



Tamarix and *Cardaria*
Exotic Management
Environmental Assessment



Chaco Culture

National Historical Park
New Mexico

February 2006

1.0 Purpose and Need

1.1 Park Setting

Chaco Culture National Historical Park (CCNHP) is located in northwest New Mexico, approximately 60 miles south of the city of Farmington. The park was originally designated Chaco Canyon National Monument in 1907. The passage of the Organic Act in 1916 created the National Park Service, within which the monument was included. The Organic Act set forth the NPS mission to preserve unimpaired the features of each park and provide for the enjoyment of these features by future generations. In 1980 the monument was enlarged to its current size of 34,000 acres and designated a National Historical Park (NPS GMP, 1985). The park was added to the UNESCO list of World Heritage Sites in 1987. The park contains thousands of archaeological sites, material evidence of a culture known collectively in modern times as the Ancestral Puebloans (also sometimes referred to as the “Anasazi,” although use of this term is discouraged), who lived in Chaco Canyon during the period from circa A.D. 800 to 1200. The great house structures, remains of multi-story buildings constructed during this period, are among the most easily observable and perhaps the most impressive cultural resources left by the Chacoan people (NPS RMP, 2003). The park is one of only two protected natural areas in the San Juan Basin, encompassing relatively undisturbed examples of floral and faunal communities within the Colorado Plateau ecosystem, which offers unique opportunities to conserve the region’s biodiversity and monitor its environmental quality (NPS APP, 2005).

Chaco Culture NHP (CHCU) contains approximately 34,000 acres located in San Juan and McKinley Counties, near the geographic center of the San Juan Basin of northwestern NM. Chaco Canyon, which bisects the main park unit, drains a 4,400 square mile watershed beginning on the Continental Divide and flowing northwest into the San Juan River near Shiprock, NM. The Colorado Plateau region surrounding and including Chaco Culture NHP is classified as a high desert steppe, with an average annual precipitation of 8.5 inches. Elevations within the park range from 6,100 feet (1,900 meters) on the west end of the park where the Chaco Wash and Escavada Wash join to form the Chaco River to 6,835 feet (2,080 meters) on Chacra Mesa. Three landforms are prominent: (1) alluvium-filled valley floors, with intermittent drainage features, (2) small side canyons eroded into the sandstone faces (including box-canyons locally known as “rincons”) adjacent to the main canyon floor, and (3) expansive sandstone mesas topped by slick-rock outcrops, low-rolling dunes, and sandy slopes. Three detached units (Pueblo Pintado, Kin Bineola, and Kin Ya’a) are on low bench/floodplain settings along broad washes (NPS LPP, 1985), (NPS RMP, 2003).

The proposed action consists of implementing control measures to eradicate and/or reduce exotic (non-native) plant infestations of tamarisk (*Tamarix chinensis*) and globe-pod hoary cress (*Cardaria pubescens*) within Kin Bineola Wash, Kin Klizhin Wash and along avenues of infestation and a series of side canyons and seeps located within the main park unit.

The purpose of this Environmental Assessment (EA) is to examine the impacts associated with implementing the proposed exotic species control action. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500-1508), and the National Park Service (NPS) Director’s Order No. 12 (DO-12, NPS, 2001b) (*Conservation Planning, Environmental Impact Analysis, and Decision-Making*), NPS-28 (Cultural Resource Management Guideline), NPS-77 (Natural Resources Management Guideline), and NPS Management Policies (2001a).

1.2 Background

Tamarisk (*Tamarix chinensis*) and globe- pod hoary cress (*Cardaria pubescens*) are exotic (non-native) species that rapidly and aggressively invade riparian areas and seeps. These invading species are displacing native species, reducing biodiversity, adversely modifying the native ecological integrity, and disrupting the hydrology of the park. The proposed control action must achieve natural resource management objectives while avoiding undue adverse impacts to other resources.

NPS Management Policies (sec. 4.1.5) indicate that “the Service will re- establish natural functions and processes in human- disturbed components of natural systems in parks”. The Management Policies include “the introduction of exotic species” as human disturbance and call for the Service to “return human- disturbed areas to the natural conditions and processes.” The policies include, under restoration of natural systems, the “removal of exotic species” (NPS Management Policies 2001).

Both tamarisk (*Tamarix chinensis*) and hoary cress (*Cardaria sp.*) are listed as noxious weeds (Class C and Class A, respectively) by the New Mexico Department of Agriculture (DuBois, 1999). Tamarisk (*Tamarix sp.*), commonly known as salt cedar, is an exotic shrub/tree that grows in dense stands along rivers and streams in the West. Tamarisk, introduced to the U.S. in the 19th century as an erosion control agent, spread through the West and caused major changes to natural environments.

