ORGAN PIPE CACTUS NATIONAL MONUMENT

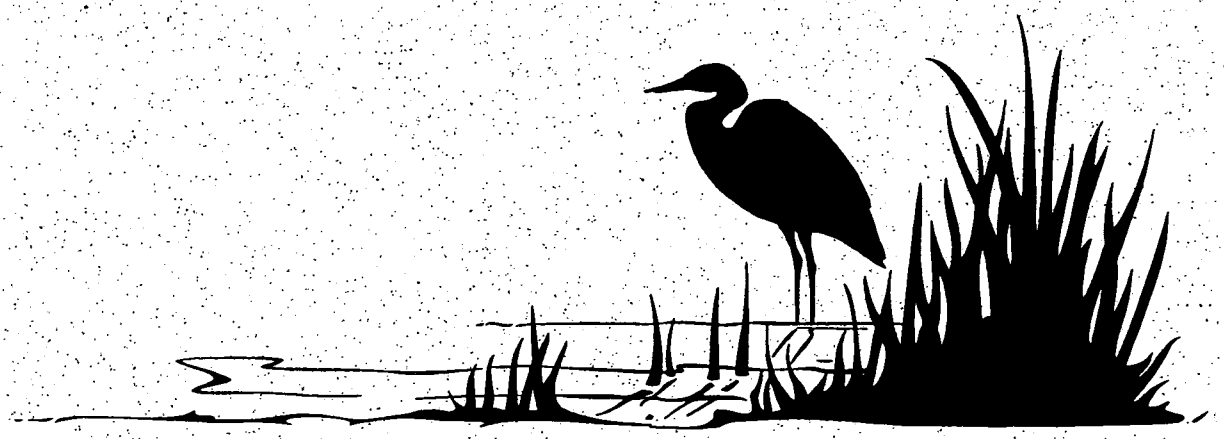
WETLANDS CONSERVATION

QUITOBAQUITO HILLS SPRINGS

JULY 1995 - OCTOBER 1998

Department of the Defense
United States Air Force
Luke Air Force Base
Luke AFB, Arizona

United States Department of the Interior
National Park Service
Organ Pipe Cactus National Monument
Ajo, Arizona



United States Department of the Interior

NATIONAL PARK SERVICE
Southern Arizona Group
202 E. Earll Drive Suite 115
Phoenix, Arizona 85012-2623

LY REFER TO:

A44

August 22, 1995

U.S. Air Force
Bruce D. Eilerts
56 CES/CEVN
14002 W. Marauder Street
Luke AFB, AZ 85309-1125

Subject: Interagency Agreement No. IA8660-95-002

Dear Mr. Eilerts:

Forwarded for your records is a fully executed copy of the subject document. Thank you for your efficient response in executing this Agreement.

Should you have questions please contact me at (602) 640-5255.

Sincerely,

Karen Clark-Fitzgerald

Karen Clark-Fitzgerald
Agreement Officer

Enclosures

Agreement No. IA8660-95-002

INTERAGENCY AGREEMENT

Between

NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

and

LUKE AIR FORCE BASE
UNITED STATES AIR FORCE

Article I. Background and Objectives

THIS INTERAGENCY AGREEMENT is made and entered into between the National Park Service and the Luke Air Force Base, United States Air Force. Luke Air Force Base (Luke AFB) enters into this agreement under the provisions of 32 C.F.R. 989 and its management policies. The National Park Service (NPS) enters into this agreement under provisions of Section 609 of the Economy Act of June 30, 1932, as amended (31 USC 1535) and in accordance with 16 USC 1, *et seq.* and its Management Policies (1978).

WHEREAS, the NPS is the Federal agency responsible for the management and protection of Organ Pipe Cactus National Monument and the NPS is charged with the responsibility to protect, administer, manage and conserve the areas under its jurisdiction and to provide for the enjoyment of the same by the public in such a manner as will leave the areas unimpaired for the enjoyment of future generations (16 U.S.C. Section 1);

WHEREAS, 31 U.S.C. 1535, the Economy Act, authorizes the NPS to place an order with another Federal agency for goods or services if 1) funds are available, 2) the NPS decides that the order is in the best interest of the United States Government, 3) the agency to fill the order is able to provide or get by contract the ordered goods or services, and 4) the NPS decides that the ordered goods or services cannot be provided as conveniently or cheaply by contract with a commercial enterprise. The NPS may also fill such orders for other agencies if the statutory requirements are met.

WHEREAS, within Organ Pipe Cactus National Monument, the NPS is responsible for the protection, maintenance, and study of certain resources, including the spring system located in Quitobaquito Hills. The Quitobaquito Hills spring system consists of a number of springs which support a desert wetland habitat. Two of the Quitobaquito springs have been channeled into a small pond. The channel and pond provide habitat for the desert pupfish (*Cyprinodon macularius eremus*), a federally listed endangered species. Quitobaquito springs and its associated natural resources are under increasing pressure from pollution, visitor impacts and their invasion of non-native flora and fauna;

WHEREAS, Luke AFB utilizes federal lands, including the Cabeza Prieta National Wildlife Refuge and Barry M. Goldwater Air Force Range, near or adjacent to Organ Pipe Cactus National Monument as part of ongoing operations;

WHEREAS, this agreement between Luke AFB and the NPS implements a wetland conservation project within the Quitobaquito Hills springs complex, Organ Pipe Cactus National Monument, Arizona. This project consists of the rehabilitation and study of Quitobaquito springs to better protect this unique ecosystem.

Article II. Statements of Work

Now, therefore, in consideration of the benefits to be derived by each party, IT IS HEREBY AGREED that Luke AFB shall provide funds to the NPS in the amount of seventy-five thousand dollars ($75,000) to rehabilitate and monitor Quitobaquito Hills springs as is described in the Wetlands Conservation Project, Organ Pipe Cactus National Monument, Quitobaquito Hills Springs which is made Attachment 1.

The NPS will implement the plan as set forth in the Wetlands Conservation Project. The NPS agrees to comply with all laws that may be applicable to this project, including, but not limited to, the National Environmental Policy Act, the Clean Water Act and amendments, and the Endangered Species Act. The NPS agrees to prepare any documentation required by this project and to obtain any necessary permits or permissions for the implementation of the project.

Article III. Term of Agreement

The total cost of the project to the United States Air Force shall not exceed seventy-five thousand dollars ($75,000), unless amended in writing by both parties. No provision of this agreement shall be interpreted to require obligation of funds in violation of the Anti-Deficiency Act, 31 U.S.C. Section 1341. Payment will be made upon the execution of this agreement.

This Interagency Agreement shall become effective upon being executed by both parties. It shall remain in effect until October 1, 1998, at which time the cooperative project shall be either modified, completed, or extended by mutual agreement.

Article IV. Key Officials

The National Park Service's Project Officer shall be:

James J. Barnett
Chief of Resources Management and Research
Organ Pipe Cactus National Monument
Rt. 1, Box 100
Ajo, Arizona 85321
(520) 387-7662 extension 7110

The Luke Air Force Base, United States Air Force Project Officer shall be:

Bruce Eilerts
Natural Resources Planner
58 CES/CEVN
14002 W. Marauder St.
Luke AFB, AZ 85309-1125
(602) 856-3823/3621

Article V. Payment

Upon approval by the Luke AFB, the Luke AFB agrees to reimburse the National Park Service for cost of the project as outlined in Article II. Bills shall be submitted using Standard Form 1080 (SF1080) and shall be forwarded to:

DAO-DE Luke/FS
7383 North Litchfield Road. Suite. 2
Luke AFB, Arizona 85309-1534

Article VI. Reports and/or Other Deliverables

The National Park Service shall provide to the Luke AFB Project Officer (see Article IV) with following reports:

1) Annual progress reports from the day the agreement becomes effective.

Article VII. Termination

This Agreement may be terminated by either party by providing 60 days advance written notice to the other party.

.ticle VIII. Authorizing Signatures

IN WITNESS WHEREOF, each party hereto has caused the Interagency Agreement to be executed by authorized officials on the day and year set forth opposite their signature.

NATIONAL PARK SERVICE

By: Harold J. Smith Date: 7-12-95
Superintendent, Organ Pipe Cactus NM

By: Karen K Clark Date: 7/13/95
NPS Agreement Officer

LUKE AIR FORCE BASE

By: Marvin R. Esmond Date: 8/4/95
Commander, Luke AFB

United States Department of the Interior

IN REPLY REFER TO:

NATIONAL PARK SERVICE
Southern Arizona Group
202 E. Earll Drive Suite 115
Phoenix, Arizona 85012-2623

A44

August 22, 1995

Memorandum

To: Jim Barnett, Organ Pipe Cactus NM

From: Contract Specialist, Southern Arizona Group

Subject: Interagency Agreement No. IA8660-95-002

Forwarded for your records is a fully executed copy of the above Agreement.

If you have any questions you may contact me at telephone number (602) 640-5255.

