that has recorded decreases in physical impacts in Glen Canyon NRA. Decreases in five physical impact categories are noted at six sites (Table 7).

Human-Related Impacts

Of the 53 monitoring locations inspected in FY96, 10 exhibited human impacts, an additional 6 exhibited an increase in human impacts, and another exhibited a decrease in human impacts. The remaining 36 sites exhibited no human impacts. Human impacts of concern include collection piles, trailing, on-site camping, and vandalism. There was a collectors pile recorded at 2 monitoring locations with an increase at one other. Onsite camping was noted at 5 monitoring locations. There were no incidences of criminal vandalism. New human impacts are noted at 9 monitoring locations. Trails are present at 32 of the 53 monitoring locations. At one, trail impacts have increased; and at another, trail impacts have decreased. Trailing is one of the most devastating human impacts.

Table 8 indicates that all site types exhibited human impacts about equally. In addition, monitoring locations representing all site types have experienced increases in human impacts. This is different from FY95 where only artifact scatters and sites with roasters/hearths had increases in visitor impacts (Burchett 1995:12).

Table 8. Visitor impacts related to various cultural resources in FY96.

	Present	Increase	Decrease	Absent	Totals
Structures/Storage	3/15.0	1/5.0	0/0.0	16/80.0	20/100.0
Artifacts	4/12.9	3/9.7	1/3.2	23/74.2	31/100.0
Roasters/Hearths	3/23.1	1/7.7	0/0.0	9/69.2	13/100.0
Rockart/Inscriptions	4/25.0	2/12.5	0/0.0	10/62.5	16/100.0

III. SITE-SPECIFIC RESULTS AND RECOMMENDATIONS

This section briefly describes the site type, land ownership, physiographic position, stability, physical and human impacts observed during previous monitoring episodes are provided along with current evaluations of site impacts. A determination of whether the impacts are related to river fluctuations or dam operations is given. Site specific characteristics, tribal considerations, and management and remedial action recommendations are included.

Sixty-nine locations are monitored by Glen Canyon NRA in Reach 0 (see Table 1). Fifty-three archaeological sites are present from Glen Canyon Dam down to River Mile 1.6 Right Bank below Lees Ferry. Fifty-one sites have 1 monitoring location, site C:2:11 has 12 monitoring locations, and site C:2:60 has 6 monitoring locations. Reported here are the results of the FY96 monitoring effort, which included monitoring 53 locations once and 3 locations twice.

AZ C:2:11, Feature 3

On an alluvial terrace of the right bank of the Colorado River, Feature 3 is the Main Ferry Site. On the left bank, cable anchor posts are present on a steep talus slope above the Stanton Road. The Main Ferry Site includes 3 partially intact masonry structures, used from 1873 to 1928.

Previous Evaluations

The feature was monitored during the initial survey in FY91. Bank cutting was impacting the site directly, and bank slumpage and accelerated arroyo cutting have impacted the site indirectly. Surface erosion was also noted. More than two distinct trails were present, and camping evidence included the rearrangement and clearing of rocks, recent trash, and concentrated soil compaction.

In FY94, masonry elements were added to the west corner of Structure 1, and the cable was moved along the trail. On Structure 2, collapse of a masonry element on both chimneys was noted. There was no change to Structure 3, although human waste and toilet paper were noted nearby. On the left bank near the cable anchor posts, bank slumpage and alluvial erosion will eventually wash away the cable at the bottom of the feature below the Stanton Road. There was a decrease in evidence of camping.

In FY95, on the right bank of the river, there were no changes to any of the structures at the main ferry site. The cable was moved, however, indicating some visitation. There was no visible evidence of camping. On the left bank, some bank slumpage occurred below the Stanton Road.

Current Evaluation

In FY96, no changes were noted. Visitor impacts noted in past years are reduced.

Recommendations

Both the left and right bank portions of this feature should be monitored annually, and instrument mapping should be conducted.

AZ C:2:11, Feature 4

This is a dry laid sandstone corral located on the right bank of the Colorado River 240 meters upstream from Feature 3 on the same alluvial terrace.

Previous Evaluations

The feature was monitored during the initial survey in FY91. Bank cutting impacts the site directly and bank slumpage and arroyo cutting impact the site indirectly. There was evidence of surface erosion. One distinct trail was noted, and other visitor evidence includes the rearrangement and clearing of rocks, recent trash, and concentrated soil compaction. In FY94, the trail bisected both sides of the corral wall, but the stone elements making up the remaining wall segments were in stable condition. In FY95, surface erosion was still evident, but the walls were in stable condition. The trail through the walls was no more pronounced than during the FY94 monitoring episode.

Current Evaluation

In FY96, no changes were noted. The site remains in relatively stable condition.

Recommendations

The stable condition of this site suggests that it could be monitored less frequently than annually. Monitoring every other year is recommended, along with instrument mapping.

AZ C:2:11, Feature 5

This is on the left bank of the Colorado River on the Navajo Nation and consists of the Cable Crossing Inscriptions associated with travelers crossing at Lee's Ferry and generally dating to around the turn of the century. They are visible from the river.

Previous Evaluations

The feature was monitored in FYs 91, 92, and 94. No changes to the inscriptions were noted.

Current Evaluation

For FY96, Feature 5, consisting of inscriptions on boulders, is not affected specifically by the operation of the dam or river fluctuations. Surface erosion of the rock faces does occur, however.

Recommendations

The inscriptions should be monitored every other year due to their extreme visibility from the river. Instrument mapping and sketch drawing of the panels are also recommended.

AZ C:2:11, Feature 6

Located on the left bank of the Colorado River on the Navajo Nation, Feature 6 includes two enigmatic low masonry wall segments on Cable Crossing Hill. They probably date to the historic period.

Previous Evaluations

The feature was monitored in FYs 91, 92, 94, and 95. Surface erosion is noted, but the wall segments are in stable condition.

Current Evaluation

There are no changes noted in FY96.

Recommendations

This feature is on the same hill on which a stationary camera sets, and servicing of that camera occurs monthly. The site is monitored annually with little effort or further trailing impacts.

AZ C:2:11, Feature 12

The Charles H. Spencer Steamboat, on the National Register, is a feature of the Lee's Ferry Historic District that sank on the right bank of the Colorado River just above the Lee's Ferry boat launch in 1914. The steamboat is partially submerged in water and present-day shoreline/fluvial deposits.

Previous Evaluations

The feature was monitored in FYs 91, 92, 93, 94, and 95. Overall, the Spencer appears in better condition underwater than above. Extensive river fluctuations continue to cause wet-dry cycles to the bow of the steamboat.

In FY93, moss and algae in the center of the boat, growing up from the river bottom and on the port side, was not as abundant as in FY92. Underwater silt buildup in and around the vessel increased noticeably from FY92 to FY93, and the amount of algae and vegetation growth decreased. In the same period, human impacts were reduced. During low water, visitors have been known to stand on the boiler of the boat to fish. This was not observed in FY93, although it still may have occurred. Litter from picnickers was present on the nearby stream terrace, and visiting tour boats often float over the steamboat; their wakes cause continued movement of sediment.

From FY94 through FY95, continuing deterioration of the bow from wet-dry cycling was noted. The amount of algae and sediment increased, particularly on the stern of the boat. A trail was nearby on shore and was used by picnickers and people fishing.

Current Evaluation

The Charles H. Spencer Steamboat was monitored twice, before and after the beach building habitat flow in March-April FY96. On the first dive, monitoring points were established in several places from stern to bow to measure the depth of sediment. These measurements were compared with others taken on the second dive after the beach building habitat flow. These observations indicated that anywhere from 2 to 6 inches of sediment was deposited on the steamboat.

In addition, on the first dive, photographs were taken moving from stern to bow for comparison with photographs taken following the beach building habitat flow. These indicated an increase in sediment and a decrease in the amount of algae, which has since grown back. With the exception of the gear box, fire box, boiler, and bow sprits, three deck board widths of the starboard side of the boat are all that remains totally uncovered at this time.

Attempts were made to locate objects previously recorded on the starboard side of the boat. But nothing was found, suggesting these items were either covered with silt, or they could have dropped into the bottom of the channel, which is adjacent to the starboard side of the boat. These items include a Sampson post cap, throttle valve, heater and exhaust pipe, smoke stack funnel collar, bilge pump, several truss rods, several sections of pipe, and several disarticulated pieces of wood and decking.

Recommendations

The steamboat is monitored by a stationary camera located on the opposite side of the river. Recommendations for best preserving the steamboat include extending the no-wake zone around the Lees Ferry boat launch area to incorporate the Spencer, and keeping the vessel underwater at all times. An "ideal" flow of 12,000 cfs or higher would accomplish the latter recommendation. The steamboat should be monitored annually from the shore, and monitored underwater prior to and following any extremely high or low flows. In addition, to prevent people from fishing from on top of the boiler, we have directed the placement of a sign on shore just above the steamboat to

inform visitors of the significance of the steamboat and asking their cooperation not to climb onto the boiler.

AZ C:2:11, Feature 14

This feature is located on the left and right banks of the Colorado River just upstream from Lee's Ferry on old alluvial terraces. It consists of the abutments of the USGS Cableway, and is included in the Lee's Ferry Historic District. The remnants on the right bank consist of concrete cable anchors, and the remnants on the left bank are on the Navajo Nation and consist of concrete cable anchors, a still-standing A-frame tower, and a cable car.

Previous Evaluations

The feature was monitored in FYs 91, 92, 93, and 94. The monitoring episodes indicate that the right bank concrete cable anchors are in stable condition. They do not appear to be threatened by either river fluctuations or dam operations.

The monitoring episodes have recorded no change in the condition of the concrete cable anchors and the tower on the left bank of the river. However, the cable car has been humanly impacted since the FY92 monitoring episode. The wooden board frame on the front, back, and right sides of the cable car have been peeled away and rearranged on the ground nearby. More importantly, the terrace on which the remains set is being dissected by side canyon erosion caused by river fluctuations. The towers, artifacts, and ground surface around them were being distributed by surface erosion, gullying, arroyo cutting, bank slumpage, and side canyon erosion.

Due to the stable condition of the concrete cable anchors on the right bank, monitoring was discontinued in FY95. On the left bank, the FY95 monitoring effort has indicated an increase in surface erosion near the cable car. The loose boards continue to be move.

Current Evaluation

As in previous monitoring episodes, the FY96 results were that the loose boards from the cable car are continuing to be displaced.

Recommendations

The elements of Feature 14 on the left bank of the river are monitored by a stationary camera, and they should be monitored by an archaeologist annually, since they are being disturbed by impacts related to river fluctuations. In addition, instrument mapping of the left bank elements of Feature 14 is recommended. Possible remedial actions include installing check dams and revegetation.

AZ C:2:11, Feature 17

This feature, called the Spencer Steamboat Inscriptions, includes a series of historic and modern inscriptions located on the right bank of the Colorado River. They are inscribed into an unpatinated Wingate sandstone outcrop 15 m south and directly above the downstream end of the Spencer Steamboat. The earliest inscription is of G. M. Wright, Nov. 17, 1892. The panel is visible from the river and from the steamboat.

Previous Evaluations

The feature was monitored in FYs 91 and 94. There is a trail directly below the inscriptions, as well as a viewing area for the Steamboat directly above. The most apparent impact is the addition of modern graffiti. The names Lee Seller and possibly Ramon Albert were added since 1979. In FY94, some erosion to the panel surface was noted; otherwise, the inscriptions are intact.

Current Evaluation

Random trailing down from the main trail above the panel was noted in FY96. There were no other changes noted. The panel is not being impacted by river fluctuations or operations of the dam.

Recommendations

Due to the visibility of the panel from the river, monitoring is recommended every other year.

AZ C:2:11, Feature 21

This includes historic hogans on the right bank of the Colorado River.

Previous Evaluations

The feature was monitored in FYs 91 and 94. In FY91, the hogans were noted in stable condition. In FY94, surface erosion, gullyng, and arroyo cutting were impacting the masonry walls, and vegetation was impacting one of the hogans, but the hogans remained in stable condition. These physical impacts are not related to river fluctuations.

Current Evaluation

In FY96, vegetation is still growing in one of the hogans.

Recommendations

A rock line trail leads to the area from the Lee's Ferry launch ramp parking lot nearby, and given the proximity of the site to modern day activities at the launch ramp, monitoring every other year is recommended. The structures should be mapped as a form of data recovery and to manage the

erosion. The vegetation within the hogan should be carefully removed to eliminate that impact.