Erosion control programs were initiated in the ephemeral washes of Chaco Canyon during the 1930s, with the planting of 700,000 trees and shrubs. NPS planting continued through the following decades, with an additional 15,000 willows planted in 1948, 72,000 willows and tamarisk in 1949, 22,000 willow in 1951, 55,000 willows and cottonwoods in 1953, and 22,000 willows and cottonwoods in 1954. Other smaller planting efforts were not completed until 1961. Cottonwoods (*Populous sp.*) are considered to be native to Chaco Wash, but do not generally propagate readily due to the sporadic water availability. Many of the seedlings planted by NPS did not survive due to drought (Simons et al., 1982) although new recruitment does occur along the wash banks (Malde, 2001).

The invasive globe- pod hoary cress (*Cardaria pubescens*) probably arrived in the southwest in infested alfalfa seed from Turkestan in 1910 (Mulligan & Frankton, 1962). Although hoary cress is an invasive perennial species that prefers irrigated and cultivated lands, it can become a serious pest in wildland environments that mimic the periodic disturbance and inundation of cultivated fields, such as the riparian system of Chaco.

1.3 Purpose

The purpose of the proposed *Tamarix* and *Cardaria* control action at Chaco Culture NHP is to comply with general NPS mandates and policies regarding resource management (Organic Act (16 USC 1), Presidential Proclamation 740, NPS Management Policies (2001a), and also with Chaco Culture NHP Resource Management Plan (RMP) (2003). The RMP states that the primary objective of resource management at Chaco is to preserve and protect park features, including historic and prehistoric structures, items in the collection, the cultural landscape, ethnographic resources and traditional uses (NPS, 2003a). The proposed *Tamarix* and *Cardaria* control action also complies with core values of CCNHP management: the concept of maintaining the existing scene—the canyon ambience—so that the major cultural features can be experienced and interpreted in a setting much like the environment that supported the daily existence of the Chacoan inhabitants (GMP 1985). Currently, the *Tamarix* and *Cardaria* in the park interfere with this core value by impacting the viewshed and obscuring the environmental context of the

cultural features (GCI 2005). The riparian regions of the park served as the most probable areas of agriculture for the prehistoric inhabitants. This association with riparian agriculture may have played a decisive role in site selection for the Chacoan people (Mathien, 2005). Removal of the exotic species in the riparian regions will restore the viewshed and reestablish the relationship between the natural environment and the cultural features of the park. This in turn will enhance the visitor experience and help restore the historical complex relationship between the Chacoan farmers and the native vegetation in this world heritage archeological site.

Chaco Culture NHP is one of only two protected natural areas in the San Juan Basin. CCNHP lands encompass relatively undisturbed examples of floral and faunal communities within the Colorado Plateau ecosystem and offer unique opportunities to conserve the region's biodiversity and monitor its environmental quality. An important objective of the removal of the monotypical stands of *Tamarix* and *Cardaria* in the park is to create opportunities for native species to re-colonize the riparian areas. This, in turn, will augment the park's role in conserving regional biodiversity (NPS APP, 2005).

The *Tamarix* and *Cardaria* control action is intended to reduce risk of damage associated with ecological and hydrological disruption caused by exotic plant species in Chaco riparian systems, while maintaining the integrity of natural systems, viewshed, and the cultural landscape. This does not imply that all measures whatsoever will be considered, but that the measures adopted need to be sufficient to achieve the goal. The action needs to balance the positive and negative effects of exotic plant removal in a way that minimizes adverse impacts to geomorphological stability and cultural resources, while maximizing the ecological benefits.

1.4 Need

The *Tamarix* and *Cardaria* eradication project at the Kin Bineola detached unit, in Kin Klizhin Wash, along avenues of infestation, and in side drainages of Chaco Canyon proper is needed to address the following concerns:

- Due to the checkerboard ownership surrounding the park, CHCU must work collaboratively with the Navajo Nation, the BLM, surrounding ranchers, and the State of New Mexico to eradicate exotics in a sustainable manner and in a way that will lessen impacts on shared resources. The eradication of *Tamarix* and *Cardaria* from park lands will eliminate seed and vegetative propagation sources that could contribute to exotic infestations on surrounding lands.
- Executive Order 13112 states that Federal agencies will control populations of invasive species.
- NPS Management Policies (2001 Sec. 4.1.5) requires the Service to "re-establish natural functions and processes in human-disturbed components of natural systems in parks".
- Currently there are 300 approximate acres of *Tamarix* and *Cardaria* in the project area (See Maps 1,2,3). These established populations are seed and vegetation sources and we can expect the populations to dramatically grow in size unless control efforts are undertaken now. These aggressive, invasive species will continue to expand crowding-out native species unless eradication methods are initiated and success rates monitored.

1.5 Project Objectives

Based on the Purpose and Need for the project and summaries of NPS internal and external scoping, the following objectives have been identified for the *Tamarix chinensis* and *Cardaria pubescens* control project at Kin Bineola, Kin Klizhin, and individuals located in the Chaco Canyon side canyons:

- Initiate a long-term, successful and sustainable exotic plant management program that will improve riparian resource conditions and will mitigate invasive species impacts.
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- Implementation of an exotic plant management program that will not impair resources and park values, especially cultural resources, nor adversely affect public access to these sites.
 - Implementation of low maintenance and long term monitoring protocols that define exotic control efficacy and effects upon wash stability, hydrology, and riparian wildlife species diversity.