Sincerely,

Karen K. Clark

Karen K. Clark
Agreement Officer

Enclosures

cc: Harold Smith, Superintendent, ORPI

AGREEMENTS

DATA SHEET

1. Agreement Number: IA8660-95-002

2. Parties to Agreement:

   a. National Park Service (WASO Division, Region, Park)
   Organ Pipe Cactus National Monument, Ajo, AZ

   b. Other(s) (Organization Name and Address)
   Department of the Defense, U.S. Air Force, Luke Air Force Base, 7383 N. Litchfield Rd. Ste. 2, Luke AFB, AZ 85309-1534

3. National Park Service Funding Data (If Applicable)

   a. Amount to be Obligated (Current FY) NA
   b. Account Number _____

4. Type of Report (Circle) and Term (Year, Month, Day):

a.	Basic	Beginning Date	07/01/95	Ending Date	10/01/98
b.	Reaffirmation	Beginning Date	_____	Ending Date	_____
c.	Sup./Modification	Beginning Date	_____	Ending Date	_____

5. Purpose of Agreement: Wetlands Conservation, Quitobaquito Hills Springs

6. Category Code:

   a. Primary 02
   b. Secondary 04

7. Signing Official:

_____
Name

Contracting Officer, Southern Arizona Group
Title Date

TECHNICAL EVALUATION

1. Title:
Wetlands Conservation: Organ Pipe Cactus National Monument, Quitobaquito Hills Springs

2. Organization:
USDI, National Park Service, Organ Pipe Cactus National Monument, Rt. 1, Box 100, Ajo, AZ 85321.

Department of Defense, United States Air Force, Luke Air Force Base, 56CES/CEVN, 14002 W. Marauder, St., Luke Air Force Base, AZ 85309-1125

3. Source of Proposal:
USDI, National Park Service, Organ Pipe Cactus National Monument, Rt. 1, Box 100, Ajo, AZ 85321.

4. Research Objectives of the Proposal:
The primary objective of this project is to develop an integrated wetlands program to protect the valuable natural and cultural resources of the wetlands associated with the Quitobaquito Hills Springs. The project includes seven components. Component I addresses the immediate issue of non-native vegetation, which is and has the potential to significantly impact the area, in terms of displacing native species and communities and altering the flow and quantity of available water. This component will assess the extent of non-native plant distribution, location of seed sources, threats to the wetland, recommend and implement control for high risk species and establish a monitoring program. Component II will address the physical structure of the immediate area surrounding the two primary springs, channel and pond. This will include both active rehabilitation of the existing trail system to provide more efficient control of visitor use and impacts, evaluation of alternatives for and stabilization of the dam which is used to impound the water in the pond, vegetation removal in the channel, evaluation and rehabilitation of the overflow channel, and assessment of alternatives for the management of hazardous and historic vegetation. Component III will involve addressing wetlands mitigation through public education, by creating an awareness to visitors from the United States and Mexico of the resources, issues and sensitivity of area. This will be accomplished both through elements of component II in trail rehabilitation, but also through development of interactive media. Component IV will provide important information on spring discharges and water quality to develop a baseline for mitigation actions in the present and future. Component V will involve assessment of non-native fish, which is an on-going and continued threat to the federally designated critical habitat. Component VI will continue work to understand the significance of the pond in supporting populations of two sensitive bat species. Finally, Component VII, will incorporate past research projects to provide a framework for future vegetation management in the Quitobaquito Hills wetland.

5. Acceptability of the Proposal:
   - X **Proposal is acceptable as submitted.**
   - X **The statement of work is clear and acceptable.**
   - ___ The statement of work should be revised as follows:

6. Relationship to existing programs:
   - X **Proposed program is new.**
   - ___ Proposed program continues research previously supported by: CA. 8000-1-0002.
   - X **Proposed research will interface with the following programs:**
     -Organ Pipe Cactus National Monument Ecological Monitoring Program.
     -Organ Pipe Cactus National Monument Threatened, Endangered & Sensitive Species Management Program.

7. Analysis of proposed effort (Labor):
   - ___ The amount of effort in each labor category and the total effort proposed are reasonable and appropriate.
   - X **The kind of effort proposed is reasonable and appropriate to accomplish the program objectives.**
   - ___ The effort proposed should be revised as follows:

8. Permanent property required by the proposed program:
   - ___ Acquisition of permanent property is not proposed - in this Amendment.
   - ___ GFE is not requested.
   - X **The amount and kind of equipment requested is necessary and appropriate for the accomplishment of the program objectives.**
   - ___ The requested property is not available from government sources.
   - ___ Authorization for the contractor to purchase equipment and/or supplies from GSA Schedules should be provided.
   - ___ Title to items of permanent property with acquisition costs of less than $1,000 should be vested in the contractor under the provisions of IPMR 114.60-10.
   - ___ Title to the following permanent property will vest in the government:
   - ___ GFE will be provided as follows:
   - ___ The following items of government property held by the contractor will be required for performance of the proposed research program, and should be transferred from the contract indicated to any new contract.

9. X **Supplies and expendable materials required by the proposed program:**
   Nets and traps for capturing non-native fish; equipment for interpretative elements of project, water flow recorder and misc. supplies for each component.
   - X **The amount and kind of supplies and expendable materials are reasonable and appropriate for the performance of the proposed research program.**
   - ___ Supplies and expendable materials are not sufficiently itemized.
   - ___ The following comments are provided regarding the supplies and expendable materials requested by the proposed budget:

10. Travel expenses required by the proposed program: **NA**
   - ___ Travel expenses are not requested.
   - ___ Travel expenses are not sufficiently itemized.
   - ___ Estimated travel expenses for field work are reasonable and acceptable.
   - ___ Estimated travel expenses for attendance at scientific meetings are reasonable and acceptable.
   - ___ The following comments are provided regarding travel expenses:

11. Analysis of other budgeted costs:
See the attached work plan for a full breakdown of costs. The Government Technical Representative for this project will be James J. Barnett and he has reviewed these costs and finds them satisfactory.

___ Computer use.
___ Laboratory use.
___ Report preparation.
___ Publication costs.
___ Equipment rental.
___ Subcontracting.
___ Other costs.

12. Report requirements:
_X_ **As outlined in the current proposal.**
___ Modify the requirements of Attachment A (the Amendment) as follows:

13. Principal Investigators: **USDI, National Park Service, Organ Pipe Cactus National Monument, Rt. 1, Box 100, Ajo, AZ 85321.**

Level of Effort: **Significant.**

14. Government Technical Representative (GTR): **James J. Barnett.**
Chief of Resources Management
Organ Pipe Cactus National Monument

15. Starting date request: **July 1, 1995**
Comments:

16. Period of Performance: **July 1, 1995 - October 1, 1998**

17. This procurement is authorized by Requisition No.:
Date: NA Amount: NA .
You are hereby authorized to increase this to $_____.

18. Additional comments and continuation of comments from previous items:
NA

19. Significant NPS Involvement in Proposed Cooperative Effort:
See attached proposal.

20. Details of Cost Analysis:
See attached proposal.

21. Additional Comments:
NA

WETLANDS CONSERVATION
ORGAN PIPE CACTUS NATIONAL MONUMENT
Quitobaquito Hills Springs

DELEGATION OF RESPONSIBILITIES

ACTIVITY	LEAD RESPONSIBILITY
Lead Project Authority	Harold Smith, Superintendent
Project Administration and Review	Jim Barnett, Chief of RM
Project Coordination	Sue Rutman, Plant Ecologist
Information Management (GIS/GPS)	Tom Potter, RM Specialist
Maintenance Assistance	Bill Mikus, Chief of Maintenance
Technical Assistance	Cheto Olais, Chief Ranger

COMP. NO.	COMPONENT DESCRIPTION	LEAD RESPONSIBILITY	PRIMARY SUPPORT
I	Non-native Vegetation Assessment and Control	Sue Rutman, Plant Ecologist	Ami Pate
II	Site Rehabilitation and Restoration	Sue Rutman, Plant Ecologist	Ami Pate Mitz Frank
III	Wetlands Education	Mitz Frank, Chief of R.E.	R.E. Staff
IV	Springs Monitoring and Discharge Assessment	Ami Pate, Biological Technician	Jon Arnold
V	Non-native Fish Control	Tim Tibbitts, Wildlife Biologist	Charles Conner
VI	Continue Evaluation of Bat Usage of Quitobaquito Pond	Tim Tibbitts, Wildlife Biologist	Charles Conner
VII	Quitobaquito Wetlands Community Evaluation	Sue Rutman, Plant Ecologist	Ami Pate

Title	Who	Due Date
Non-Native Vegetation Assessment and Control	Sue Rutman	11/30/97
Integration of Quitobaquito GIS data	Tom Potter	11/30/96
Map non-native vegetation and seed sources in the Quitobaquito Region	Rutman/Pate	11/30/97
Control high risk non-native vegetation in the Quitobaquito region	Rutman/Pate	11/30/97
Site Rehabilitation and Restoration	Sue Rutman	11/30/97
Rehabilitate the exisiting trail system	Rutman/Pate/Frank	5/30/97
Dam stabilization	Rutman/Pate	11/30/97
Remove vegetation from the channel	Rutman/Pate	11/30/96
Rehabilitate the overflow channel	Rutman/Pate	12/30/96
Assess and implement alternatives for main. of haz. veg. and historic trees	Rutman/Pate	11/30/97
Wetland Education	Mitz Frank	10/30/96
Wetlands environmental education program	Frank/RE Staff	10/30/96
Springs Monitoring and Discharge Assessment	Ami Pate	11/30/96
Springs monitoring and discharge assessment	Pate/Arnold	11/30/96
Non-native Fish Control	Tim Tibbitts	11/30/97
Non-native fish survey and assessment	Tibbitts/Conner	5/30/96
Non-native fish monitoring protocol	Tibbitts/Conner	11/30/97
Continue Evaluation of Bat Usage of Quitobaquito Pond	Tim Tibbitts	5/30/97
Continue assessment of bat usage of Quitobaquito Pond	Tibbitts/Pate	5/30/97
Quitobaquito Wetlands Community Evaluation	Sue Rutman	5/30/98
Native wetlands community evaluation	Rutman/Pate	5/30/98