AZ C:2:13

This prehistoric site consists of a rock shelter with a low dry-laid wall enclosing the front. A sherd and lithic artifact scatter is present along with a small petroglyph panel. The site is located on the Navajo Nation on an alluvial terrace and talus slope where it contacts with a low Kayenta sandstone cliff face.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. It is actively eroding with impacts from sheet washing, gullying, arroyo cutting, and bank slumpage. A small rivulet crosses the site and drains into a river-based stream west of the site. Extensive trampling and trailing are also present. Evidence of camping on the site was noted in FY91, however, no trace of that activity was noted during the FY93 monitoring session. In FY94, surface erosion was noted for Features 1 and 3, the structures. Animals have rubbed against the rock art panel, eroding the lower portions of the petroglyphs. The artifact scatter in front of rock art panel 1 and Feature 1, the rock shelter, is continuing to erode through gully washing down the rivulet. Feature 2, on a high cutbank of the river-based stream, was eroding. In FY95, surface erosion did not increase.

Current Evaluation

In FY96, movement of the wooden logs of Feature 2 was noted. There was no change to Features 1 and 3. Surface erosion is present on the structures and the rock art, but there does not appear to have been an increase in erosion.

Recommendations

Annual monitoring is recommended, since the features, particularly Feature 2, are continuing to erode into a river-based stream. Mapping and testing of the cultural resources present are also recommended, since materials are being displaced.

AZ C:2:32

This site is a series of charcoal lenses eroding from a high cutbank of an alluvial terrace on the left bank of the river.

Previous Evaluations

The site is actively eroding with physical impacts including surface erosion, gullying, arroyo cutting, and bank slumpage. The cutbank was undermined by 1983 high CFS releases, causing bank slumpage and steepening and

widening of gullies and the arroyo east of the site. These impacts are related to river fluctuations and dam operations, specifically, direct inundation, bank slumpage and steepening adjacent to the current high water zone and headward migration of arroyos due to lowering base levels. A river-based arroyo is present 20 m east of the site. An increase in gully and arroyo cutting east of the site datum was not noted between FYs 92 and 93. There were no human-related impacts. In FY94, the continued loss of the lens and the terrace deposits was noted. Impacts included surface erosion, gullyng, arroyo cutting, and bank slumpage. An increase in bank slumpage occurred in FY95.

Current Evaluation

In FY96, no changes were noted. The lenses were not impacted by the beach building habitat flow conducted in the spring. However, sections of the cutbank just upstream and downstream from the lenses did collapse into the river.

Recommendations

The site is being monitored by a stationary camera located on the opposite side of the river. Additionally, on-site monitoring should take place annually.

AZ C:2:33

On the right bank of the Colorado River, this is a small rock shelter with the remains of a crude, wet-laid granary, an associated sherd and lithic scatter, and a possible storage space in a low bedrock shelf. The site overlooks the River Drive near the junction at its southwest end. It is located on prehistoric fluvial deposits at the base of a Kaibab Limestone cliff.

Previous Evaluations

The site was monitored in FYs 91 and 94. Site condition was considered poor, being directly impacted by bank slumpage, and surface erosion. The granary is being impacted by surface erosion and two masonry elements have collapsed. The artifacts are being displaced by surface erosion, gullyng, and trailing. It was recommended to monitor the granary because it is visible from the road, and the walls are extremely fragile.

Current Evaluation

The FY96 monitoring program noted no further change in site condition. The impacts noted above are not related to the operation of the Dam.

Recommendations

Since the granary is highly visible from the road, biennial monitoring is recommended. Stabilization of the granary wall and testing of the artifact scatter are recommended as well.

AZ C:2:35

This is a PII Anasazi site containing an extremely sparse lithic and ceramic artifact scatter with a low wall. A charcoal stain indicating a hearth is also present. The site is located in old Colorado River alluvium and covered with shallow colluvium.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. The site sets back away from a high cutbank of the Colorado River. It is moderately stable in that fragile features are present but are not actively eroding. Away from the features, the site exhibits incipient erosion with surface erosion, gullyng, and arroyo cutting present. Human impacts consist of a single trail to the site, which was not noted in FY91. These impacts do not appear to be related to river fluctuations or dam operations; however, there is a high potential for slope erosion due to gullyng and arroyo cutting. Sherds are being washed down the gully north of the main site area. Gullyng occurs on either side of the boulder outcrop/wall area and below the wall. The few artifacts and a midden area below the wall are threatened by continuing gully action. More serious undercutting of the river bank directly to the south may add to the site deterioration in the future. The wall appears unchanged from the FY91 to the FY93 monitoring episodes. The successive monitoring episodes evidenced continuing erosion of the midden area.

The FY94 monitoring effort showed that the structure, hearth, and artifacts were being impacted by surface erosion, and gullyng and arroyo cutting were impacting the artifact scatter. As noted in the FY93 monitoring episode, there was a high potential for slope erosion due to gullyng and arroyo cutting. Sherds and lithic artifacts were washing down the gully north of the main site area. The cutbank south of the site was slumping as a result of river level fluctuations.

As in previous evaluations, FY95 monitoring showed that there is a high potential for slope erosion due to gullyng and arroyo cutting. The slumping cutbank on the south side of the site has not caused any damage as of yet, however. The surface sample unit was checked, and there was no change in the position of the artifacts. The collector's pile shows evidence of human visitation. A flake was moved and replaced in a different position. A light trail is still discernable along the terrace.

Current Evaluation

In FY96, surface erosion was evident on the wall, the hearth, and artifacts. A light trail is still noticeable, but no footprints were present. No other changes were noted.

Recommendations

Annual monitoring is recommended due to the proximity of the site to the river cutbank.

AZ C:2:37

This is Faatz Camp, the Hot Panel, consisting of prehistoric petroglyphs and historic inscriptions situated at the base of a Navajo Sandstone cliff. The glyphs are visible directly from the River.

Previous Evaluations

The site was monitored in FYs 91 and 94. Most of the impacts are physical, exfoliation, erosion, and patination of the rock surfaces. Human impacts are graffiti scratches beneath the middle panel, yet they are not recent. Vandalism and physical erosion/exfoliation of the rock surfaces are long-term threats. The prehistoric rock art and historic inscriptions are being impacted by erosion of the panel surface through exfoliation. Since FY91, new graffiti next to the historic inscription "G.M. Wright" includes the name "Tom" scratched into the panel surface.

Current Evaluation

In FY96, no change was noted to the prehistoric petroglyphs. However, the graffiti "km" is noted just east of the historic inscription.

Recommendations

Graffiti has been recently added to the rock surface. The panel is visible directly from the River, therefore, biennial monitoring is recommended.

AZ C:2:38

This site is a petroglyph panel situated at the base of a vertical Navajo sandstone cliff face where it joins a fluvial terrace. There are two possible prehistoric components at this site, late Archaic and PI-PIII Anasazi. The terrace in front of the panel probably contains buried cultural materials.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. This rock art site is visited by over 40,000 people per year on guided tours. This causes surface erosion to the terrace in front of the panel. In earlier monitoring episodes, extensive trailing could be seen meandering through the tamarisk and across the terrace to the panel, and the rock-lined trail that leads to the panel was kicked out and displaced.

The panel has undergone continuing impacts from graffiti, and the panel surface itself is impacted by wind, rain, and exfoliation. The modern dry-laid rock wall in front of the panel has been impacted by human visitation. Several of the large rocks from the top of the wall have been knocked to the ground. These impacts are not directly related to the river fluctuations or to dam operations.

The site was visited twice during the FY95 monitoring effort. The first visit in March indicated that the dry-laid wall in front of the panel had been impacted by visitors displacing masonry elements. The second visit in June indicated no further change. The graffiti problem is under control for the present. A more concerted effort has been made to train tour guides about the importance of controlling this impact, and an NPS interpretive ranger is on site during much of the week.

Current Evaluation

In FY96, the site was monitored twice. The first monitoring episode, in October, 1995, noted the addition of a "B" near the FY94 "Danny Foust" graffiti. The petroglyph panel itself was not impacted. The second monitoring episode, in June, 1996, noted no changes.

On May 16, 1996, this site was monitored by members of the Zuni Tribe. They noted that there seems to be an increase in the amount of sediment loss at the base of the petroglyph panel, and they noted a number of footprints inside the stone wall built to keep people out.

Recommended Remedial Actions

The site is monitored by stationary camera on a daily basis. On-site semiannual monitoring will continue due to the extreme visitation this petroglyph panel receives, and since there are probably buried cultural components in the terrace in front of the panel.

To reduce the loss of sediment at the base of the petroglyph panel caused by heavy visitation, the Zuni Tribe has recommended that the stone wall be augmented by adding more courses of stone and by the addition of poles and sticks to build the fence up to 3-4 feet high. Also, they recommended to plant more desert cactus inside the fence to deter access.

As a component of the ongoing trail maintenance program at Glen Canyon NRA, the trail to the petroglyph panel was upgraded by stabilizing the base of

the trail. This has reduced the amount of downcutting and erosion to the terrace. Other trails that meandered across the terrace to the site have been reduced.

When cultural resources are exposed on the terrace in front of the petroglyph panel, testing to determine the nature and extent of the subsurface cultural deposits will be recommended.

AZ C:2:39

This is a lithic reduction and procurement area on two large prominent terraces atop Navajo Sandstone slickrock on the right bank of the Colorado River. The terraces are littered with a variety of river cobble lithic materials.

Previous Evaluations

This site was monitored in FYs 91, 92, and 94. There is some evidence of surface erosion and gullying. A trail leads up from the sand bar camping area directly below the terraces, but visitation appears to be light. These impacts are not related to the operation of the Dam or river fluctuations. Surface and gully erosion are on-going, and trailing and animal burrowing are noted. Two collection piles were noted since the monitoring episode in FY92.

Current Evaluation

In FY96, the collection piles noted in FY94 were not seen. Surface and gully erosion are ongoing, but have not increased in intensity.

Recommendations

Biennial monitoring is suggested due to the visitor impacts. Mapping as a measure to protect the integrity of the site is recommended for the future.

AZ C:2:40

This site is located on the right bank of the Colorado River and consists of lithic artifacts, including flakes, cores, and a hammerstone, on an old alluvial terrace at the base of the Navajo Sandstone cliff face where a slight bedrock indentation creates a degree of shelter from weather.

Previous Evaluations

This site was monitored in FYs 91 and 94. It is impacted by minimal surface erosion, gullying, and one arroyo. There is evidence of one trail accessing the site from the beach area below. These impacts are not related to river fluctuations, but surface erosion and gullying are displacing artifacts. No human impacts were noted in FY94.

Current Evaluation

In FY96, no changes were noted.

Recommendations

The site is not being impacted by river fluctuations or dam operations, but it is being eroded. Therefore, it should be monitored biennially. Instrument mapping is also recommended in the future.

AZ C:2:48

This is the Lee's Backbone wagon road, an historic trail used in the early 1870s to access the original and upper Lee's Ferry crossings. The trail is located on the left bank of the river on the Navajo Nation at the base of the Shinarump Conglomerate slope where it joins the Chinle formation. Occasional remnants of the rock work bordering the road and wagon ruts can be discerned. One notable feature is Sentinel Rock, which contains an incised 1878 inscription recording the passing of the "First Mesa Company" under the command of Hyrum S. Phelps.

Previous Evaluations

The site was monitored in FYs 91, 93, and 94. Site condition is considered poor, but fairly stable. There is evidence of surface erosion, gullying and arroyo cutting through the Shinarump Conglomerate. This erosion may threaten the wagon ruts. Evidence of human impact between the FYs 91 and 93 monitoring episodes includes graffiti on the east face of the 'E' boulder at the bottom of the wagon road. These physical and human impacts are not related to river fluctuations and dam operations. No new impacts occurred between FYs 93 and 94.

Current Evaluation

In FY96, recent bank slumping of the south cutbank above a section of the road was noted, causing this portion of the road to be buried. The site is considered to be in poor condition, but the road itself is in stable condition. No recent graffiti was noted.

Recommendations

The site is stable and it is not being impacted by river fluctuations or dam operations. Biennial monitoring is suggested.

AZ C:2:50

This is a multicomponent camp consisting of two loci situated on the narrow remnant of an alluvial terrace on the right bank of the Colorado River. Locus A contains a fire-cracked rock scatter with charcoal, a cobble concentration and nearby hearth, and artifacts. Locus B contains a cist,

fire-cracked rock, charcoal stains, the remains of an eroded structure, and artifacts.