WETLANDS CONSERVATION
ORGAN PIPE CACTUS NATIONAL MONUMENT
Quitobaquito Hills Springs

UPDATE: MARCH 4, 1996

DEPARTMENT OF DEFENSE
UNITED STATUS AIR FORCE
LUKE AIR FORCE BASE
56 CES/CEVN
14002 W. Marauder St.
Luke AFB, AZ 85309-1125
(520) 856-3823/3621

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
ORGAN PIPE CACTUS NATIONAL MONUMENT
Route 1, Box 100
Ajo, AZ 85321
(520) 387-7662 ext. 7110

WETLANDS CONSERVATION
ORGAN PIPE CACTUS NATIONAL MONUMENT
Quitobaquito Hills Springs

PROBLEM STATEMENT

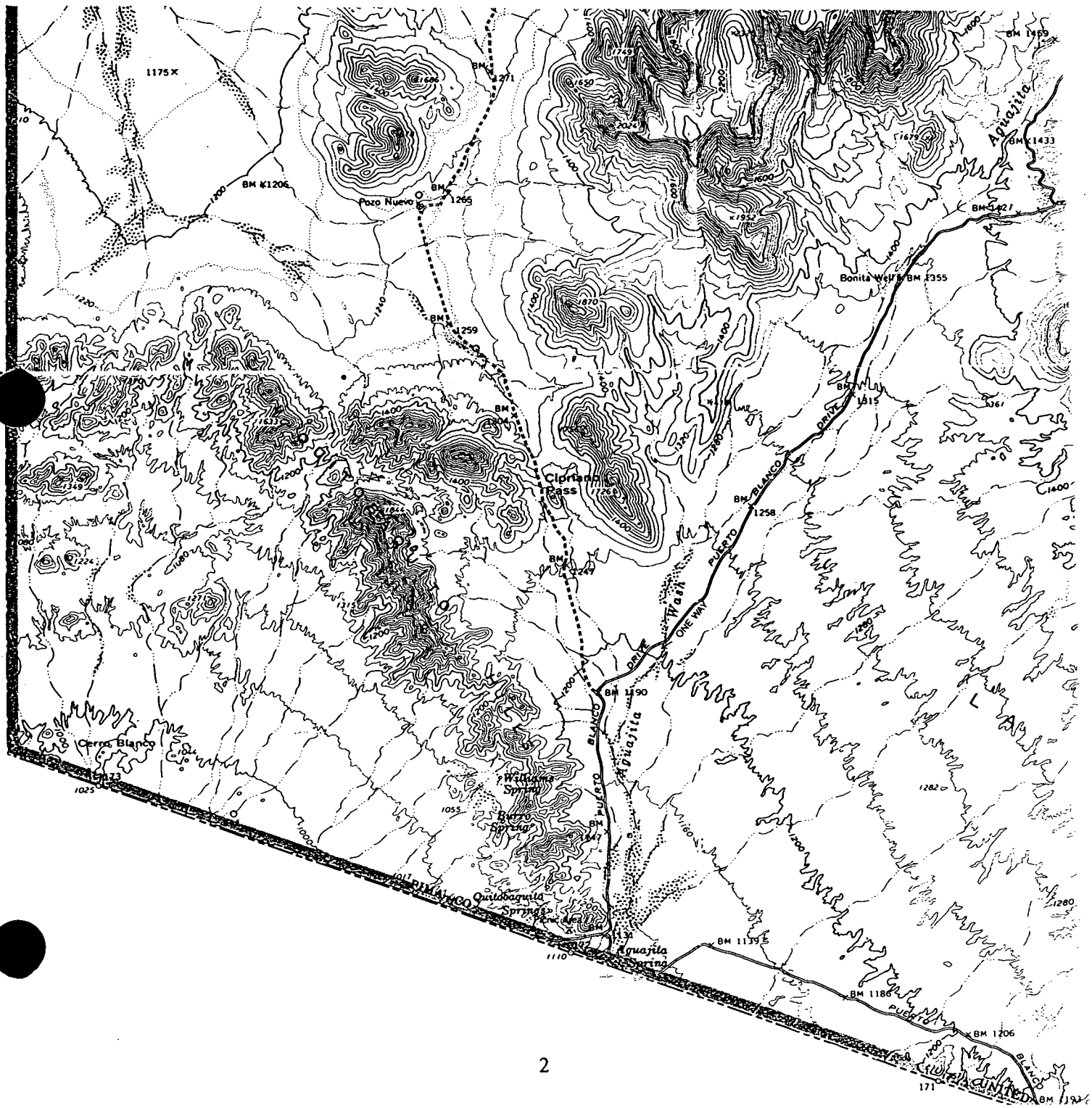
An integrated wetlands program is needed to protect the valuable natural and cultural resources of the wetlands associated with the Quitobaquito Hills Springs. The area includes a number of seeps and flowing springs which form an oasis in the Sonoran Desert (see Map I). The largest springs, Quitobaquito (northeast and southwest), historically were utilized for farming and livestock ranching. Today, the waters are impounded by an earthen dam originally constructed in the 1860s and refurbished a hundred years later. Williams (Rincon) Spring is the second largest spring. Its impoundment was dismantled by the National Park Service and returned to a natural condition. Quitobaquito Springs have been declared critical habitat for the listed, endangered desert pupfish (*Cyprinodon macularius eremus*) and is located within federally designated wilderness. Issues of concern include the invasion of non-native plant and animal species - resulting in the displacement and loss of native species; impacts to the groundwater system supporting the springs; impacts to resources due to visitor use; pesticide/herbicide drift and air pollution, primarily that associated with traffic along Mexican Highway 2; urbanization and agricultural development adjacent to the Quitobaquito area; contamination of water sources; and, the need for baseline data and monitoring protocols on the native plant and animal species and communities of this region.

BACKGROUND INFORMATION

Organ Pipe Cactus National Monument, established in 1937, is located in southwestern Arizona and is geographically near the center of the Sonoran Desert. The monument encompasses 330,689 acres, of which 95% (312,600 acres) is designated wilderness. On October 26, 1976, the United Nations Education, Scientific and Cultural Organization (UNESCO) recognized and designated Organ Pipe Cactus National Monument as a Biosphere Reserve. The primary significance of the monument is the perpetuation of a sample of the Sonoran Desert. Although the monument includes only a small portion of the vast Sonoran Desert, it preserves many elements of that ecosystem.

Situated approximately 20 yards to the north of the international boundary with Mexico, in Organ Pipe Cactus National Monument, is Quitobaquito, an oasis in the Sonoran Desert. It is a spot of lush riparian growth and is one of the few authentic desert oases on the North American continent. Natural springs flow into a man-made channel and pond, which are habitat for an endangered species of desert pupfish. A foot trail partially encircles the pond. Razed habitation sites and that of a general store are also close to the pond, but they are unmarked, and are perhaps recognized only by those familiar with the rich ethnic history of Quitobaquito, which has been occupied by various groups from prehistoric times through the historic period.

MAP I
VICINITY MAP



Organ Pipe Cactus National Monument: Quitobaquito Hills Springs

There are eleven springs within the boundaries of the monument, three of which are perennial and eight intermittent. Of the eleven springs, eight are located at or near Quitobaquito Springs, in the extreme southwestern corner of the monument, two are located in the Ajo Mountains, and one is found in the Puerto Blanco Mountains. The three perennial springs occur entirely in the southwestern corner of the monument, either in the Quitobaquito area or in the Puerto Blanco Mountains. Quitobaquito is one of the largest spring-fed oasis situations in the Sonoran Desert, surpassed in volume and size only by Quitovac in Sonora, Mexico (Johnson 1984).

Andrew Dorsey dug Quitobaquito pond and built a dam to hold the water in 1860 (Greene 1977). The flow of the two largest perennial springs at Quitobaquito has been diverted to the pond, which measures approximately 200 feet wide by 260 feet long and averages 4.8 feet deep. A 700 ft. open channel from the southeast spring to the pond was constructed in 1989. The channel and pond provide habitat for an endangered species of desert pupfish (*Cyprinodon macularius eremus*). In addition, the pond provides habitat for the Sonoran mud turtle (*Kinosternon sonoriense*), and numerous species of avifauna and invertebrates. The spring and pond at Quitobaquito together form the largest surface water resource in the monument (Johnson 1984).

Although the two Quitobaquito springs are the best known of the springs, several other springs associated with it are perhaps equally important biologically. This series of springs is arranged along southeast-northwest trending fault on the south side of the Quitobaquito Hills. The major springs in the system are, from the southeast, Aguajita, Quitobaquito (northeast and southwest), Muddy, Burro and Williams. Smaller unnamed seeps also lie between Quitobaquito and Burro, and to the northwest of Williams Spring. Quitobaquito has the greatest flow of the springs in the complex and probably has received the greatest man-caused disturbance to its natural condition (Warren and Anderson 1987).

Three hundred years of grazing and ranching caused profound ecological change before the National Park Service assumed full control of the Quitobaquito area in 1956. Attempts to clean up, restore, and improve the situation often exacerbated rather than mitigated situation. An interdisciplinary study undertaken between 1982 and 1985 inventoried resources. Six informal recommendations were made to management based on these studies. All of the following recommendations have been implemented: to restrict management in order to ensure maximum diversity while maintaining the appearance of naturalness; to conduct spring water to the pond through an open concrete canal; to create shoal areas suitable for shorebirds and rearing of Sonoran mud turtle fry; to relocate the pupfish held in the Williams Spring and Bates Well refugia to the Arizona State University; to monitor pupfish populations utilizing a non-destructive technique; and to relocate the parking lot to a more distant site.

Due to a dependable supply of fresh water in an arid region, Quitobaquito and its associated springs have long been a crossroads of human activity. These same factors have made it a center of biological change and diversity. The vascular plant flora includes 271 species in 198 genera and 63 families; in addition a number of plants were formerly cultivated at this desert oasis. The Quitobaquito region supports approximately 45 percent of the total flora of the monument, although it comprises only 3.5 percent of the area. Thirty-five species are wetland plants. Thirty-five species are non-native. The flora of the Quitobaquito region is dynamic: major vegetational and floristic changes have occurred due to human influences (Felger et al. 1992).

One species of fish is known to occur at the monument. This is the Quitobaquito desert pupfish (*C. macularius eremus*). The species inhabits the pond and spring outflows at Quitobaquito. At this time, the species is federally listed as endangered. Other rare and sensitive species include the giant white checkerspot butterfly (*Ascia howarthii*) and its forage plant the desert tree caper (*Atamisquia emarginata*). Quitobaquito is the only known United States occurrence for this butterfly. Landye (1981) reported on a new snail, which since has been named the Quitobaquito snail (*Tryonia quitobaquitae*), and is listed by the US Fish and Wildlife Service as a Category 2 species.

Organ Pipe Cactus National Monument contains one of the highest diversity of avian species in the Sonoran Desert for an area of its size. Approximately 260 species of birds have been recorded within the 516 square miles of the monument. This diversity is due to a combination of factors, including: a relatively large number of habitat types; the presence of open, standing water sources which attract migrants; and the monument's proximity to a major migratory route along the Gulf of California, which accounts for the large number of vagrant species recorded. Quitobaquito Springs, and nearby Aguajita and Williams Springs, are among the best-known sites for observing birds both in the monument and in southwestern Arizona. The lush riparian vegetation surrounding each area serves to attract an interesting variety of desert and riparian birds, as well as large number of migrants. Quitobaquito is where the majority of vagrant birds noted on the monument checklist have been recorded (Groschupf et al. 1988)

The area supports a diverse resident community of grasshoppers and butterflies and is also an important stop-over area for transient butterflies. Seventeen species of Orthoptera and 52 species of Lepidoptera have been recorded (Kingsley and Bailowitz 1987). A preliminary investigation of the arthropod fauna of Quitobaquito Springs Area recorded 559 species-level taxa in 134 families representing 12 orders (Kingsley et. al. 1987).

Approximately 37 species of mammals have been recorded from Quitobaquito. Among species recorded include the desert shrew (*Notiosorex crawfordi*); ten species of bats, including the category two species Underwood's mastiff bat (*Eumops underwoodi*), great western bat (*Eumops perotis*) and California leaf-nosed bat (*Macrotus californicus*); three species of lagomorphs; 14 species of rodents; 5 species of carnivores; and, four species of even-toed hoofed mammals.

Quitobaquito Springs was previously a major anuran center. In 1937, Huey (1942) collected four Great Plains toads there. This was the last report for this species at Quitobaquito, in irrigated fields. During the 1950s, but not since, large numbers of red-spotted and Sonoran Desert toads were observed to breed successfully in the pond margins and environs. Desert spadefoot also bred in numbers in the area. Successive alterations of the aquatic habitat at Quitobaquito have worsened conditions for anurans, until today, where there are essentially no fish-free areas at Quitobaquito where anuran eggs and larvae can survive.

The single native aquatic turtle at Organ Pipe is the Sonoran mud turtle *(K. sonoriense)*. It is represented by the subspecies *K. s. longifemorale* (Rio Sonoyta mud turtle) that is endemic to Quitobaquito and the Rio Sonoyta. Desert populations of the Sonoran mud turtle may be threatened throughout their natural range in the United States. A single, mating pair of a second species, the yellow mud turtle *(K. flavescens)* was collected at Quitobaquito in 1955. It has not been reported

before or since, and the 1955 records may represent an introduction. Typically, it occurs in seasonally dry--not perennial--ponds, especially on the Tohono O'odham Reservation. Other introduced turtles that have been removed from Quitobaquito are the painted turtle *(Chrysemys picta)* and the slider *(Trachemys scripta)*.

The Sonoran mud turtle was formerly abundant at Quitobaquito but has been declining since at least the 1970s. This trend has continued into the 1990s, although spurts of reproduction have been observed in association with years of good rainfall. A disproportionate number of inexplicably dead mud turtles have been observed at Quitobaquito, suggesting that adult survivorship is adversely affected in some way not normally seen in this species. Pesticides, poor water quality, disease, and starvation are possible causes. Visitors may also collect turtles at Quitobaquito and remove them from the monument.

The Quitobaquito region is the oldest continuously occupied area within Organ Pipe Cactus National Monument. Julian Hayden (personal communication) indicates that San Dieguito artifacts have been noted in association with extinct springs on the slopes above the present day springs. Survey of this area by Paul Ezell in 1951 resulted in the identification of SON B:4:1(ASM). This site number appears to refer to unprovenienced artifacts collected from the Quitobaquito basin and adjacent areas (Teague 1977).

Archeological survey of the Quitobaquito Basin was conducted by Lynn Teague of the Arizona State Museum in 1977. Nine prehistoric and historic loci were identified which were recorded as seven separate sites. Three sites, SON B:4:9, 11, and 13(ASM) were identified as prehistoric. Son B:4:9(ASM) is a multi-component artifact scatter containing ceramics, chipped and ground stone, and fire-cracked rock clusters. The earliest component indicates use of the area from the early to late Archaic period. Prehistoric ceramic period evidence also indicates use by the Hohokam from A.D. 900-1000; and finally, historic period use by Hia C-ed O'odham is indicated. This site has been partially destroyed by the parking lot. The site does, however, have the potential to yield significant information. Site maps and collections need to be conducted for this site and the San Dieguito site identified by Hayden.

Survey of 500 acres from the crest of the Quitobaquito Hills east to Aguajita Wash resulted in the recording of eight sites and identification of several trail segments and a portion of an historic wagon trail. Sites east of the spring include prehistoric artifact scatters, quarry and associated workshops, and multiple fire-cracked rock clusters with associated chipped stone artifacts. Isolated artifacts identified in the passes confirm use of the area from the Archaic through Historic period. Prehistoric ceramics include Hohokam red-on-buff and red-on-brown, Trincheras purple-on-red, and Lower Colorado buff wares.

Son B:4:16(ASM) was recorded during the ORPI 1989 D survey. The site is an extensive artifact scatter of ceramics, chipped and ground stone, and eight fire-cracked rock clusters. Three discrete activity loci were identified with the site. The presence of Trincheras purple-on-red suggests cultural affiliation with the Trincheras culture. Additionally, a chipping station with a high density of obsidian nodules and flakes was identified. The presence of high densities of obsidian is consistent with information from sites in the Dos Lomitas area which show cultural affiliation with the Trincheras culture.

PROPOSED PROJECT

The Organ Pipe Cactus National Monument Natural and Cultural Resources Management Plan was approved in December 1994. The plan identified resources management actions to assist in the management of the Quitobaquito Area. In addition, the monument's draft Geographic Information System Plan and outline for the Vegetation Management Plan go further in identifying strategies for preservation of this area. In coordination with these documents and recent problem identification this interdisciplinary wetlands conservation project is proposed.

The project is comprised of seven components and designed to address specific wetlands conservation activities associated with the Quitobaquito Hills Spring wetland, primarily involving the areas encompassing the pond, channel, outflow and northeast and southwest Quitobaquito springs.

TABLE I. WETLANDS MITIGATION: Quitobaquito Hills Springs

COMPONENT NO.	COMPONENT DESCRIPTION
I	Non-native Vegetation Assessment and Control
II	Site Rehabilitation and Restoration
III	Wetlands Education
IV	Springs Monitoring and Discharge Assessment
V	Non-native Fish Control
VI	Continue Evaluation of Bat Usage of Quitobaquito Pond
VII	Quitobaquito Wetlands Community Evaluation

Component I addresses the immediate issue of non-native vegetation, which is and has the potential to significantly impact the area, in terms of displacing native species and communities and altering the flow and quantity of available water. This component will assess the extent of non-native plant distribution, location of seed sources, threats to the wetland, recommend and implement control for high risk species and establish a monitoring program. Component II will address the physical structure of the immediate area surrounding the two primary springs, channel and pond. This will include both active rehabilitation of the existing trail system to provide more efficient control of visitor use and impacts, evaluation of alternatives for and stabilization of the dam which is used to impound the water in the pond, vegetation removal in the channel, evaluation and rehabilitation of the overflow channel, and, assessment of alternatives for the management of hazardous and historic vegetation. Component III will involve addressing wetlands mitigation through public education, by creating an awareness to visitors from the United States and Mexico of the resources, issues and sensitivity of area. This will be accomplished both through elements of component II in trail rehabilitation, but also through development of interactive media. Component IV will provide important information on spring discharges and water quality to develop a baseline for mitigation

actions in the present and future. Component V will involve assessment of non-native fish, which is an on-going and continued threat to the federally designated critical habitat. Component VI will continue work to understand the significance of the pond in supporting populations of two sensitive bat species. Finally, Component VII, will incorporate past research projects to provide a framework for future vegetation management in the Quitobaquito Hills wetland.