Previous Evaluations

This site was monitored in FYs 91, 94 and 95. Bank cutting directly impacts the site and accelerated arroyo cutting and bank slumpage are occurring. river-based arroyos are present. Surface erosion and gullying are noted as well. A trail across the site is frequented by day hikers who access the area from the nearby Paria River riffle overlook parking area. The FY94 monitoring effort recorded a small pothole in Feature 7, a roaster. The FY95 monitoring recorded that surface erosion, gullying, and arroyo cutting were impacting both loci. Trailing through the site has caused movement of three stone elements in Feature 6.

Current Evaluation

In FY96, no change was noted for Features 1, 2, 4, 5, 6, 7, and 8. Feature 1.5 exhibited the displacement and removal of some stones and some rodent damage. Feature 3 exhibited the loss of some sandstone elements.

Recommendations and Remedial Actions

Since the site is being impacted by fluctuating levels of the Colorado River, annual monitoring is recommended. The trail through the site should be better defined, possibly lined with rocks, to redirect foot traffic away from the features. Instrument mapping and testing of subsurface cultural deposits are recommended.

AZ C:2:53

This site is located on the right bank of the Colorado River and consists of a ceramic and lithic artifact scatter in a flat, fairly denuded area that used to be a plowed field. The site is near the Weaver Ranch House at Lonely Dell Ranch.

Previous Evaluations

The site was monitored in FYs 91, 92, and 94. It is located on the flood plain of the Paria River and could be impacted by high water floods. It is also below the 300,000 cfs level. Farming and ranching activities at Lonely Dell Ranch have impacted the site historically, and artifact collecting by tourists visiting the ranch has probably occurred.

Current Evaluation

No changes were noted during FY96 monitoring. The site is not being impacted by river fluctuations or dam operations, but surface erosion is displacing the artifacts. The site is located in a plowed field and has been heavily disturbed over the years.

Recommendations

The site is not being impacted by river fluctuations or dam operations. It is visited by tourists who come to see Lonely Dell Ranch. Therefore, biennial monitoring is recommended. Testing to establish the presence of buried cultural deposits in this alluvial terrace is suggested.

AZ C:2:57

This is an historic site consisting of six distinguishable structures and associated trash. It is located on the left bank of the river on the Navajo Nation where the fluvial terrace contacts Moenkopi sandstone bedrock exposures.

Previous Evaluations

This site was monitored in FYs 91, 92, 93 and 94. There is extensive surface erosion, gulying, minor arroyo cutting, and trailing. Several gullies continue to run directly into Features 1 and 2, and a fairly active arroyo drains directly northwest of Feature 5. Also, artifacts are being washed away from the site by arroyo/gully runoff and surface erosion. None of these impacts are related to river fluctuations or dam operations. In FY94, surface erosion, gulying, arroyo cutting, and trailing were impacting the structures. Feature 1 exhibited collapse of its wooden wall elements on its south side. Feature 2 exhibited loss of a piece of milled wood from the south wall. Feature 3 exhibits erosion of its basal elements on the inside fence near the lambing? pen, undercutting the foundation. There was no change to Features 4, 5 and 7. On the south end of the exterior east wall of Feature 6, a sandstone slab was broken in two.

Current Evaluation

In FY96, several changes are noted. The fill on the exterior north wall of Feature 2 exhibits increases in rodent/cattle caused erosion. Surface erosion is also undercutting the northwest corner of the structure. Feature 2 also shows evidence of human visitation. There is a newly started collection pile of historic wood behind the south wall. These are actually removed roof beams. Some south wall stone elements have also been removed or collapsed. South of Feature 3, a lambing pen, gulying is severe, it is undercutting the wall.

Recommended Remedial Actions

The site is not being impacted by river fluctuations or dam operations. Biennial monitoring is recommended to record continuing non-river-related erosion. Feature 1 and the main habitation structure, Feature 2, should be stabilized soon, and all the structures should be mapped in detail. Surface collection of historic diagnostic items is also suggested. The gulying underneath the wall of Feature 3 should be eliminated.

This site consists of four loci, three on the left bank on the Navajo Nation and the fourth on the right bank. Resources include historic inscriptions, ephemeral masonry rooms, and cement cable anchors for the Bureau of Reclamation cableway on both sides of the river. The loci are located on narrow alluvial terraces and colluvial slopes above the river. Locus A, LB: Reclamation Cableway Features and Inscriptions. Locus B, LB: Masonry Rooms. Locus C, LB: Concrete Slab w/Trash. Locus D, RB: portion of the Cableway.

Previous Evaluations

The site was monitored in FYs 91, 93 and 94. Physical impacts include surface erosion, gullyng, and arroyo cutting. Between FYs 91 and 93, however, no changes were noted. Human impacts are limited to trails on both sides of the river. None of these impacts are related to river fluctuations or dam operations. No changes were noted at any of the loci in FY94, although the ground surfaces the features lie upon are impacted by surface erosion, gullyng, arroyo cutting, and side canyon erosion. The surfaces of the inscription panels are being eroded by eolian forces.

Current Evaluation

In FY96, Loci A, B and C exhibited no changes. Locus D, on the north side of the river, received heavy disturbance from a side-channel debris flow. Movement and displacement of large boulders in the bottom of the channel adjacent to the iron anchor occurred. The pipe that was semi-buried and the tin cans are no longer present, and the section of cable noted in previous monitoring episodes is gone. In addition, there appears to be new graffiti on the wall next to the iron anchor.

Recommendations

The erosional impacts are not related to river fluctuations or dam operations. Biennial monitoring is recommended to record non-river-related erosion at Loci A, B, and C. For Locus D, not much is left of the artifacts following the debris flow, therefore, monitoring should be limited to every 3-5 years at the maximum.

AZ C:2:60, Feature 1

Feature 1 is an historic forge and inscriptions on a Pleistocene terrace along the Stanton Road on the left bank of the river. The feature is located on the Navajo Nation.

Previous Evaluations

The feature was monitored in FYs 91, 93 and 94. The site is considered stable with only slight wind deflation occurring. Minor exfoliation of the bedrock ledges may impact the feature in the future. A trail is located just below the feature, but it is not directly impacting the feature. There are

fire scars and rearrangement of rocks, suggestive of camping, but no new graffiti, human foot prints, or other evidence of recent visitation is noted. In FY94, the surface of the inscription panel was being eroded by wind, and some modern graffiti had impacted the historic graffiti. Some deposition occurred inside the forge. The inscription panel is visible from the trail below.

Current Evaluation

In FY96, no changes were noted.

Recommendations

The feature is not being impacted by river fluctuations or dam operations. Biennial monitoring is recommended to record non-river-related impacts.

AZ C:2:60, Feature 2

Feature 2 is a remnant masonry structure on the edge of a narrow alluvial terrace along the Stanton Road. The feature is on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 93 and 94. Active erosion is occurring. Pre-dam floods have cut the river bank precariously close to the structure, and fluctuating water levels may cause further bank slumpage. Surface erosion, wind deflation, and trailing also occur. There were fewer human impacts observed in FY93 than there were in FY91. No changes were noted in FY94.

Current Evaluation

In FY96, no changes were noted. There is a lack of vegetation due to the drought, however.

Recommendations and Remedial Actions

The structure is near an eroding cutbank of the Colorado River. Therefore, it should be monitored annually. Additionally, the structure should be stabilized.

AZ C:2:60, Feature 8

Feature 8 is an historic petroglyph located on a steep Pleistocene terrace on the left bank of the river on the Navajo Nation.

Previous Evaluations

This feature was monitored in FYs 91, 93, 94 and 95. The rock art element is in stable condition with no physical or human impacts evident, except for some slight surface erosion of the stone. The glyph can be seen from a nearby trail.

Current Evaluation

In FY96, no changes were noted. Other than some surface erosion to the panel, it is not impacted by physical or human agents.

Recommendations

The panel is not being impacted by river fluctuations or dam operations. A biennial monitoring schedule is recommended due to its visibility from and proximity to the trail.

AZ C:2:70

This site is on the right bank of the Colorado River and consists of a small Kaibab limestone rockshelter with a light scatter of lithics and sherds on the talus slope below. The site is above River Drive.

Previous Evaluations

The site was monitored in FYs 91 and 94. Impacts include pack rat activity in the shelter. Artifacts are eroding down the talus slope. The impacts are not related to river fluctuations or dam operations. In FY94, surface erosion and trailing were displacing the artifacts.

Current Evaluation

In FY96, no further impacts affected the site.

Recommendations

A biennial monitoring schedule is recommended to record non-river-related erosional patterns.

AZ C:2:71

This site consists of an artifact scatter and petroglyph. It is located on an alluvial terrace on the left side of the river.

Previous Evaluations

The site was monitored in FYs 91, 93 and 94. The FY91 monitoring results suggest that overall, the site has been heavily impacted. Locus A is impacted by humans collecting, piling, and stashing artifacts. A pot hole was

dug at the base of a large boulder. Surface erosion is also evident. At Locus B, the anthropomorphic petroglyph panel surface is highly eroded from wind and rain. Small spalls have broken away from the cliff face on and around the figure. In FY93, the previously noted collection pile was gone. Recent trash included one aluminum can and one plastic fork. These impacts are not related to river fluctuations or dam operations. In FY94 surface erosion was displacing the artifacts, and the surface of the rock art panel is eroding from eolian forces.

Current Evaluation

In FY96, impacts include rodent activity, which has moved some sticks and further exposed 2 stones in back of the shelter. The can noted in FY93 is in its same position outside the overhang.

Recommendations

A biennial monitoring schedule is recommended to record ongoing non-river-related impacts.

AZ C:2:72

This site is a prehistoric artifact scatter with associated buried hearth features. It is located on the left bank on the Navajo Nation on a Pleistocene alluvial terrace.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, 94 and 95. Surface erosion, gullying, arroyo cutting, bank slumpage, and side canyon erosion have all increased. The headward migration of arroyos is extremely active on and around the site. The main arroyo at the east-northeast site boundary drains to the Colorado River. The site is being impacted by fluctuating river flows. A buried hearth has collapsed into the arroyo, and these same agents are displacing the artifact scatter. A visitor trail has also impacted one of the hearths. No changes were noted during the FY95 monitoring episode.

Current Evaluation

In FY96, animals have trampled the center of the hearth disturbing the charcoal deposit. There is an increase in arroyo cutting and bank slumpage at the check dam.

Recommendations and Remedial Actions

Due to the active erosion, it is recommended that monitoring continue annually. Monitoring efforts should concentrate on the migration of side arroyos that drain into the main arroyo noted above. Recommended remedial actions to reduce site impacts include planting vegetation and the installation of check dams. Mapping as a form of data recovery is suggested for the near future.

AZ C:2:74

This site is an alcove shelter containing six flakes and a fragmented mano. Other remains are probably still buried. It is located on an upper stream terrace at the base of a Navajo sandstone cliff.

Previous Evaluations

The site was monitored in FYs 91, 92 and 94. It is being impacted by surface erosion, gullying, and animal burrowing. In FY94, surface erosion and gullying were displacing the artifacts. These impacts are not related to fluctuating river flows or dam operations. The mano fragment was relocated. None of the flakes noted as being previously present were observed. However, an increase in vegetation may have been obscuring the artifacts.

Current Evaluation

In FY96, displacement of the mano fragment is noted, caused by animals. Again, none of the flakes noted in FY92 were observed.

Recommendations

The site should be monitored on a biennial schedule to record continuing non-river-related impacts.

AZ C:2:75

This is a prehistoric camp and artifact scatter located on an alluvial terrace at the base of the Navajo sandstone cliff on the left bank of the river.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, 94 and 95, and it is actively eroding. Surface erosion, bank slumpage, dune migration, gullying, and arroyo cutting are noted impacts. A trail from the Ferry Swale camp site climbs through Locus A. Since the FY91 monitoring episode, the artifacts in Locus B are being displaced by surface erosion, gullying, arroyo cutting, bank slumpage, and side canyon erosion, and new evidence of bank slumpage is present in Locus B, increasing the size of the arroyo.

These impacts are directly related to river fluctuations and dam operations. A deep arroyo continues to cause heavy impact with major undercutting of the terrace bank, which has caused the loss of most of the site. Slickrock runoff from the side canyons is impacting the site as well.