COMPONENT I
Non-Native Vegetation Assessment and Control

The invasion of non-native vegetation into the Quitobaquito Hills Spring region poses one of the most significant threats to native plant and animal communities in the area. Non-native vegetation in some portions of the Quitobaquito Hills area are competing and preventing other more desirable plants from establishing while others pose threats to the flow and availability of water. Among the most significant of these species are:

Buffelgrass (*Pennisetum ciliare*): This old world plant has been widely introduced into hot, semi-arid regions of the world for forage. It is the most important and extensively planted forage grass in Sonora. Since about the late 1960s and early 1970s it has spread into many natural areas in Sonora and southern Arizona including desert habitats. It began to appear in the monument about the mid-1980s. Between 1984 and 1988 a local increase in this grass was noted at Quitobaquito (Felger 1990). Of the many non-native plant species in the monument, buffelgrass poses the most serious threat to Sonoran desert communities. It is a very aggressive species that can so seriously disrupt the community that all native plants and animals are "crowded out." An established population can rapidly expand because the wind carries the light seeds long distances from the mature plants (ORPI, memorandum 11/94).

Wild Turnip (*Brassica tournefortii*): This species is native to North Africa and is now widely naturalized in the Sonoran Desert. It has spread almost explosively into lowland desert regions, especially in places with sandy soils. The earliest record for it in Arizona is from Yuma in 1957 (Mason 1960). By the 1980s it had become widespread and well established in the lowland desert of southwestern Arizona. When the plant matures and its heavy crop of seeds dry, it is easily snapped off.....and moves with the wind as a tumbleweed (Robins et al. 1951). The species was first recorded at Quitobaquito in 1978 and has since become abundant in this vicinity of the monument.

Salt Cedar (*Tamarix ramosissima*): The salt cedar is a common shade tree in the Sonoran Desert. The plant is native to North Africa and the Eastern Mediterranean. Salt cedar is found in the wet soils around Quitobaquito pond and at the springs, near water sources in washes, and old fields. There is no doubt that this weedy shrub is competing and preventing other more desirable plants from establishing in the Quitobaquito region (Felger 1990).

In total, there are 35 non-native species recorded in the flora of Quitobaquito, which represents 12% of the total flora. Of these, 11 are not established as reproducing populations in the Quitobaquito region (Felger et. al. 1992). Table III. provides a list of known none native species recorded in the area.

To understand and mitigate impacts of non-native vegetation to the Quitobaquito region the following component elements will be implemented:

1) Integration of the existing Quitobaquito geographic information system (GIS) database into the monument's GIS database. This will involve georeferencing of a high resolution Quitobaquito Springs GIS database that exists in an IDRISI format and transformation into an ARC/INFO format, including georeferencing control points using a global positioning system (GPS) and using control points for map transformation.

2) Map the distribution and seed source of all non-native vegetation within the Quitobaquito Springs Hill Complex. All distributions will be recorded utilizing GPS and integrated into the monument's GIS. High risk species will be identified and methods of control developed. Modeling of the projected spread of high risk species will be demonstrated. Deliverables will include voucher specimens, report and recommendations and slides.

3) Control of high risk non-native vegetation species. Recognized high risk species will be immediately controlled. Tamarisk will be removed at water sources, buffelgrass will be removed from known localities and yellow star-thistle (*Centaurea melitensis*) will be eliminated where possible near the pond. Recommendations from element two will be implemented pending additional funding.

TABLE II: COMPONENT I: Non-native Vegetation Assessment and Control (Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Integration of Quitobaquito GIS data	$ 5,000	11/30/96
Map non-native vegetation and seed source in the Quitobaquito region	$10,000	11/30/97
Control high risk non-native vegetation in the Quitobaquito region	$10,000	11/30/97
TOTAL	$25,000	

TABLE III. Non-native Plants in the Quitobaquito Area

FAMILY: Aizoaceae	FAMILY: Nyctaginaceae
Mesambryanthemum crystallinum	Boerhavia erecta var. erecta
Mesambryanthemum nodiflorum	FAMILY: Poaceae
FAMILY: Asteraceae	Bromus rubens
Carthamus tinctorius	B. tectorum
Centaurea melitensis	Chloris virgata
Conyza coulteri	Cynodon dactylon
Eclipta prostrata	Dactyloctenium aegyptium
Sonchus asper	Echinochloa colonum
S. oleraceus	Eragrostis cilianensis
FAMILY: Brassicaceae	Hordeum murinum
Brassica tournefortii	Pennisetum ciliare
Nasturtium officinale	Poa annua
Sisymbrium irio	Polypogon monspeliensis
FAMILY: Chenopodiaceae	P. viridis
Chenopodium murale	Schismus barbatus
Salsola australis	FAMILY: Portulacaeae
FAMILY: Fabaceae	Portulaca oleracea
Melilotus indica	FAMILY: Punicaceae
FAMILY: Geraniaceae	Punica granatum
Erodium cicutarium	FAMILY: Solanaceae
FAMILY: Malvaceae	Calibrachoa parviflora
Malva parvifolia	FAMILY: Tamaricaceae
FAMILY: Moraceae	Tamarix ramosissima
Ficus carica	

Table III From: Vascular Plants of a Desert Oasis: Flora and Ethnobotany of Quitobaquito, Organ Pipe Cactus National Monument, Arizona (Felger 1992 et al)

COMPONENT II
Site Rehabilitation and Restoration

Quitobaquito is one of the most heavily visited areas within Organ Pipe Cactus National Monument. A large percentage of the annual 250,000+ visitors to the monument each year visit at least the pond and primary springs. Due to its proximity to Mexican Highway 2 and its unique features, several people from Mexico also visit the area. In addition, Hi-ced O'odham and Tohono O'odham people use the site for ceremonies, sometimes attracting well over one-hundred individuals at a time. Visitation is heavy and impacts are noticeable but not fully quantified.

In the draft General Management Plan for Organ Pipe Cactus National Monument two alternative Development Concept Plans (DCPs) are proposed for action for the Quitobaquito area. The DCPs recommend several modifications to the area including relocation of the existing parking lot and establishment of a modified trail system. Neither DCP has been approved, and when/if either is selected, funding for implementation will undoubtedly be several years in the future. The objective of this component is to make immediate minor improvements to the area at a level to mitigate current impacts, while at the same time not altering the landscape in anyway that would conflict with either proposed alternative and not contrary to current management.

Elements associated with this component include:

1) Rehabilitate the trail system to include defining and grooming of primary system in the vicinity of the pond, channel and spring. This will involve identifying primary trail route and defining through grooming, interpretive waysides and a brochure, elimination of extensive spider-web trails, recognizing sensitive areas (i.e. breeding birds) and rerouting trail, ensuring adequate public information and direction throughout the trail system, both in English and Spanish.

2) Identify options and select alternative for long-term stabilization of the dam impounding the water at Quitobaquito pond. Included will be an assessment of modifications to the pond since its construction in 1860, primarily focusing on National Park Service alterations accomplished since the 1960s. These modifications have involved significant dredging of the pond and stabilization of an old cottonwood tree, whose trunk and roots are the primary stabilizing factor holding the dam together today.

3) Remove and control vegetation in the channel that flows from the southwest spring into the pond. This will include clearing the channel of vegetation monthly over a period of two years. In 1989, the National Park Service created a 700 foot linear naturalized stream channel to feed water from both the northeast and southwest springs to the pond. The channel replaced an underground pipe system that was prone to failure, with a system that more closely resembled the historic method of providing water to the pond. The channel itself is made of reinforced concrete and includes several pools with overhangs, designed to enhance the habitat of the desert pupfish, sonoran mud turtle and associated aquatic flora and fauna. Due to the prolific growth of species such as bullrush it is necessary to manually remove vegetation from the channel to ensure adequate flow of water through the channel and into the pond.

4) Rehabilitate the overflow channel below the pond. Old irrigation ditches that serve as the overflow below the pond have become clogged with vegetation and need to be evaluated to determine method of control. The overflow provides water to a historic fig and pomegranate orchard and have until recently flowed for several hundred feet. For a variety of factors this flow has been reduced over the years.

5) Assess and implement alternatives for maintenance of hazardous vegetation and historic trees. Several of the plants at Quitobaquito have been introduced and many can be categorized as either/or hazardous and historic. Pomegranates and figs whose source may date to the time of Padre Kino can be found on the southern side of Quitobaquito pond. Historic cottonwoods help provide the unique character of Quitobaquito, but due to their age and size are potentially very hazardous.

TABLE IV: COMPONENT II: Site Rehabilitation and Restoration (Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Rehabilitate the existing trail system	$ 7,000	05/30/97
Dam stabilization	$ 6,000	11/30/97
Remove vegetation from the channel	$ 1,500	11/30/96
Rehabilitate the overflow channel	$ 2,000	12/30/96
Assess and implement alternatives for maintenance of hazardous vegetation and historic trees	$ 5,000	11/30/97
TOTAL	$21,500	

COMPONENT III
Wetlands Education

Existing developments for visitor use at Quitobaquito are substandard and lack coherent design. Informal paths lace the area and are random and undirected. Visitors do not receive orientation to the site, nor do they receive information about how to use the area without adversely impacting the sensitive resources found there. The parking area and approach to the spring have an improvised appearance, and vandalism of picnic tables and signs are apparent (Draft ORPI General Management Plan 1995).

Impacts to the areas from visitor use are evident. In addition to interpretive messages developed through rehabilitation of the trail system this component will develop a Wetlands/Quitobaquito environmental education program for school students using a visual interactive computer system so as to reach the most people over the greatest period of time. The system will also be used for information for individuals and family group visitors to the Quitobaquito area. The program will be

developed using current research and resources management information and data gathered through this project.

TABLE V: COMPONENT III: Wetlands Education
(Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Wetlands Environmental Education Program	$ 5,000	10/30/96
TOTAL	$ 5,000	

COMPONENT IV
Springs Monitoring and Discharge Assessment

Flow of water discharged from he primary springs at Quitobaquito are no longer monitored due to lack of funding. This critical baseline is necessary to detect changes in the system that may impact the entire area. Quitobaquito is the largest spring system in the monument discharging a nearly constant flow of over 30 to 35 gallons per minute. Discharge occurs predominantly at two points on the southern slope of the Quitobaquito Hills. Monitoring of the flow of these springs was initiated on January 12, 1974. Water at this time was piped from the northeast spring to the southwest spring where the combined flow was directed over a weir. Volumetric discharge measurements were collected by monument personnel on a monthly basis until October 26, 1981, when the monitoring became part of the USGS program, and a recorder was installed on the weir to obtain continuous data. Measurements taken during the initial seven year period provide a fair record of the flow. In November 1989, the pipeline was removed and replaced by the naturalized stream channel. A flume at the southwest spring was built to accommodate a flow recorder. This recorder was not installed due to lack of funding to continue USGS monitoring of the springs. 1989 was the last year that data was acquired on flow from the primary springs at Quitobaquito.

Through this component a continuous flow recorder will be installed at the southwest spring at Quitobaquito which will record the volume of water flowing from both the northeast and southwest springs. This recorder will be maintained and serviced by NPS resources management personnel. In addition, routine ph and conductivity measurements will be taken at all of the springs as well as in the pond. Large (±300uMHOs) changes in conductivity indicate significant changes in water chemistry (Bennett 1983). Continued coordination with the Arizona Department of Environmental Quality will continue to take more complex measurements of water quality at the Quitobaquito springs and pond (ions: sodium, potassium, calcium, magnesium, lead, arsenic, chloride, sulfate, total nitrogen, total phosphorus, carbonate, bicarbonate, sulfide and total dissolved solids).

TABLE VI: COMPONENT IV: Springs Monitoring and Discharge Assessment (Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Springs Monitoring and Discharge Assessment	$ 7,000	11/30/96
TOTAL	$ 7,000	

COMPONENT V
Non-native Fish Control

A recurring threat of non-native fish introductions into Quitobaquito springs, pond and channel is always present. Since pupfish are the only fish native to the Quitobaquito system, any species of larger size represents a probable non-native fish that could impact the pupfish through predation and competition (ORPI memorandum - 04/95). Exotic species are the most probable major threat to the Quitobaquito ecosystems (Bennett 1983). In 1969 golden shiners were introduced into the pond leading to a major pupfish removal, pond draining and poisoning of the pond. With increased use of the area from both the United States and Mexico the likelihood of such an event recurring is likely. On May 6, 1990, fish were discovered in the only pool located at the Aguajita Springs. Three species, mosquito fish (*Gambusia affinis*), spike dace (*Agosia chrysogaster*) and pupfish (*Cyprinodon macularius* sp.) were identified. Fish have never been known to inhabit the Aguajita Springs area. Since there is no water link with the Rio Sonoyta, where all three species are known to occur, the most likely explanation for the occurrence of the fish is human introduction. The introduction is most likely from Mexico, where many people live within walking distance to the Aguajita Springs, and are known to use the water. A 10 inch catfish was caught and removed from the southwest spring at Quitobaquito on August 1, 1993, by researchers conducting a census of the Sonoran mud turtle. It was unknown whether the catfish (*Ictalurus meias*) was an isolated introduction or one of a larger population released into the Quitobaquito system. Follow-up surveys did not yield any additional catfish.

On April 25, 1995, the monument received a report of a large (4" to 6") fish in the pond. Follow-up examinations by National Park Service staff made several observations of likely non-natives the following day. Trapping efforts coordinated by the NPS, U.S. Fish & Wildlife Service and Arizona Game & Fish Department did not yield any vouchers. The NPS today continues to examine the pond for the presence of non-native fish. This component will provide support to surveys and removal of non-native fish. Elements of the component include:

1) Continue immediate surveys of the pond and channel for the presence of non-native fish. If non-native fish are located then at least one voucher specimen will be collected and sent for identification and assessment by U.S. Fish and Wildlife Service, Arizona Game & Fish Department and Arizona State University.

2) A draft protocol exists to address the introduction of non-native fish into the Quitobaquito system. This protocol will be evaluated, updated and finalized. A variety of potential non-

native fish species will be evaluated and their impact to pupfish and the Quitobaquito aquatic flora and fauna.

TABLE VII: COMPONENT V: Non-native Fish Control
(Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Non-native fish survey and assessment	$ 2,000	05/30/96
Non-native fish monitoring protocol	$ 5,000	11/30/97
TOTAL	$ 7,000	

COMPONENT VI
Continue Evaluation of Bat Usage of Quitobaquito Pond

This component will address the status of two sensitive mammal species, *Eumops underwoodi* and *Eumops perotis* at Quitobaquito pond. Both of these bat species are known to utilize this area as a watering, and possibly a food resource. Questions that will be addressed include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture rate, and relative abundance of *E. underwoodi* and *E. perotis*. The work will continue efforts initiated in 1994. The data gathered from this project will provide management with invaluable information on these bat species, as well as additional knowledge on the sensitive habitat Quitobaquito. Information will be useful in the development of management strategies, resources management activities and interpretation programs.

This effort will monitor Quitobaquito Pond, for two consecutive nights on a bimonthly basis for one year. This will entail setting a 120 ft. mist net across the pond. This setup has proven to be successful in the past. The net will be checked periodically from sunset to the next morning's first light. All bats captured will be identified, sex determined, relative age estimated, weighed, and reproductive activity and time of capture noted. The data accumulated in this fashion should shed light on the relative number of bats utilizing Quitobaquito seasonally and annually. Sex ratios, breeding strategies, size, and nightly activity periods will be determined for the bats visiting Quitobaquito. Do bats utilize this water source faithfully throughout the year? What ratio of females have young in any given year? What is the relative abundance of *E. underwoodi* and *E. perotis* at this water source?

Since little is known of the diets of these bats, any fecal pellets deposited in the holding bags (a common occurrence) will be analyzed for prey content. Short of sacrificing the animal and analyzing stomach content, this is the only way to get information on food items.

TABLE VIII: COMPONENT VI: Continue Evaluation of Bat Usage of Quitobaquito Pond (Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Continue Assessment of Bat Usage of Quitobaquito Pond	$ 2,500	05/30/97
TOTAL	$ 2,500	

COMPONENT VII
Quitobaquito Wetlands Community Evaluation

Management options for native vegetation, primarily woody riparian species, at Quitobaquito needs to be developed and implemented. Prior to formal acquisition by the National Park Service in the 1950s, Quitobaquito Springs oasis was disturbed by human and livestock activities which maintained the surrounding riparian vegetation in a relatively open condition. National Park Service management eliminated most disturbances, resulting in the development of dense woodland and scrubland in the formerly open areas. The dynamic process of vegetative succession can be expected to cause further changes in the appearance, diversity and structure of woody vegetation at the site (Brown B. T., P.L. Warren 1986).

This component will bring together existing data, including conducting a new survey to provide a descriptive analysis of woody riparian vegetation and habitat types at Quitobaquito. Issues such as vegetation clearing, fire management and control and percentage of coverage by non-native species of each habitat type will be addressed.

TABLE IX: COMPONENT VII: Quitobaquito Wetlands Community Evaluation (Elements, Cost and Due Date)

ELEMENT	COST	DUE DATE
Native Wetlands Community Evaluation	$ 7,000	05/30/98
TOTAL	$ 7,000	

MONUMENT PARTICIPATION

Monument staff will provide significant in-kind contributions and project support. The following positions will be involved with the project:

Superintendent
The Superintendent will provide overall authority for all project components. Elements of all components will be reviewed and approved by the Superintendent before implementation.

Chief of Resources Management
The Chief of Resources Management will provide lead project oversight and administration. He will review and approve all products and deliverables and serve as the Government Technical Representative.

Plant Ecologist
The Plant Ecologist will coordinate and implement Components I, II and VII. She will prepare all request for proposals, cooperative and/or interagency agreements for contracted elements of each component. In addition, she will supervise all contracts and monitor and evaluate work in the field and prepare and implement work plans for non-contracted items. Finally, the Plant Ecologist will coordinate compliance activities for all components.

Wildlife Biologist
The Wildlife Biologist will coordinate and implement Components V and VI. He will prepare all request for proposals, cooperative and/or interagency agreements for contracted elements of each component. In addition, he will supervise all contracts and monitor and evaluate work in the field and prepare and implement work plans for non-contracted items. Finally, the Wildlife Biologist will work closely with the Plant Ecologist and Chief of Resource Education with elements of Component II.

Chief of Resource Education
The Chief of Resource Education will coordinate and implement Component III. She will also work closely with the Plant Ecologist and Wildlife Biologist, and will be responsible for all interpretive elements associated with Component II.

Park Rangers (2 positions) (Resource Education)
These two positions will assist primarily with public education elements of Components II and III.

Resources Management Specialist (Ecological Monitoring)
The Resources Management Specialist (Ecological Monitoring) will coordinate and implement Component IV. He will ensure purchase of necessary equipment and assign Biological Science Technician support staff to gather data.