In FY95, bank slumpage in Locus B increased. There was also an increase in arroyo cutting and side canyon erosion. There were no changes in a surface sample unit placed to measure the movement of artifacts.

Current Evaluation

In FY96, monitoring noted an increase in bank slumpage in both Loci A and B. In Locus B the terrace margin has retreated back to the edge of the surface sample unit, although no artifacts on the surface of the sample unit have moved. Some charcoal staining is noted around the northwest corner of the surface sample unit.

Recommendations

The site should be monitored annually. Recommended data collection measures include surface collection of the entire site and testing for subsurface deposits. The site was instrument mapped on April 13, 1995.

AZ C:2:76

This is a single slab-lined hearth with an associated artifact scatter located on the left bank of the river on the Navajo Nation. The site is located on top of a sandy alluvial terrace near the base of Navajo sandstone cliffs.

Previous Evaluations

The site was monitored in FYs 91, 93 and 94. The hearth is intact with vegetation growing from its center. Surface erosion and gulying are noted nearby. A small gully 6 m to the northeast of the site runs north to the drainage down Waterholes Canyon, thence to the Colorado River. Extreme fluctuations in flows may result in impacts from arroyo cutting and bank slumpage. The FY91 monitoring episode noted modern campsite remains and trash. These impacts were not observed in FY93. A trail was noted, however. In FY94, the hearth was filling with sediment from recent rain storms. Eventually, the nearby gully will erode headward to the hearth.

Current Evaluation

In FY96, more sediment is noted in the hearth. The gully noted in FY94 is increasing in size and is moving headward toward the hearth from the north. The trail on top of the terrace is fading. There is no evidence of visitation.

Recommendations

Consultation with the Navajo Nation Historic Preservation Department resulted in a biennial monitoring schedule initially and then every 3-5 years. The trail is being obliterated physically. In FY94, rain storms created a gully that is migrating headward toward the hearth. The installation of a small check dam to fill the gully would help to reduce the potential of this impact.

This prehistoric artifact scatter on the left bank of the river is spread over the first alluvial terrace and is eroding from the cutbank of the second alluvial terrace.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. In FY91, gullying was noted along the terrace edge, and one arroyo was present 50 m south of the site. The terrace slope was eroding from sheetwashing and human foot traffic. No trails were present, just random foot prints. Gullying from heavy runoff could cause the terrace margin to retreat.

The FY93 monitoring results showed similar minor impacts caused by surface erosion, gullying, wind deflation, and bank slumpage. There was also recent camper trash. The impacts are not related to river fluctuations and dam operations. The FY94 monitoring effort documented the displacement of artifacts by surface erosion, gullying and bank slumpage. The FY95 monitoring effort documented no further impacts. In FY94, a surface sample unit was placed to record the movement of artifacts by surface erosion. The monitoring effort recorded that no movement of artifacts occurred.

Current Evaluation

In FY96, some minor surface erosion is documented in the lithic concentration. The surface sample unit exhibits fewer flakes. Collection from visitors may have occurred. Ferry Swale Camp is nearby and is often occupied.

Recommendations

The site should be monitored biennially to record non-river-related impacts. Testing for subsurface cultural deposits is recommended. The site was instrument mapped on April 13, 1995.

This site, on the right bank of the Colorado River, is beneath a small Navajo sandstone rockshelter at the head of a major arroyo that cuts through the uppermost river terrace. Lithic artifacts are eroding out of the floor and down a loose slope below the shelter.

Previous Evaluations

The site was monitored in FYs 91, 94 and 95. The site is not currently being impacted by the Colorado River, but the arroyo through the terrace is cutting headward 4 m west of the site. Surface erosion, arroyo cutting, and side canyon erosion are displacing the artifacts. In FY95, surface erosion increased since FY94, but all artifacts plotted on the original site map were relocated.

Current Evaluation

In FY96, eolian deposition has increased and surface erosion has decreased, thus slowing the eroding impacts to the site.

Recommendations

The site should be monitored annually. Instrument mapping, surface collection, and testing for subsurface deposits is also recommended.

AZ C:2:79

This site is located on the left bank of the Colorado River in and around a rockshelter on a talus ridge at the contact with a Navajo sandstone cliff face. Ceramic and lithic artifacts and a masonry wall segment are present and suggest an early-mid PII Anasazi affiliation.

Previous Evaluations

The site was monitored in FYs 91, 94 and 95. The wall is being impacted by surface erosion, gullyng, and vegetation. The artifacts are being displaced by surface erosion, gullyng, and arroyo cutting. The arroyo is a river-based stream, draining to the Colorado River. Impacts are related to river fluctuations and dam operations. As noted during the FY94 monitoring episode, vegetation was still impacting the structure wall in FY95, but there were no increase in impacts.

Current Evaluation

No changes were noted in FY96.

Recommendations

The site should be monitored annually. It was mapped by total station equipment on April 13, 1995.

AZ C:2:80

This site is on the right bank of the Colorado River and consists of a lithic scatter at the base of the Navajo sandstone slickrock on a terrace. The artifacts occupy a 40 x 30 m area, having been dispersed by runoff from the slickrock.

Previous Evaluations

The site was monitored in FYs 91, 92, and 94. The site is impacted by surface erosion, gullyng, and there are two small arroyos on each side of the site. There are no human impacts. In FY94, the artifacts were being displaced by surface erosion, gullyng, and arroyo cutting, however, all artifacts plotted on the site map were relocated.

Current Evaluation

In FY96, physical surface erosion of a sherd was noted near one metate, but the impacts are not the result of fluctuating river flows or dam operations.

Recommendations

Some active erosion is occurring. However, the gullies are terrace-based and do not extend to the Colorado River. The monitoring schedule is being changed from biennially to every 3-5 years. Mapping as a form of data recovery is also recommended.

AZ C:2:81

This is a prehistoric artifact scatter buried in the uppermost alluvial terrace on the left bank of the river. Artifacts are exposed along the visitor trail to AZ C:2:38.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. Visitor impacts have cut the trail deeply, further exposing the site. The trail leads to AZ C:2:38, a large petroglyph panel just downstream. In FY91, the trail ranged from 10-50 cm deep. In FY93, the trail was 70 cm deep in some places. After the FY91 monitoring episode, maintenance crews lined the trail with a rock boundary to help direct visitors to the petroglyph site.

Through FY93, the trail increased in width and depth. In addition, other trails funneling into the main trail were established. Physical impacts included surface erosion and wind deflation, and a rain storm aggravated the erosion problem along the trail, downcutting it as much as 50 more cm.

Maximum depth of the trail cut was over 1 m in some places. Continuing use of the trail exposed more of the site. Artifacts were noted on the surface, but there were no buried cultural materials noted in the trail cuts. None of the impacts were directly related to river fluctuations or dam operations, instead, the site was impacted by foot traffic from 40,000 visitors per year. Continued exposure of artifacts and buried components was anticipated.

The site was monitored twice in FY95. The trail through the site developed into a terrace-based stream. The trail did not increase in width or depth since the tremendous downcutting episode in FY94.

Current Evaluation

The site was monitored twice in FY96, just prior to trail rehabilitation and following it. Prior to trail rehabilitation, the trail eroded another 5 cm in depth since the last monitoring episode in FY95. No further artifacts have eroded from the deposits, however.

Following the trail rehabilitation, local erosion has stopped. So far, there is a decrease in the amount of surface erosion, gullyng, arroyo cutting, bank slumpage, and alluvial erosion.

Recommendations and Remedial Actions

As part of the trail maintenance program at Glen Canyon NRA, the trail through AZ C:2:81 to the petroglyph panel was repaired and regraded by adding geoweb fabric to stabilize the base of the trail. This reduced the amount of downcutting and erosion to the terrace and through the site. The rocks aligning the trail were reestablished, and other trails that meander across the terrace to the site are being eliminated. This project will be completed by Fall FY96.

As an element of Section 106 Compliance for the trail maintenance program, Site AZ C:2:81 was tested to determine the nature and extent of any buried deposits (Burchett 1995). No subsurface artifacts were recovered. As a part of the testing program, surface artifacts were mapped and collected, however. Another element of Compliance included monitoring of the trail rehabilitation activities by an archaeologist. No further cultural resources were exposed. Due to the amount of visitation, the site should be monitored semi-annually.

AZ C:2:82

This prehistoric rock shelter with associated masonry wall and artifact scatter is located in a small overhang of Navajo sandstone adjacent to the first alluvial terrace above the river. The site is on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, and 94. Impacts include surface erosion, gullyng, arroyo cutting, bank slumpage, and trailing. The deepening and widening of arroyos from side canyon flooding is a possible threat. The trailing appears to have dwindled since FY92. These impacts are not related to river fluctuations or dam operations. In FY94, the wall and artifacts were being impacted somewhat by surface erosion.

Current Evaluation

In FY96, no change was noted other than a reduction in the amount of vegetation due to the recent drought.

Recommendations

The site should be monitored biennially to record non-river-related impacts. Testing is also recommended.

This is a prehistoric artifact scatter with associated hearth located on the left bank of the river on the Navajo Nation. The remains are on a talus slope at the base of the Shinarump Conglomerate above the fluvial terrace.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. This area has seen much activity in the last century, including construction associated with Lees Ferry, the dugway road, and a gauging station. Hikers trail through the site as well. Surface erosion is extensive, and a cutbank is on the eastern side of the site. The exposed surface hearth will continue to erode. A river-based arroyo is below and northwest of the artifact scatter. Headward migration of the arroyo will eventually cut into the scatter. The presence of the arroyo is related to river fluctuations, but surface erosion will displace the surface expression of the site prior to that. Continued use of the trail to the USGS gauging station is noted. The hearth has been extensively impacted by trampling. It is a light charcoal stained lens of sand. Three small flecks, but no chunks, of charcoal were noted.

The FY94 monitoring effort recorded an increase in the surface erosion to the hearth and artifacts. The thin veneer of fine well-sorted sands that was capping the hearth stain has eroded away to expose a deposit of coarse gravelly sands, and gullying has begun eroding downslope through the cultural deposit. The charcoal staining is still present but is eroding downslope. These most recent impacts are due to late summer rains in the area. Evidence of the trail passing through the site to the U.S.G.S. Gauging Station has eroded away.

The FY95 monitoring recorded no changes to the condition of the feature or of impacts since FY94.

Current Evaluation

In FY96, there was an increase in the amount of surface erosion, bank slumpage, and animal-caused erosion to the artifact scatter and to the thermal feature, and arroyo cutting has increased on the artifact scatter. Some artifacts have eroded into the arroyo. There also is an increase in the amount of trailing from humans in the artifact scatter and on the thermal feature.

Recommendations

Annual monitoring is recommended to record ongoing impacts from surface erosion.

This prehistoric site consists of a shallow overhang with a collapsed wall, a midden, and artifact scatter located at the base of a Navajo sandstone

cliff face above an alluvial terrace. The site is on the right bank of the river.

Previous Evaluations

The site was monitored in FYs 91, 93, and 94. The site is actively eroding; gullyng, wind deflation, and surface erosion are the primary impacts. Surface erosion is impacting the midden, and one gully and one arroyo are developing. Human visitation is evident from trailing and recent trash. In FY 91, one small collector's pile of lithic artifacts was noted. The collector's pile was also noted in FY 93. A distinct trail recorded during the FY91 monitoring episode was not present during the FY93 monitoring episode. These impacts are not related to river fluctuations or dam operations.

In FY94, the wall was being impacted slightly by surface erosion, and the artifacts were being displaced slightly by surface erosion and gullyng. One collector's pile was noted, and there was no change to it since the last monitoring episode in FY93.

Current Evaluation

In FY96, no new physical impacts were noted. However, human impacts have increased. In the collection pile, flakes have been moved, and another flake has been added.

Recommendations

The site should be monitored biennially. It is also a candidate for instrument mapping.

AZ C:2:86

This prehistoric site consists of a cist, a masonry wall, and artifact scatters located on the left bank of the river on the Navajo Nation at the mouth of Fall Canyon. The remains are on a sandy alluvial terrace next to an arroyo and under an outcropping bedrock ledge.

Previous Evaluations

The site was monitored in FYs 91, 93, and 94. Surface erosion is the most predominant impact, the features and artifacts are exposed from downslope sheetwashing. Trailing through the site is also displacing artifacts and causing erosion. These impacts do not appear to be related to river fluctuations or dam operations. Bank slumpage from side canyon flooding is a definite threat, and the deepening and widening of a river-based arroyo from side canyon flooding was occurring, but was not yet impacting the site.

In FY94, Feature 1 (cist), Feature 2 (wall), and Feature 3 (fire-cracked rock scatter) all were being impacted by trailing, and Feature 3 was being impacted by increased surface erosion.

Current Evaluation

In FY96, impacts noted for Features 1, 2, and 3 are ongoing. These impacts are not related to river fluctuations or dam operations.

Recommendations and Remedial Actions

The site should be monitored biennially. The trails should be obliterated, and testing to determine the nature and depth of buried cultural deposits is recommended.

AZ C:2:87

This site consists of historic and modern artifacts and the remains of a tower located on the alluvial terrace on the left bank of the river on the Navajo Nation.

Previous Evaluations

This site was monitored in FYs 91, 93, and 94. Surface erosion was impacting the northeast end of the site, and one arroyo is cutting the southwest side. These impacts do not appear to be related to river fluctuations or dam operations. No human impacts were noted. In FY94, the artifacts were being displaced slightly by surface erosion, gullyng, and arroyo cutting.

Current Evaluation

No increases in impacts were noted in FY96.

Recommendations

The site should be monitored every three-five years to record non-river-related impacts. It is a candidate to instrument mapping.

AZ C:2:88

This site is located on the right bank of the Colorado River within an overhang shelter at the contact between a Navajo sandstone cliff face and a talus slope. The shelter contains a grinding slab enclosed by two expedient parallel walls extending from the back of the overhang. A single sherd below the shelter suggests a possible PII Anasazi affiliation.

Previous Evaluations

The site was monitored in FYs 91, 94, and 95. Physical impacts include surface erosion and gullyng caused by runoff from a dripline at the top of the overhang. A 3 m deep river-based arroyo is located 3 m west of the shelter, and surface erosion is causing minor displacement of artifacts and is beginning to undermine the wall. One stone wall element has been moved from

below the wall to the back of the wall. Recent trash is present, and a trail ascends the talus slope to the site. Recent graffiti is scratched into the wall above the site. This graffiti includes a "P" and wavy lines. Visitor trampling of vegetation has occurred in the rock shelter, although no foot prints were present.

In FY95, the monsoon thunderstorms noted the previous fall hit this site as well. A storm cleaned out the river-based arroyo and formed a new debris flow below the site on the shore of the river. Trailing and trampling were reduced.

Current Evaluation

In FY96, there are increases in surface erosion and gullying to the structure, and an increase in surface erosion to the artifact scatter. But the metate is less exposed due to deposition of sediment. The wall segment is intact. A gully below the dripline is in front of the rockshelter. There are no new human impacts. A trail is present below the shelter.

Recommendations

The site should be monitored annually to record enlargement of the encroaching arroyo. The site is a candidate for instrument mapping.

AZ C:2:90

The site consists of a group of massive sandstone boulders under which were built prehistoric dry-laid structures, a few petroglyphs, and a ceramic artifact scatter. The remains are located at the base of the Chinle Formation overlooking a narrow alluvial terrace on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 93, and 94. It is poorly preserved and exhibits spalling of the petroglyph panel surface, surface erosion, gullying, trailing, and modern camping evidence including fire scars and recent trash. The Stanton Road is nearby. These impacts do not appear to be related to river fluctuations or dam operations. Exposure and destabilization of the features by visitation is a definite threat.

In FY95, surface erosion and gullying were causing minor impacts, undermining the structure and displacing artifacts. The surface of the rock art panel was being eroded by wind and water. A visitor trail and evidence of camping were present as well.

Current Evaluation

In FY96, surface erosion and gullying are increasing impacts to the artifacts. Sherds below the furthest downstream petroglyph panel are eroding

downslope. Trampling is adding to the erosional impacts. No new human impacts are present.

Recommendations

Biennial monitoring to record non-river-related impacts is recommended. The trail should be obliterated.

AZ C:2:91

This prehistoric site consists of two loci with charcoal lenses and an associated artifact scatter on top of an alluvial terrace on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 93, 94, and 95. Physical impacts are extensive and include arroyo cutting, gullying, surface erosion, wind deflation, and bank slumpage. These impacts increased in severity from FY93 to FY94. A 6 m deep river-based arroyo bisects the site and is eroding through the charcoal lenses. Recent seasonal rains have caused a debris flow that has scoured the river-based arroyo, removing all vegetation and causing collapse of the arroyo walls. An ephemeral game-foot trail was present, though little use was noted.

In FY95, arroyo cutting, bank slumpage, and side canyon erosion increased, causing more material in the charcoal lenses to collapse into the arroyo. The trail across the terrace was almost unnoticeable.

Current Evaluation

In FY96, gullying, arroyo cutting, bank slumpage, and side canyon erosion increased. Bank slumpage increased particularly on the north side of the hearth. The top left portion of the lens has eroded away. The right portion is still present, but it is on a block of sediment at the top of the terrace that is surrounded by gullies, which are eroding. There are no human impacts.

Recommendations

The site should be monitored annually.

AZ C:2:95

This prehistoric site consists of a small rockshelter at the base of a low Shinarump Conglomerate cliff with an associated artifact scatter eroding down an ephemeral drainage below the shelter. The site is on the right bank of the river.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, and 94. Physical impacts include gullying, animal burrowing, wind deflation, and surface erosion. Human impacts include two nearby trails and the rearrangement of rocks. There appear to be no impact changes since FY 91. These impacts are not related to river fluctuations or dam operations. The site is visible from the launch ramp road.

Current Evaluation

In FY96, no changes were noted.

Recommendations

The site should be monitored biennially to record non-river-related impacts.

AZ C:2:99

This site has both prehistoric and historic components, artifact scatters and a rock alignment, located on a sandy dune above a flood plain. The remains are on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 93, and 94. Physical impacts include surface erosion, wind deflation, and gullying. Eolian deflation is a major impact. Artifacts are exposed and buried quickly. A gully passes by the rock alignment, but is not directly impacting it. A distinct trail passes nearby. The FY93 monitoring episode recorded one newly exposed rock near a metate.

In FY 94, surface erosion increased, undermining the retaining wall and displacing artifacts. The trail noted during the FY93 monitoring episode has been filled in by eolian deposition. Gullying did not increase in severity. Out of four black-on-red sherds noted during FY91, one was noted during this monitoring episode. The impacts do not appear to be related to river fluctuations.

Current Evaluation

In FY96, an increase in eolian surface deposition has occurred. Sherds that were previously noted on the surface were not found. They are assumed to have been covered up by blowing sand. The wind also exposed a previously unrecorded sandstone grinding slab. No human impacts were noted.

Recommendations and Remedial Actions

A biennial monitoring schedule is recommended to record non-river-related impacts. The installation of check dams would reduce the amount of surface erosion and gullying. The site should be mapped and tested.

This is a prehistoric site consisting of buried charcoal features and artifact scatters located on an alluvial terrace. The remains are on the left side of the river on the Navajo Nation.

Previous Evaluations

This site was monitored in FYs 91, 92, 93, 94, and 95. The site is actively eroding from side draining river-based arroyos. Physical impacts include arroyo cutting, gullying, surface erosion, wind deflation, and bank slumpage. These impacts are related to river fluctuations and dam operations, based on headward migration of arroyos due to the lowering of the base level. A gear and a bicycle frame have been plotted on a revised site map. Artifacts are expected to move downslope. Trampling and trailing through the site also occurs.

The FY94 monitoring noted no changes to Feature 1, the charcoal lens in the cutbank. The bicycle frame collapsed. Feature 2, a set of sandstone slabs, was more dispersed since the monitoring episode in FY93. The cutbank near the gear receded 12 cm since FY93. Bank slumpage had therefore increased.

The FY95 monitoring results note no changes to Feature 1, the lens in the cutbank, or to the bicycle frame. Feature 2, the set of sandstone slabs, has a new gully eroding into it. The bicycle gear has collapsed into the arroyo, indicating an increase in bank slumpage and arroyo cutting.

Current Evaluation

In FY96, surface erosion has increased. The gear noted in FY95 to have collapsed into the arroyo is now being covered by terrace sediments deposited by bank slumpage. The charcoal lens is more fully exposed now. Trampling continues. There are no human impacts.

Recommendations and Remedial Actions

The site is being monitored by stationary camera, and on-site monitoring is recommended annually. The installation of check dams and planting vegetation could help to reduce the erosion. Mapping as a form of data recovery is recommended.

The site is on the right bank of the Colorado River and consists of a sandstone boulder with three pecked petroglyphs: a circle or zero, a circle with a tangent line, and an anthropomorph. The site is on a sandstone boulder on a large alluvial terrace directly behind the rest rooms at the Lee's Ferry launch ramp. The boulder is visible from the rest rooms.

Previous Evaluations

The site was monitored in FYs 91 and 94. The boulder itself is in good condition, as are the petroglyphs. A gully adjacent the boulder, and there is a major wash a few meters east. There are no human impacts. The surface of the petroglyph panel is undergoing some wind and water erosion, but it is in stable condition.

Current Evaluation

In FY96, no changes were noted.

Recommendations

The site should be monitored biennially for non-river-related impacts due to its proximity to the Lees Ferry launch ramp.

AZ C:2:105

This site is on the left bank of the Colorado River on the Navajo Nation. It is a large Navajo sandstone alcove that contains the "1889 Hislop" historic inscription. The alcove is visible from the river.

Previous Evaluations

The site was monitored in FYs 91 and 94. The main impacts are from visitors and roof spalling. Visitors have made several hearths on the east side of the alcove. A pot hole was noted in the floor fill. The back east wall has numerous recent scratched and charcoal names, many of which are superimposed. Several modern wall segments and rock piles are noted, presumably from the occupation of the cave in the 1960s by a hippie.

In FY94, there were no physical impacts to the historic inscription. There is no graffiti on the inscription rock, but there is considerable graffiti on the cave walls and on other nearby boulders. Since FY91, graffiti includes "Nick 92"; "Sena 92";, and "MMS 93 9E". Charcoal from a recent hearth is noted on the cave floor. These impacts are not related to river fluctuations or dam operations.

Current Evaluation

In FY96, no impacts were noted.

Recommendations

The monitoring schedule at this site is being lengthened to every three to five years to record non-river-related impacts.

AZ C:2:106

This prehistoric site consists of a roasting feature and associated artifact scatter located near the base of a dune on an alluvial terrace. Colluvial debris from a nearby Navajo sandstone cliff is also present. The site is on the left bank of the river on the Navajo Nation.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, and 94. Surface erosion and trailing are noted impacts. These impacts do not appear to be related to river fluctuations or dam operations. In FY94, minor surface erosion was noted for the roaster and artifacts.

Current Evaluation

In FY96, no changes were noted.

Recommendations and Remedial Actions

The site should be monitored on a biennial basis to record non-river-related impacts. The trail should be obliterated, and testing of the terrace for buried deposits is recommended.

AZ C:2:108

This site is on the left bank of the Colorado River on the Navajo Nation. It consists of a large sandstone boulder located on a dune-covered talus slope with several stipple-pecked petroglyph elements on its south face. The boulder is visible from a trail below.

Previous Evaluations

The site was monitored in FYs 91 and 94. The figures have faded from the erosion of the panel, are repatinated, and are somewhat difficult to define. The panel face itself is in good condition, there is no spalling or major freeze/thaw cracking. The surrounding sand slope is impacted by surface erosion, gulying, arroyo cutting, and trampling. There are no human impacts. These impacts are not related to river fluctuations or dam operations.

Current Evaluation

In FY96, no new impacts were noted on the petroglyph panel. Trampling around the panel was noted, causing downslope surface erosion.

Recommendations

The site should be monitored biennially for non-river-related impacts.

AZ C:3:3

This is the trail built during the time of the construction of Glen Canyon Dam as part of the development plan for a proposed marina below the dam site. The route is on the right bank of the river.

Previous Evaluations

The trail was monitored in FYs 91, 93, and 94. Physical impacts include surface erosion, gullyng, and arroyo cutting. The top of the stairway has been eroded by alluvial forces and talus slope wash. Culverts are exposed in several places. Stone elements of the trail retaining walls have been misplaced. A rockslide has taken out a portion of the trail. Little or no change was noted on the photographic records between FYs 91 and 93. These impacts are not related to river fluctuations or operations of the dam. There are no human impacts. In FY94, surface erosion, gullyng, and arroyo cutting were impacting the culverts and retaining walls of the trail. The culvert at the top of the stairs exhibited more eolian deposition than noted during the FY93 monitoring episode.