Biological Science Technicians (2 positions)
The two Biological Science Technicians will assist with all components of this project. They will provide support with vegetation control, trail rehabilitation, non-native fish control and other elements of all seven components.

Resources Management Specialist (Information Management)
The Resources Management Specialist (Information Management) will be extensively involved with Component I, in terms of geographic information system and global positioning system support and map preparation. He will also be involved from an information management standpoint in all seven components.

Geographer (Geographic Information/Global Positioning Systems)
The Geographer (Geographic information/Global Positioning Systems) in coordination with the

Resource Management Specialist (Information Management) will provide geographic information/global positioning systems support.

Chief of Resource Protection
The Chief of Resource Protection will provide technical assistance on protection issues associated will all components. He will also assist with any elements that deal with fire management or history.

Chief of Maintenance
The Chief of Maintenance will provide assistance on maintenance issues associated with all components.

In addition to staff assistance, facilities and equipment will be available for this project. This includes the monument's GIS lab and associated equipment and facilities (i.e. workstation, GPS field units and base station, software, etc.), field equipment, monument library and museum, office facilities and vehicle support.

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COMPONENT I
NON-NATIVE VEGETATION ASSESSMENT AND CONTROL

INTRODUCTION

The invasion of non-native vegetation into the Quitobaquito Hills Spring region poses one of the most significant threats to native plant and animal communities in the area. Non-native vegetation in some portions of the Quitobaquito Hills area are competing and preventing other more desirable plants from establishing while others pose threats to the flow and availability of water. Among the most significant of these species are:

Buffelgrass (*Pennisetum ciliare*): This old world plant has been widely introduced into hot, semi-arid regions of the world for forage. It is the most important and extensively planted forage grass in Sonora. Since about the late 1960s and early 1970s it has spread into many natural areas in Sonora and southern Arizona including desert habitats. It began to appear in the monument about the mid-1980s. Between 1984 and 1998 a local increase in this grass was noted at Quitobaquito (Felger 1990). Of the many non-native plant species in the monument, buffelgrass poses the most serious threat to Sonoran desert communities. It is a very aggressive species that can so seriously disrupt the community that all native plants and animals are "crowded out." An established population can rapidly expand because the wind carries the light seeds long distances from the mature plants (ORPI, memorandum 11/94).

Wild Turnip (*Brassica tournefortii*): This species is native to North Africa and is now widely naturalized in the Sonoran Desert. It has spread almost explosively into lowland desert regions, especially in places with sandy soils. The earliest record for it in Arizona is from Yuma in 1957 (Mason 1960). By the 1980s it had become widespread and well established in the lowland desert of southwestern Arizona. When the plant matures and its heavy crop of seeds dry, it is easily snapped off.....and moves with the wind as a tumbleweed (Robins et al. 1951). The species was first recorded at Quitobaquito in 1978 and has since become abundant in this vicinity of the monument.

Salt Cedar (*Tamarix ramosissima*): The salt cedar is a common shade tree in the Sonoran Desert. The plant is native to North Africa and the Eastern Mediterranean. Salt cedar is found in the wet soils around Quitobaquito pond and at the springs, near water sources in washes, and old fields. There is no doubt that this weedy shrub is competing and preventing other more desirable plants from establishing in the Quitobaquito region (Felger 1990).

In total, there are 35 non-native species recorded in the flora of Quitobaquito, which represents 12% of the total flora. Of these, 11 are not established as reproducing populations in the Quitobaquito region (Felger et. al. 1992).

COMPONENT ACTIONS

To understand and mitigate impacts of non-native vegetation to the Quitobaquito region the following component elements will be implemented:

1) Integration of the existing Quitobaquito geographic information system (GIS) database into the monument's GIS database. This will involve georeferencing of a high resolution

Quitobaquito Springs GIS database that exists in an IDRISI format and transformation into an ARC/INFO format, including georeferencing control points using a global positioning system (GPS) and using control points for map transformation.

2) Map the distribution and seed source of all non-native vegetation within the Quitobaquito Springs Hill Complex. All distributions will be recorded utilizing GPS and integrated into the monument's GIS. High risk species will be identified and methods of control developed. Modeling of the projected spread of high risk species will be demonstrated. Deliverables will include voucher specimens, report and recommendations and slides.

3) Control of high risk non-native vegetation species. Recognized high risk species will be immediately controlled. Tamarisk will be removed at water sources, buffelgrass will be removed from known localities and yellow star-thistle (*Centaurea melitensis*) will be eliminated where possible near the pond. Recommendations from element two will be implemented pending additional funding.

COMPONENT ELEMENTS, BUDGET AND DUE DATES

ELEMENT	COST	DUE DATE
Integration of Quitobaquito GIS data	$ 5,000	11/30/96
Map non-native vegetation and seed source in the Quitobaquito region	$10,000	11/30/97
Control high risk non-native vegetation in the Quitobaquito region	$10,000	11/30/97
TOTAL	$25,000	

NON-NATIVE PLANTS OF QUITOBAQUITO

FAMILY: Aizoaceae	FAMILY: Nyctaginaceae
Mesambryanthemum crystallinum	Boerhavia erecta var. erecta
Mesambryanthemum nodiflorum	FAMILY: Poaceae
FAMILY: Asteraceae	Bromus rubens
Carthamus tinctorius	B. tectorum
Centaurea melitensis	Chloris virgata
Conyza coulteri	Cynodon dactylon
Eclipta prostrata	Dactyloctenium aegyptium
Sonchus asper	Echinochloa colonum
S. oleraceus	Eragrostis cilianensis
FAMILY: Brassicaceae	Hordeum murinum
Brassica tournefortii	Pennisetum ciliare
Nasturtium officinale	Poa annua
Sisymbrium irio	Polypogon monspeliensis
FAMILY: Chenopodiaceae	P. viridis
Chenopodium murale	Schismus barbatus
Salsola australis	FAMILY: Portulacaeae
FAMILY: Fabaceae	Portulaca oleracea
Melilotus indica	FAMILY: Punicaceae
FAMILY: Geraniaceae	Punica granatum
Erodium cicutarium	FAMILY: Solanaceae
FAMILY: Malvaceae	Calibrachoa parviflora
Malva parvifolia	FAMILY: Tamaricaceae
FAMILY: Moraceae	Tamarix ramosissima
Ficus carica	

Table III From: Vascular Plants of a Desert Oasis: Flora and Ethnobotany of Quitobaquito, Organ Pipe Cactus National Monument, Arizona (Felger 1992 et al)

COMPONENT II
SITE REHABILITATION AND RESTORATION

INTRODUCTION

Quitobaquito is one of the most heavily visited areas within Organ Pipe Cactus National Monument. A large percentage of the annual 250,000+ visitors to the monument each year visit at least the pond and primary springs. Due to its proximity to Mexican Highway 2 and its unique features, several people from Mexico also visit the area. In addition, Hi-ced O'odham and Tohono O'odham people use the site for ceremonies, sometimes attracting well over one-hundred individuals at a time. Visitation is heavy and impacts are noticeable but not fully quantified.

In the draft General Management Plan for Organ Pipe Cactus National Monument two alternative Development Concept Plans (DCPs) are proposed for action for the Quitobaquito area. The DCPs recommend several modifications to the area including relocation of the existing parking lot and establishment of a modified trail system. Neither DCP has been approved, and when/if either is selected, funding for implementation will undoubtly be several years in the future. The objective of this component is to make immediate minor improvements to the area at a level to mitigate current impacts, while at the same time not altering the landscape in anyway that would conflict with either proposed alternative and not contrary to current management.

COMPONENT ACTIONS

Elements associated with this component include:

1) Rehabilitate the trail system to include defining and grooming of primary system in the vicinity of the pond, channel and spring. This will involve identifying primary trail route and defining through grooming, interpretive waysides and a brochure, elimination of extensive spider-web trails, recognizing sensitive areas (i.e. breeding birds) and rerouting trail, ensuring adequate public information and direction throughout the trail system, both in English and Spanish.

2) Identify options and select alternative for long-term stabilization of the dam impounding the water at Quitobaquito pond. Included will be an assessment of modifications to the pond since its construction in 1860, primarily focusing on National Park Service alterations accomplished since the 1960s. These modifications have involved significant dredging of the pond and stabilization of an old cottonwood tree, whose trunk and roots are the primary stabilizing factor holding the dam together today.

3) Remove and control vegetation in the channel that flows from the southwest spring into the pond. This will include clearing the channel of vegetation monthly over a period of two years. In 1989, the National Park Service created a 700 foot linear naturalized stream channel to feed water from both the northeast and southwest springs to the pond. The channel replaced an underground pipe system that was prone to failure, with a system that more closely resembled the historic method of providing water to the pond. The channel itself is made of reinforced concrete and includes several pools with overhangs, designed to enhance the habitat of the desert pupfish, Sonoran mud turtle and associated aquatic flora and fauna. Due to the prolific growth of species such as bullrush it is necessary to manually

remove vegetation from the channel to ensure adequate flow of water through the channel and into the pond.

4) Rehabilitate the overflow channel below the pond. Old irrigation ditches that serve as the overflow below the pond have become clogged with vegetation and need to be evaluated to determine method of control. The overflow provides water to a historic fig and pomegranate orchard and have until recently flowed for several hundred feet. For a variety of factors this flow has been reduced over the years.

5) Assess and implement alternatives for maintenance of hazardous vegetation and historic trees. Several of the plants at Quitobaquito have been introduced and many can be categorized as either/or hazardous and historic. Pomegranates and figs whose source may date to the time of Padre Kino can be found on the southern side of Quitobaquito pond. Historic cottonwoods help provide the unique character of Quitobaquito, but due to their age and size are potentially very hazardous.