Current Evaluation

In FY96, there was an increase in deposition of sediment on the lower exposed culvert. There was no change to the higher culvert. A stone wall element has been displaced, and there is an increase in vegetation. A utility pole at the bottom of the steps has been moved, indicating human visitation.

Recommendations and Remedial Actions

The impacts are not related to river fluctuations or dam operations. A biennial monitoring schedule is recommended to record non-river-related impacts. The retaining walls should be stabilized as needed.

AZ C:3:4

This site is on the right bank of the Colorado River and consists of a petroglyph panel 10 m long and 1 m high at the base of a Navajo sandstone cliff on top of a talus slope. Fifteen figures are Glen Canyon Style 5 elements.

Previous Evaluations

The site was monitored in FYs 91 and 94. Physical impacts include erosion of the panel surface. The sediment directly below the panel is slowly eroding downslope.

In FY94, ongoing wind and water affected the surface of the rock art panel. Physical impacts also include spalling of the panel surface. These impacts are not related to river fluctuations or dam operations. There are no human impacts.

Current Evaluation

In FY96, no further impacts were noted.

Recommendations

The site is visible from the river. A biennial monitoring schedule is recommended to record non-river-related impacts. The rock art elements should also be sketched.

AZ C:3:6

This site is located on the right bank of the Colorado River and consists of a large, southeast-facing sandstone cliff face with 23 petroglyph elements and three historic inscriptions. It is known as the Bullet Hole Panel.

Previous Evaluations

The site was monitored in FYs 91 and 94. Physical impacts include surface erosion to the panel from wind and rain, spalling, and exfoliation. The panel has been shot at, it has been abraded by scratches and graffiti. A campsite is nearby.

In FY94, the surface of the panel was being impacted by wind and water. Continued vandalism of the petroglyph panel was noted with incising and eradication of historic signatures. It appears that most vandalism occurred prior to FY91. Only minor incised scratches have been placed since then. Camping trash noted includes toilet paper and aluminum cans. These impacts are not related to river fluctuations or dam operations.

Current Evaluation

In FY96, trailing increased on the terrace below the panel. A camping area is nearby, but no new graffiti or other impacts to the panel were noted.

Recommendations

The site should be monitored on a biennial schedule to record non-river-related impacts.

AZ C:3:10

This prehistoric site included a hearth with charcoal staining and an associated artifact scatter. It was located on top of a dune remnant that caps an alluvial terrace on the left side of the river.

Previous Evaluations

The site was monitored in FYs 91, 92, 93, 94, and 95. Surface erosion, gullying, and arroyo cutting impacted the entire site, and runoff was impacting the hearth. Artifacts southwest of the site were eroding down the terrace slope. These impacts were related to river fluctuations, i.e., direct inundation of the site occurred, but the site was also threatened by surface erosion and eolian deflation. The charcoal lens exposed in the cutbank was eroding and getting smaller. A system of trails was nearby, and foot prints were noted on site.

The FY95 monitoring episode recorded that bank slumpage around the hearth increased. One new trail was present in the arroyo and on the north side of the hearth. A previously noted trail was also present on the south side of the hearth.

Mitigation

The site was instrument mapped, collected, and excavated prior to its inundation from the FY96 beach building habitat flow. The data recovery program will be reported in the beach building habitat flow report due this fall.

Recommendations

The site has been removed from the monitoring schedule.

IV. MANAGEMENT ACTIONS

Management actions in FY96 included five various activities, including monitoring, observations of surface analysis units, terrestrial photogrammetry, instrument site mapping, and remedial actions.

Monitoring Activities

Monitoring activities include site selection, scheduling, and field and laboratory methods.

Site Selection

The intent of the Monitoring Plan is for sites to be visited to the minimal extent necessary in order to identify and prevent erosional processes and human impacts. Given the monitoring data base generated to date, patterns of continuing impacts have been established at sites, and based on that patterning, beginning in FY95, recommendations concerning the cycle of monitoring at specific sites were adhered to. The recommendations include monitoring only sites that are actively eroding or receiving human impacts based on FY94 observations and on the results of a consultation trip conducted on July 25, 1994 with representatives from the Navajo Nation Historic Preservation Department concerning sites on Navajo Nation lands. But, the Monitoring Plan holds that there is flexibility in cases of site impacts such as intense local seasonal monsoon rains and debris flows caused by them.

The NPS has developed site selection criteria that justify six monitoring schedule categories, discussed below. The criteria are based most importantly on whether erosional impacts are related to river fluctuations and/or dam operations (the "I" Group). Lesser issues for site selection include erosion not related to the river or dam, visitor impacts such as graffiti on rock art panels, visibility of the sites from the river or trails, and proximity of sites to heavy use areas. The Glen Canyon NRA GCES monitoring program includes 69 monitoring locations at 53 sites.

Site Schedule

The monitoring schedule categories are defined, and the number of sites assigned to each category follow:

Semi-annual Monitoring. Two locations are being impacted by extensive visitor traffic, over 40,000 people per year. A semi-annual monitor schedule, twice per year, is recommended. Episodes will be conducted prior to and following the visitor season.

Annual Monitoring. Locations (N=21) that are currently being impacted by river fluctuations or dam operations will be monitored annually;

Biennial Monitoring. Locations (N=31) that are being impacted by erosion not related to river fluctuations or dam operations will

be monitored biennially, every 2 years. Included are locations containing recent graffiti, locations visible from the river or trails, and locations near visitor impact areas;

Monitoring 3-5 Years. Locations (N=14) that are stable or not being impacted by river fluctuations, dam operations, other erosion, or visitor impacts will be monitored every 3 years initially, and if warranted, less frequently in the future;

Inactive Monitoring. Locations that are in stable condition but are located in areas where there is a slight potential for change. These locations are usually in pristine condition and are located around 300,000 cfs. These locations will be monitored on an as-needed basis. A few locations may be assigned to this new category in FY97.

Discontinue Monitoring. Past monitoring episodes have shown that one location does not need to be monitored. This feature is the concrete Bureau of Reclamation Gauging Station at Lee's Ferry. This site may be reassessed and possibly placed on the inactive monitoring list.

See Table 1 for a list of all 69 locations monitored by Glen Canyon NRA and their monitoring schedule. For FY96, 56 locations were monitored. Fifty-three locations received one monitoring episode and three locations received two episodes.

Field and Laboratory Methods

Within Glen Canyon NRA, sites are accessible by boat on day trips. The day trips are opportunities for signatories wishing to travel between Lees Ferry and Glen Canyon Dam. Field personnel consisted of one project archaeologist and one or two archaeological technicians. Site monitoring involves the in-field assessment of site conditions and documentation of impacts through photographic means and the completion of the monitoring form. The monitoring form developed in FY94 was used to record physical and human impacts. This is a compilation of qualitative observations that represent current site conditions. The form records information concerning physical and human impacts and presents site-specific management assessments and recommendations. Locations of impacted features are noted on both the monitoring forms and site sketch maps. Current condition/previous condition assessments are based on comparisons of monitoring forms and photographic records. When conditions change, the new condition is recorded with photography and on monitoring forms. This way, changes through time are observed and impact trends are identified.

Data compiled on monitoring forms is entered into an application written in DBASE III+, and statistics are generated from SYSTAT statistical analysis software. Raw field data, photographs, and negatives are stored at Glen Canyon NRA.

Surface Analysis Units
by
Christopher M. Coder

At the request of various representatives for the signatories of the PA a series of surface analysis units were placed on sites within the project area during the spring of 1994. The purpose for surface analysis units was to document and quantify changes in artifact density and distribution related to site formation processes.

At each of the applicable sites, at least one permanent artifact recording unit was established and tied into the permanent datum. The units are two dimensional one by one meter squares laid out on the surface. Within Grand Canyon National Park, a total of 11 units on 10 sites have been monitored, and in Glen Canyon NRA, 14 units on 14 locations have been monitored. Results from the first two years of monitoring the analysis units can be reviewed in the 1994 and 1995 Annual Reports provided by the project.

In summary, observation of the units has led to the conclusion that three situations are occurring to artifacts located on the surface; certain objects move, certain other objects do not move, and still other objects disappear only to reappear again at another time and place. The mechanisms for this movement (or lack thereof) are occasionally obvious, such as in the case of trampling by wildlife, function of slope or covering by eolian sand, but more often the reasons are obscure.

For several years the archaeological profession has "emphasize(d) intrasite spatial analysis when identifying non-random distribution of artifacts" (Rick 1976;133). It is believed by some that inferences can be made regarding patterns of human behavior by scrutinizing the patterns of artifacts found in the archaeological record. It has become apparent to researchers in this field that following an occupation, post depositional processes dominate movement of artifacts to such a degree that more often than not, original patterns that may bear some sort of fingerprint to the human condition have been destroyed (Rick 1976), or at least significantly altered. This is particularly true about surface archaeological manifestations.

But whether surface components of artifacts can be accurately interpreted because of the effects of site formation processes or not is not the issue here. The question is whether those site formation processes can be identified.

More thought than actual study has been dedicated to the life of an artifact (assemblage) after it becomes a part of the historic record. The literature supports a variety of opinions and data on the subject. From taphonomic processes (Behrensmeyer 1980) to the regional distribution of cultural materials (Camilli 1988). Foremost is the need for more intensive scientific study concerning the mechanics of movement. It is universally acknowledged that movement occurs and often the forces at work are obvious and locally determined (Baker 1978; Bowers et al. 1983; Camilli 1988; Rick 1976).

Bowers et al. (1983) expands on this theme to warn other researchers, "Another related aspect of this problem that warrants consideration is the degree of accuracy that we are able to achieve in our interpretations. We emphasize here the distinction between the concepts of precision and accuracy as they apply to archaeological measurements" (Bowers et al. 1983:568). With an understanding of the scientific definitions of these terms (precision and accuracy) it is possible to make very precise measurements and still be completely off regarding accuracy with reference to what Bowers et al. calls "the reality of the situation" (1983:569). Bowers et al. goes on to state "What we do emphasize is that our ability to interpret the data may be limited by (our incomplete understanding of) noncultural processes" (1983:569).

Gravity, water, wind, plant, animal and human activity all contribute to movement. This constant repositioning which is more readily observable on the surface is also taking place underground and can be attributed to one or a combination of factors. Each material reacts differently to these forces. Bone reacts differently than stone, stone reacts differently than metal, metal differently than ceramics and so on. In addition each material breaks down at a different rate as time goes on further complicating understanding of the process. Then there are the attributes of shape, size and density of each item to contend with. Each additional variable complicates the issue geometrically. (Baker 1978; Bowers et al. 1983; Rick 1976).

Bowers et al. (1983) also observe the general movement of an artifact assemblage overtime is akin to what physicists refer to as Brownian or random movement which after an extended amount of time tends to redistribute the materials on the surface in a homogenous fashion. Dr. Christian Downum (NAU Principal investigator) stated at the SAA meetings in New Orleans this past spring, "Rigorous tracking of the movement or disappearance of surface artifacts is a VERY complicated endeavor....In all probability this method is far too expensive and methodologically problematic for widespread use."

The surface analysis units placed in the river corridor are only capable of dealing with spacial relationships as simple distances, not as functions of the more complex phenomenon of mechanics or erosional process. Firstly, the concern of the project is with the utility of such an exercise. Field time is expensive and there must be a practical return on the investment in the form of useful information that pertains to the project specifically. This is not happening. How does this exercise direct or enhance the management of the whole system better? The analysis units are telling us nothing about the environment that we do not already know, i.e., the wind blows, objects tend to move down slope.

Secondly, and possibly most importantly, scrutinizing these units is an invasive procedure. In several cases it has caused an adverse impact to the surface from repeat visitation at a specific location. One lesson the field teams have learned from the units is that we can be the greatest impact to a site.

The concept of "Adaptive Management" tells us to 1) stop the impractical use of surface analysis units, or 2) invest a lot more time and money into the effort. Considering the increased human impacts caused by monitoring these

surface analysis units and the lack of specific significant information concerning site formation processes, the first choice is the best. Considering the real world constraints of field time and budgets it is the contention of the project that the time and money allotted to the monitoring program can be utilized more effectively. It is therefore recommended the surface analysis units be removed from the program.

Terrestrial Photogrammetry

Film retrieval and replacement every 34 days at the camera locations continued. This process involves day trips down the river from the dam. These day trips are opportunities for any signatories wishing to travel between Lees Ferry and Glen Canyon Dam. Glen Canyon NRA requests that arrangements be made with Tim W. Burchett, (520) 608-6275, at least one month in advance. The NPS river boat has a capacity of 7 people, 6 visitors and the driver.

Instrument Site Mapping

As in the past, five sites were chosen for total station mapping for FY96: C:2:72, 91, 99, 100 and C:3:10. These sites were chosen for mapping based on their Priority Ranks indicated on Table 9. Site C:3:10 was mapped excavated prior to its inundation from the beach building habitat flow in March-April 1996. The rest of the scheduled work, however, was not completed due to scheduling conflicts and the additional work load required for the beach building habitat flow.

Remedial Actions

Following the stabilization workshop conducted in May FY95, the next step involves writing a remedial action plan. Due to varying degrees of site conditions, it is crucial to prioritize the needs of each site based on the degree of impact. Three priority ranks were subjectively established and assigned to sites needing remedial actions (Table 9). Information used to prioritize the sites for remedial actions include the accumulated monitoring data, comparative photographic records, and the field archaeologist's opinions concerning relative need of the remedial actions.

Table 9 lists site type, impacts, priority rank, and recommendations for 37 monitoring locations. The other 32 sites monitored by Glen Canyon NRA have thus far not received remedial action/data recovery recommendations. Sites with extensive impacts are given a priority rank of 1 (N=11), and remedial actions should take place on these sites first, preferably beginning in FY97.

Moderate impacts are given a priority rank of 2. These sites (N=9) are not endangered by any immediate impact, therefore, remedial actions will be conducted following the completion of remedial actions at Priority 1 sites. A priority rank of 3 (N=17) is recommended when there are very minor impacts,

Table 9. Summary of the Sites that have been assigned remedial action/data recovery recommendations and priority ranks. Rank 1 is the highest priority, rank 3 is the lowest priority, 0 indicates all recommendations have been completed.

AZ Site Number, Feature	Site Type	Impacts	Rank	Recommendations
C:2:11, Feature 3	Lee's Main Ferry Site	Bank slumpage, wall collapse	3	Map
Feature 4	Sandstone corral	Trailing	3	Map
Feature 5	Cable Crossing Inscriptions		3	Map
Feature 11	Lee's Ferry Mining Operation	Surface erosion, gully, trailing	3	Map
Feature 12	Spencer Steamboat	Wet-dry cycling	2	Extend no-wake zone around steamboat
Feature 14	USGS Cableway	Surface erosion, gully, arroyo cutting, bank slumpage	1	Plant vegetation, install check dam
Feature 21	Hogans	Surface erosion, gully, arroyo cutting, growing vegetation	3	Map
C:2:13	Rock shelter w/wall	Surface erosion, gully	2	Map, test
C:2:33	Rock shelter w/granary	Surface erosion, gully, trailing, wall collapse	3	Stabilize, test
C:2:38	Petroglyph panel	Panel surface erosion, trailing, graffiti	1	Retrail, obliterate trail, stabilize, test
C:2:39	Lithic scatter	Surface erosion, gully, trailing, animal burrowing	2	Map
C:2:40	Lithic scatter	Surface erosion, gully	2	Map
C:2:50	Camp	Surface erosion, gully, arroyo cutting, trailing	2	Retrail, map, test

AZ Site Number, Feature	Site Type	Impacts	Rank	Recommendations
C:2:53	Artifact scatter	Surface erosion	3	Test
C:2:57	Historic habitation	Surface erosion, gully, arroyo cutting, trailing	2	Stabilize, map
C:2:60, Feature 2	Masonry structure	Surface erosion, trailing	3	Stabilize
Feature 4	Stock gate	Surface erosion, trailing	3	Stabilize
Feature 7	Corrals, stock pens		3	Map
C:2:72	Camp	Surface erosion, gully, arroyo cutting, bank slumpage	1	Plant vegetation, install check dam, map
C:2:75	Camp	Surface erosion, gully, arroyo cutting, bank slumpage	1	Mapping completed in FY95; surface collect, test
C:2:76	Camp	Gully, trailing	1	Obliterate trail, install check dam
C:2:77	Artifact scatter	Surface erosion, gully, bank slumpage	1	Mapping completed in FY95; test
C:2:78	Rock shelter w/artifacts	Surface erosion, arroyo cutting	2	Map, test
C:2:80	Lithic scatter	Surface erosion, gully, arroyo cutting	3	Map
C:2:81	Artifact scatter	Surface erosion, gully, trailing	1	Retrail, surface collect, test
C:2:82	Rock shelter w/wall, artifacts	Surface erosion	3	Test
C:2:84	Overhang w/wall, midden	Surface erosion, gully, collecting	3	Map
C:2:86	Cist, wall, artifacts	Surface erosion, trailing	2	Obliterate trail, test

AZ Site Number, Feature	Site Type	Impacts	Rank	Recommendations
C:2:87	Historic artifacts, tower	Surface erosion, gully, arroyo cutting	3	Map
C:2:88	Shelter w/walls, artifacts	Surface erosion, wall collapse, trailing	2	Map
C:2:90	Structures, petroglyphs, ceramics	Surface erosion, gully, panel surface erosion, trailing	3	Obliterate trail
C:2:91	Camp	Surface erosion, gully, arroyo cutting, bank slumpage, trailing	1	Obliterate trail
C:2:99	Artifact scatters, rock alignment	Surface erosion, gully, trailing	1	Install check dam, map, test
C:2:100	Camp	Surface erosion, gully, arroyo cutting, wind deflation, bank slumpage	1	Plant vegetation, install check dam, map
C:2:106	Roaster	Surface erosion, trailing	3	Obliterate trail, test
C:3:3	Glen Canyon Dam Trail	Surface erosion, gully, arroyo cutting	3	Stabilize
C:3:10	Camp	Surface erosion, gully, arroyo cutting, bank slumpage, trailing	1	Surface collect, test, excavate
Totals	37		1 = 11 2 = 9 3 = 17	

VISITOR-RELATED IMPACTS

Site Number :

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 18 - 24)

Monitor Session :

	Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
18. Visitor Impacts						

19. Collection Piles: If present, explain in 26.

20. Trails: If present, explain in 26.

21. On-site Camping: If present, explain in 26.

22. Criminal vandalism/ARPA violations: If present, explain in 26.

23. Other: If present, explain in 26.

24. Visitor-related impacts since last monitoring:

25. Are any visitor-related impacts directly related to river fluctuations and/or dam operations?
 0 = no; 1 = yes If yes, explain in 26 (i.e., development of new trails to avoid high water, availability of new beaches in proximity of site).

26. Comments:

MANAGEMENT ASSESSMENT AND RECOMMENDATION

27. Monitor Schedule: 1) discontinue 2) semiannual 3) annual 4) biennial
 5) every three to five years 6) inactive

28. Recommended measures to reduce site impacts: 0 = no; 1 = yes

Retrail _____ Plant vegetation _____ Stabilize _____
 Obliterate trail(s) _____ Install checkdams _____ Close site to visitors _____

29. Recommended measures to protect the site's integrity: 0 = no; 1 = yes

Surface collect entire site _____ Test for depth of subsurface cultural deposits _____
 Map as a form of data recovery _____ Data recovery _____

30. Comments: (i.e., surface sample unit)

Grand Canyon National Park

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

1. Site Number AZ: _____
2. Monitor Session _____
3. River Mile _____ Bank (L/R/B): _____
4. Date _____
5. Monitor (s) _____
6. Site Type _____

PHYSICAL IMPACTS

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for items 7 - 14)

	Structures / Storage	Artifacts	Roasters/ Hearths	Perishables/ Midden	Rock Art	Other
7.	Surface Erosion (0-10cm)					
8.	Gullying (10-100cm)					
9.	Arroyo Cutting (>1m)					
10.	Bank Slumpage					
11.	Eolian/Alluvial Erosion/Deposition					
12.	Side Canyon Erosion					
13.	Animal-Caused Erosion (trailing, burrowing)					
14.	Other Natural Impacts (spalling, roots)					

15. If arroyos or gullies are present, do they drain to the river? (Note: Some drainages die out in dune fields or on terraces before reaching the river.) 0 = no; 1 = yes; 2 = NA _____
16. Do any of the above impacts appear to have occurred since the last monitoring episode? 0=no; 1=yes
If yes, explain in 17. _____
17. Comments:

and remedial action will occur following the completion of remedial actions at Priority 2 sites. All remedial actions will be preceded by a reassessment of the site to insure that previous recommendations are still necessary and/or appropriate.

Writing a remedial action plan identifying a limited number of sites most appropriate for immediate remedial action and including field methods will require 10 person days, and will be sent to the members of the Programmatic Agreement. Response is requested within 30 days. In the case of retrailing and trail obliteration, a memorandum will be substituted for the proposal. This will provide for immediate attention to those two impacts.

V. MANAGEMENT SUMMARY

This management summary includes site-specific measures to reduce impacts, measures to protect site integrity, and a summary of work completed in FY96.

Measures to Reduce Site Impact

Table 10 lists specific recommendations designed to reduce site impacts for all monitoring locations within Glen Canyon NRA. The FY97 work plan outlined below prioritizes these actions based on what sites need immediate attention. Eighteen monitoring locations are recommended for some form, or combination of, remedial action. One site is recommended for three impact reduction measures, four sites are recommended for two impact reduction measures, and 13 sites are recommended for one impact reduction measure. These methods include retrailing, obliterating trails, planting vegetation, installation of check dams, and stabilization. Closing the site to visitors is also an option within the remedial action plan, but this recommendation was not applied to a site within Glen Canyon NRA.

Stabilization of the cultural features is the most commonly recommended method for reducing site impacts. In several cases masonry walls are under the threat of collapse. Remortaring of top course elements is recommended in one case, while reconstructing a door frame is suggested for another.

Trail obliteration is recommended in six cases. Where sites are difficult to detect, trails are the result of inadvertent visitor use. Many sites are traversed by multiple trails, and they are formed by private and guided boaters hiking and fishing within the canyon. Until these trails are obliterated, people will continue walking on them, thus impacting site features. If these trails are not eliminated, they tend to become entrenched, making shallow to deep gullies that connect, in some circumstances, with river-based or terrace-based drainages as in the case of the trail through C:2:81. Trails exacerbate the effects of all classes of erosion, from surface erosion to arroyo cutting and bank slumpage.

The installation of check dams is recommended in five cases where, using traditional methods, dams made from sticks or branches can reduce the downcutting on alluvial terraces cut by shallow gullies. The planting of vegetation is suggested in three cases where increased vegetation on terrace surfaces would reduce the amount of surface erosion and gullyng.

Retrailing is recommended in three cases where established trails exist. Some of the desired trails need maintenance, such as replaced stone borders to redirect traffic from ancillary paths toward the desired trail.

Table 10. Site-specific recommended measures to reduce site impacts, all sites. * Indicates monitoring locations inspected during FY96.

AZ Site Number, Feature	Retrail	Obliterate Trail	Plant Vegetation	Install Check Dam	Stabilize
C:2:11, Feature 14 *	0	0	1	1	0
C:2:33 *	0	0	0	0	1
C:2:38 *	1	1	0	0	1
C:2:50 *	1	0	0	0	0
C:2:57 *	0	0	0	0	1
C:2:60, Feature 2 *	0	0	0	0	1
Feature 4	0	0	0	0	1
C:2:72 *	0	0	1	1	0
C:2:76 *	0	1	0	1	0
C:2:81 *	1	0	0	0	0
C:2:86 *	0	1	0	0	0
C:2:90 *	0	1	0	0	0
C:2:91 *	0	1	0	0	0
C:2:99 *	0	0	0	1	0
C:2:100 *	0	0	1	1	0
C:2:106 *	0	1	0	0	0
C:3:3 *	0	0	0	0	1
Totals	3	6	3	5	7

Measures to Protect Site Integrity

After all measures of reducing site impacts are exhausted and deterioration continues, methods to protect a site's integrity are activated. Generally, these are methods used to collect archaeological data before they are irretrievable. The four measures suggested to protect site integrity are: mapping, surface collection of the entire site, subsurface testing, and excavation.