COMPONENT ELEMENTS, BUDGET AND DUE DATES

ELEMENT	COST	DUE DATE
Rehabilitate the existing trail system	$ 7,000	05/30/97
Dam stabilization	$ 6,000	11/30/97
Remove vegetation from the channel	$ 1,500	11/30/96
Rehabilitate the overflow channel	$ 2,000	12/30/96
Assess and implement alternatives for maintenance of hazardous vegetation and historic trees	$ 5,000	11/30/97
TOTAL	$21,500	

COMPONENT III
WETLANDS EDUCATION

INTRODUCTION

Existing developments for visitor use at Quitobaquito are substandard and lack coherent design. Informal paths lace the area and are random and undirected. Visitors do not receive orientation to the site, nor do they receive information about how to use the area without adversely impacting the sensitive resources found there. The parking area and approach to the spring have an improvised appearance, and vandalism of picnic tables and signs are apparent (Draft ORPI General Management Plan 1995).

COMPONENT ACTIONS

Impacts to the areas from visitor use are evident. In addition to interpretive messages developed through rehabilitation of the trail system this component will develop a Wetlands/Quitobaquito environmental education program for school students using a visual interactive computer system so as to reach the most people over the greatest period of time. The system will also be used for information for individuals and family group visitors to the Quitobaquito area. The program will be developed using current research and resources management information and data gathered through this project.

COMPONENT ELEMENT, BUDGET AND DUE DATE

ELEMENT	COST	DUE DATE
Wetlands Environmental Education Program	$ 5,000	10/30/96
TOTAL	$ 5,000	

COMPONENT IV
SPRINGS MONITORING AND DISCHARGE ASSESSMENT

INTRODUCTION

Flow of water discharged from he primary springs at Quitobaquito are no longer monitored due to lack of funding. This critical baseline is necessary to detect changes in the system that may impact the entire area. Quitobaquito is the largest spring system in the monument discharging a nearly constant flow of over 30 to 35 gallons per minute. Discharge occurs predominantly at two points on the southern slope of the Quitobaquito Hills. Monitoring of the flow of these springs was initiated on January 12, 1974. Water at this time was piped from the northeast spring to the southwest spring where the combined flow was directed over a weir. Volumetric discharge measurements were collected by monument personnel on a monthly basis until October 26, 1981, when the monitoring became part of the USGS program, and a recorder was installed on the weir to obtain continuous data. Measurements taken during the initial seven year period provide a fair record of the flow. In November 1989, the pipeline was removed and replaced by the naturalized stream channel. A flume at the southwest spring was built to accommodate a flow recorder. This recorder was not installed due to lack of funding to continue USGS monitoring of the springs. 1989 was the last year that data was acquired on flow from the primary springs at Quitobaquito.

COMPONENT ACTIONS

Through this component a continuous flow recorder will be installed at the southwest spring at Quitobaquito which will record the volume of water flowing from both the northeast and southwest springs. This recorder will be maintained and serviced by NPS resources management personnel. In addition, routine ph and conductivity measurements will be taken at all of the springs as well as in the pond. Large (±300uMHOs) changes in conductivity indicate significant changes in water chemistry (Bennett 1983). Continued coordination with the Arizona Department of Environmental Quality will continue to take more complex measurements of water quality at the Quitobaquito springs and pond (ions: sodium, potassium, calcium, magnesium, lead, arsenic, chloride, sulfate, total nitrogen, total phosphorus, carbonate, bicarbonate, sulfide and total dissolved solids).

COMPONENT ELEMENT, BUDGET AND DUE DATE

ELEMENT	COST	DUE DATE
Springs Monitoring and Discharge Assessment	$ 7,000	11/30/96
TOTAL	$ 7,000	

COMPONENT V
NON-NATIVE FISH CONTROL

INTRODUCTION

A recurring threat of non-native fish introductions into Quitobaquito springs, pond and channel is always present. Since pupfish are the only fish native to the Quitobaquito system, any species of larger size represents a probable non-native fish that could impact the pupfish through predation and competition (ORPI memorandum - 04/95). Exotic species are the most probable major threat to the Quitobaquito ecosystems (Bennett 1983). In 1969 golden shiners were introduced into the pond leading to a major pupfish removal, pond draining and poisoning of the pond. With increased use of the area from both the United States and Mexico the likelihood of such an event recurring is likely. On May 6, 1990, fish were discovered in the only pool located at the Aguajita Springs. Three species, mosquito fish (*Gambusia affinis*), spike dace (*Agosia chrysogaster*) and pupfish (*Cyprinodon macularius* sp.) were identified. Fish have never been known to inhabit the Aguajita Springs area. Since there is no water link with the Rio Sonoyta, where all three species are known to occur, the most likely explanation for the occurrence of the fish is human introduction. The introduction is most likely from Mexico, where many people live within walking distance to the Aguajita Springs, and are known to use the water. A 10 inch catfish was caught and removed from the southwest spring at Quitobaquito on August 1, 1993, by researchers conducting a census of the Sonoran mud turtle. It was unknown whether the catfish (*Ictalurus melas*) was an isolated introduction or one of a larger population released into the Quitobaquito system. Follow-up surveys did not yield any additional catfish.

On April 25, 1995, the monument received a report of a large (4" to 6") fish in the pond. Follow-up examinations by National Park Service staff made several observations of likely non-natives the following day. Trapping efforts coordinated by the NPS, U.S. Fish & Wildlife Service and Arizona Game & Fish Department did not yield any vouchers. The NPS today continues to examine the pond for the presence of non-native fish. This component will provide support to surveys and removal of non-native fish.

COMPONENT ACTIONS

Elements of the component include:

1) Continue immediate surveys of the pond and channel for the presence of non-native fish. If non-native fish are located then at least one voucher specimen will be collected and sent for identification and assessment by U.S. Fish and Wildlife Service, Arizona Game & Fish Department and Arizona State University.

2) A draft protocol exists to address the introduction of non-native fish into the Quitobaquito system. This protocol will be evaluated, updated and finalized. A variety of potential non-native fish species will be evaluated and their impact to pupfish and the Quitobaquito aquatic flora and fauna.

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Organ Pipe Cactus National Monument: Quitobaquito Hills Springs

COMPONENT ELEMENTS, BUDGET AND DUE DATES

ELEMENT	COST	DUE DATE
Non-native fish survey and assessment	$ 2,000	05/30/96
Non-native fish monitoring protocol	$ 5,000	11/30/97
TOTAL	$ 7,000	

COMPONENT VI
CONTINUE EVALUATION OF BAT USAGE OF QUITOBAQUITO POND

INTRODUCTION

This component will address the status of two sensitive mammal species, *Eumops underwoodi* and *Eumops perotis* at Quitobaquito pond. Both of these bat species are known to utilize this area as a watering, and possibly a food resource. Questions that will be addressed include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture rate, and relative abundance of *E. underwoodi* and *E. perotis*. The work will continue efforts initiated in 1994. The data gathered from this project will provide management with invaluable information on these bat species, as well as additional knowledge on the sensitive habitat Quitobaquito. Information will be useful in the development of management strategies, resources management activities and interpretation programs.

COMPONENT ELEMENTS

This effort will monitor Quitobaquito Pond, for two consecutive nights on a bimonthly basis for one year. This will entail setting a 120 ft. mist net across the pond. This setup has proven to be successful in the past. The net will be checked periodically from sunset to the next morning's first light. All bats captured will be identified, sex determined, relative age estimated, weighed, and reproductive activity and time of capture noted. The data accumulated in this fashion should shed light on the relative number of bats utilizing Quitobaquito seasonally and annually. Sex ratios, breeding strategies, size, and nightly activity periods will be determined for the bats visiting Quitobaquito. Do bats utilize this water source faithfully throughout the year? What ratio of females have young in any given year? What is the relative abundance of *E. underwoodi* and *E. perotis* at this water source?

Since little is known of the diets of these bats, any fecal pellets deposited in the holding bags (a common occurrence) will be analyzed for prey content. Short of sacrificing the animal and analyzing stomach content, this is the only way to get information on food items.

COMPONENT ELEMENT, BUDGET AND DUE DATE

ELEMENT	COST	DUE DATE
Continue Assessment of Bat Usage of Quitobaquito Pond	$ 2,500	05/30/97
TOTAL	$ 2,500	

COMPONENT VII
QUITOBAQUITO WETLANDS COMMUNITY EVALUATION

INTRODUCTION

Management options for native vegetation, primarily woody riparian species, at Quitobaquito needs to be developed and implemented. Prior to formal acquisition by the National Park Service in the 1950s, Quitobaquito Springs oasis was disturbed by human and livestock activities which maintained the surrounding riparian vegetation in a relatively open condition. National Park Service management eliminated most disturbances, resulting in the development of dense woodland and scrubland in the formerly open areas. The dynamic process of vegetative succession can be expected to cause further changes in the appearance, diversity and structure of woody vegetation at the site (Brown B. T., P.L. Warren 1986).

COMPONENT ACTIONS

This component will bring together existing data, including conducting a new survey to provide a descriptive analysis of woody riparian vegetation and habitat types at Quitobaquito. Issues such as vegetation clearing, fire management and control and percentage of coverage by non-native species of each habitat type will be addressed.

COMPONENT ELEMENT, BUDGET AND DUE DATE

ELEMENT	COST	DUE DATE
Native Wetlands Community Evaluation	$ 7,000	05/30/98
TOTAL	$ 7,000	