Table 11 lists site-specific recommendations for protecting site integrity. Some form, or combination of, data collection is recommended at 32 monitoring locations. Twenty-four locations have been recommended for total station mapping. This process of data recovery is essential prior to several methods of reducing site impact, or data collection. Eleven sites have thus far been mapped. The fiscal years during which they were mapped are indicated on Table 11. Five other sites have also been mapped. In FY94, C:2:32 and C:2:105; and in FY95, C:2:35, C:2:71, and C:2:73 were mapped.

Testing a site for subsurface cultural deposits, including the collection of radiocarbon and ethnobotanical samples, could be the most affective and efficient option for collecting archaeological data. Fourteen monitoring locations are recommended for testing.

Surface collecting the entire site is recommended at four monitoring locations. Site C:2:81 was surface collected in FY94 (Table 11) as part of the Section 106 compliance for the rehabilitation of the Petroglyph Trail. It is recommended that prior to implementing the total collection of artifacts, methods of reducing site impacts have been attempted. The FY96 Work Plan below prioritizes these recommendations depending on whether the sites are in immediate, moderate or minor danger of deterioration. Data recovery was conducted at one site, C:3:10. Results of that work will be presented in the beach building habitat flow report due in Fall, 1996.

Table 11. Site-specific recommended measures to protect integrity.
 *: Indicates monitoring location inspected in FY96.

AZ Site Number, Feature	Map	Surface Collect	Test	Data Recovery	Other
C:2:11, Feature 3 *	1	0	0	0	0
Feature 4 *	1	0	0	0	0
Feature 5 *	1	0	0	0	0
Feature 11	1	0	0	0	0
Feature 12 *	0	0	0	0	1
Feature 14 *	1	0	0	0	0
Feature 21 *	1	0	0	0	0
C:2:13 *	1	0	1	0	0
C:2:33 *	0	0	1	0	0
C:2:38 *	FY94	0	1	0	0
C:2:39 *	1	0	0	0	0
C:2:40 *	1	0	0	0	0
C:2:50 *	1	0	1	0	0
C:2:53 *	0	0	1	0	0
C:2:57 *	1	0	0	0	0
C:2:60, Feature 7	1	0	0	0	0
C:2:72 *	1	0	0	0	0
C:2:75 *	FY95	1	1	0	0
C:2:77 *	FY95	0	1	0	0
C:2:78 *	1	1	1	0	0
C:2:79 *	FY95	0	0	0	0
C:2:80 *	1	0	0	0	0
C:2:81 *	FY94	FY94	FY95	0	0
C:2:82 *	0	0	1	0	0
C:2:84 *	1	0	0	0	0
C:2:86 *	0	0	1	0	0
C:2:87 *	1	0	0	0	0
C:2:88 *	1	0	0	0	0

AZ Site Number, Feature	Map	Surface Collect	Test	Data Recovery	Other
C:2:99 *	1	0	1	0	0
C:2:100 *	1	0	0	0	0
C:2:106 *	0	0	1	0	0
C:3:10 *	FY96	FY96	FY96	FY96	0
Totals	24	4	14	1	1

Summary of Work Completed in FY96

The Glen Canyon NRA GCES monitoring program in FY96 involved inspecting 53 selected monitoring locations, three of which were monitored twice during the year. Results indicate that there has been an increase in the amount of physical and human impacts. However, this is the first year the decreases in certain impacts at certain sites have occurred. It has been determined that the monitoring of surface analysis units should be reconsidered.

Five sites were chosen for total station mapping for FY96: C:2:72, 91, 99, 100 and C:3:10. Site C:3:10 was mapped and excavated prior to its inundation from the beach building habitat flow in March-April 1996. The other four sites were not mapped due to scheduling conflicts and the additional work load required for the beach building habitat flow.

Terrestrial photogrammetry continued with film retrieval and replacement at two camera locations. This work was completed on the following days: August 23, September 25, October 30, and December 1, 1995, and February 5, March 11, April 9, May 9, June 7, and July 9, 1996.

Priority rankings for remedial actions have been assigned to 37 monitoring locations. The other 32 sites monitored by Glen Canyon NRA have thus far not received remedial action/data recovery recommendations. One site, C:2:81, has received remedial work in FY96, involving upgrading of the trail. This compliance project was designed to reduce the amount of downcutting of the trail caused by visitors to C:2:38, the Descending Sheep Panel. This site is visited by over 40,000 people per year on Wilderness River Adventures raft trips. Before the project started, the trail was downcut more than 1 meter into the terrace and there were ancillary trails around it and in other areas.

The rehabilitation project filled in the downcut area and rebuilt the trail, designing it to withstand the foot traffic of high visitation. Since the completion of the project, no further downcutting has occurred, the human impacts to C:2:81 have been eliminated, and ancillary trails in the area are reduced.

VI. PROJECT ASSESSMENT

The FY96 GCES monitoring program within Glen Canyon NRA is complete. By the end of the FY93 program, 126 monitoring episodes had been conducted at 69 locations from Glen Canyon Dam to the Paria River riffle -- one at 24 sites, two at 33 sites, and 3 episodes at 12 sites. This suggests fairly comprehensive monitoring coverage during the first three years of the ongoing monitoring program. The FY94 monitoring program has filled the holes in the data base at the 24 sites with only one monitoring record. One-hundred ninety-five monitoring episodes were conducted up through FY95. An additional 56 monitoring episodes have occurred in FY96, making a total of 251 episodes since the project began.

Since the monitoring program began in FY91, field logistics have been modified to optimize the time spent on the river, while recording methodologies have been adjusted to obtain the most important and interesting data on physical and human impacts present.

The long-term monitoring and remedial action program has successfully completed several tasks. The program has determined what impacts occur at what sites. It has determined what kinds of impacts are related to river fluctuations and dam operations, and what impacts are related to other factors. Rates of erosion are beginning to be understood.

Remedial Actions

Remedial action recommendations have been assigned and prioritized. The next task involves operationalizing the methods for remedial actions and then implementing those actions at priority sites, with follow up monitoring at those sites to assess the success or failure of the remedial actions. Follow-up monitoring will be necessary to assess the success or failure of the program.

FY97 Work Plan

The FY97 work plan includes monitoring activities, instrument mapping, continued terrestrial photogrammetry, and remedial actions.

Monitoring Activities

Site Selection Process. The intent of the Monitoring Plan is for sites to be visited to the minimal extent necessary in order to identify and prevent erosional process and human impacts. Given the monitoring data base generated to date, patterns of continuing impacts have been established at sites, and based on that patterning, beginning in FY95, recommendations concerning the cycle of monitoring at specific sites are being adhered to. The recommendations include monitoring only sites that are actively eroding or receiving human impacts based on continuing observations and on the results of a consultation trip conducted on July 25, 1994 with representatives from the Navajo Nation Historic Preservation Department concerning sites on the Navajo

Nation. But, the Monitoring Plan holds that there is flexibility in cases of site impacts such as intense local seasonal monsoon rains and debris flows caused by them.

The National Park Service (NPS) has developed site selection criteria that justify six desired monitoring schedule categories for our monitoring locations. They are based most importantly on whether erosional impacts are related to river fluctuations and/or dam operations. Lesser issues for site selection include erosion not related to the river or dam, visitor impacts such as graffiti on rock art panels, visibility of the sites from the river or trails, and proximity of sites to heavy use areas. The Glen Canyon NRA GCES monitoring program includes 69 monitoring locations in all (see Table 1).

The six monitoring schedule categories include semi-annual monitoring, annual monitoring, biennial monitoring, monitoring every 3-5 years, discontinue monitoring, and inactive. In FY97, the sixth monitoring schedule, inactive, will be implemented. "Inactive" sites are situated on alluvial terraces and relatively near or above the 300,000 cfs level. These sites are in pristine condition and in no harm of deterioration from visitor-related or physical impacts. The actual monitoring of these sites will be on an as-needed basis, for example, when flash flooding or rock slides occur, upon tribal requests, or during times of heavy visitor use in specific areas.

Table 1 presents the monitoring schedule for all 69 locations within Glen Canyon NRA. For FY97, 36 locations to be monitored include those assigned to the annual (N=20), and semiannual (twice a year; N=2), and every 3-5 year (N=14) schedules on Table 1. This totals 38 monitoring episodes.

Level of Effort. Monitoring activities are scheduled to begin in October 1996. The two locations to be monitored on a semi-annual basis will be inspected in the fall following the visitor season and then again in the spring prior to high visitor season. For FY97, it is estimated that an average of five locations can be monitored per two-person day. Conducting the 38 monitoring episodes should require about 16 person days.

Reporting procedures include updating computer files and submission of a trip report and the annual report synthesizing FY97's monitoring results. Entering and processing computer data will require 10 days. One Trip Report immediately following completion of the FY97 field work will be provided to all signatories for review, and will require 5 person days. The annual report, due on August 1, 1996, will require 15 person days to complete.

Instrument Site Mapping

The instrument mapping program will be designed to follow two major criteria. Sites will be instrument mapped if:

- 1) major remedial actions are performed; and/or
- 2) previously unknown cultural resources are exposed.

Newly exposed cultural materials were observed at AZ C:2:99, on the Navajo Nation, in FY96. The mapping of this site would require 2 person days

and the use of Bureau of Reclamation mapping personnel. A spring FY97 timetable is suggested.

Terrestrial Photogrammetry

Film retrieval and replacement every 34 days at the two camera locations will continue. This process involves day trips down the river from the dam. These day trips are opportunities for any signatories wishing to travel between Lees Ferry and Glen Canyon Dam. Glen Canyon NRA requests that arrangements be made with Tim W. Burchett, (520) 608-6275, at least one month in advance. The NPS river boat has a capacity of 7 people, 6 visitors and the driver. Film changes, processing requisitions, and mailing will require 22 person days.

Remedial Actions

Due to varying degrees of site conditions, it was crucial to prioritize the needs of each site based on the degree of impact. Three priority ranks were subjectively established. Information used to prioritize the sites for remedial actions include the accumulated monitoring data, comparative photographic records, and the field archaeologist's opinions concerning relative need of the remedial actions.

Table 9 lists site type, impacts, priority rank, and recommendations for 37 monitoring locations. The other 32 sites monitored by Glen Canyon NRA have thus far not received remedial action/data recovery recommendations. Sites with extensive impacts are given a priority rank of 1 (N=10). Data recovery actions began in FY96 with data recovery at AZ C:3:10 prior to the spring FY96 beach building habitat flow. Remedial actions will begin for the remaining Priority 1 sites in FY97 following the development of a Remedial Action Plan to direct the efforts.

Moderate impacts are given a priority rank of 2. These sites (N=9) are not endangered by any immediate impact, therefore, remedial actions will be conducted following the completion of remedial actions at Priority 1 sites. A priority rank of 3 (N=17) is recommended when there are very minor impacts, and remedial actions will occur following the completion of remedial actions at Priority 2 sites. All remedial actions will be preceded by a reassessment of the site to insure that previous recommendations are still necessary and/or appropriate.

Writing a remedial action plan will involve identifying a limited number of sites most appropriate for immediate remedial action and field methods. This will require 10 person days, and will be sent to the signatories of the Programmatic Agreement. Response is requested within 30 days. In the case of retrailing and trail obliteration, a memorandum will be substituted for the proposal. This will provide for immediate attention to those two impacts.

Monitor Form Updates
by
Lisa M. Leap
Grand Canyon National Park

Appendix A is the updated version of the river corridor archaeological site monitoring form to be used beginning in FY97. Three changes in the "Management Assessment and Recommendations" section are recommended. The first is to remove the "stationary camera" option for observing site changes. In Reach 0 in Glen Canyon NRA, two stationary cameras are in use where they can record daily erosion and catastrophic loss to alluvial terraces. Semi-annual or annual monitoring is sufficient in most other areas. If this option is seriously considered, it could simply be written in the comments section if so desired.

A second change is to substitute "Data Recovery" for "Excavate Entire Site". Often, only a portion of any particular site is impacted, unless the site consists of a single feature, which does occur in the Glen Canyon NRA portion of the river corridor. The term "Data Recovery" is used to refer to the retrieval of information from eminent loss due to erosion of specific cultural features that are beyond the means of preservation.

The third change is the addition of the monitoring schedule option "inactive", meaning that although the site is situated on alluvial deposits and is relatively near or above the 300,000 cfs level, it is in pristine condition and in no danger of deterioration from visitor-related or physical impacts. The actual monitoring of these sites will be on an as-needed basis, for example, when impacts due to flash flooding or rock slides occur, or at the request of tribes, or during heavy visitor use of a specific area.

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VIII. APPENDICES