1.6 Project Scoping

NPS staff has conducted internal and external scoping to formulate an exotic control Environmental Assessment (EA) outline and a 20% series of Fee Demonstration project proposals aimed at eradicating *Tamarix* and *Cardaria* in the project areas. (PMIS#s 80586, 121474, 123248, 80724, 86923, 123244.) In addition, technical assistance requests to the Exotic Plant Management Team Coordinator stationed at Petrified Forest and communications with Gerald McCrea, Integrated Pest Management Coordinator: NPS Intermountain Support Office, have provided further efficient and efficacious exotic control prescriptions. John Stein, Program Director for the Navajo Nation Chaco Protection Sites Program was consulted to determine if the removed dead tamarisk trees could be used to assist with any program objectives. We met Dean and Dilbert Slim who currently lease the surrounding lands from the Navajo Nation Tribal ranchers program on November 21, 2005 to discuss exotic control work and associated fencing. They raised no objection to camping on a roadbed within their leased grazing parcel. Fritz Roanhorse of the Tribal Ranchers Program was contacted by letter in December 2005 (to date there has been no response).

The following chapters contain the elements of this EA:

- **Section 2.** Information describing the proposed action and potential alternatives associated with the *Tamarix* and *Cardaria* control and removal project at Chaco Culture NHP.
- **Section 3.** The Affected Environment followed by detailed descriptions of environmental consequences associated with the proposed action and the identified alternatives.
- **Section 4.** The list of references.
- **Section 5.** A list of people who have been consulted and/or contributed to the preparation of this EA.

2.0 Alternatives Considered

Two alternatives were considered for addressing the presence of the exotic species, *Cardaria* and *Tamarix*, in Chaco Culture NHP: 2.1) the No- action alternative; and 2.2) the Preferred Alternative, a combination of treatments that will control the exotic species in specific locations (approximate 300 acres) and assess eradication efficacy over a five- year period.

2.1 No Action

Under the No Action alternative, no *Tamarix* or *Cardaria* control would be attempted. The present trend of increasing numbers, ages, and distribution of non- native tamarisk will continue. This trend has been well- documented in riparian areas throughout the southwest. This alternative would not allow for the preservation of high quality desert riparian ecosystems found within the park.

Tamarix

The impacts caused by tamarisk in the Southwest are well documented (See Reference Section). These prolific non- native shrubs displace native vegetation and animals, alter soil salinity, and increase fire frequency. Tamarisk is an aggressive competitor, often developing monotypic stands and lowering water tables which can negatively affect wildlife and native vegetative communities (Duncan 1996; Dudley, et al. 2000). In many areas, tamarisk occupies previously open spaces and is adapted to a wide range of environmental conditions. Once established in an area, it typically spreads, persists, and out- competes native vegetation thereby narrowing the riparian plant community diversity.

Cardaria

Hoary cress (*Cardaria sp.*) establishes dense, persistent infestations that displace and exclude native herbaceous vegetation (Carr 1995; Hill 1995; O'Brien & O'Brien 1994). By displacing native vegetation used by wildlife, hoary cress negatively affects native fauna as well. *Cardaria* species are strong competitors for nutrients and moisture. Several sources list hoary cress (*Cardaria sp.*) as potentially toxic to grazing livestock (Lyons, 1998). Although grazing is no longer permitted on park owned lands, if the park *Cardaria* population continues to spread, it will have negative impacts on surround ranching operations which could jeopardize neighbor relations and/or potential land exchanges with allottees. It is not known if *Cardaria* toxicity extends to native browsers/grazers.

2.2 Preferred Alternative

The Preferred Alternative will remove and control the exotics *Cardaria* and *Tamarix* from the riparian areas of the Kin Bineola detached unit (179 acres), near Kin Klizhin (114 acres), and at isolated and individual stand locations in the Chaco Canyon side canyons including Gambler's Spring, Mockingbird Canyon Spring, and Wijiji Spring, and along the general access roads of the park (called "avenues of infestation") (10 acres). (See maps #1, 2, and 3). In addition, the Preferred Alternative will assess eradication efficacy of the project over a five- year period.

Tamarix

The preferred alternative will remove and control tamarisk through a combination of mechanical, chemical, and cultural (i.e. seeding) methods. The method selected would be site specific, and determined by the NR Program Manager or project leader, (i.e., it will be determined by adaptive management). Any treated saplings and dead mature trees left on site will provide wildlife habitat until the woody materials break down naturally. The cut materials will be hauled as short a distance as possible and temporarily stock- piled in small mounds away from archeological sites. Selection of locations for temporary storage of material will fulfill two criteria: 1) the vegetative material will be removed to a dry location where the materials will not find a suitable environment for sprouting; and 2) the location for the vegetative materials will be selected to minimize the impacts of on- site burning for the final disposal for the materials (burning is a component and will be conducted as prescribed in the cooperative Navajo Nation and Chaco Fire Management Plan and therefore will not be addressed in this EA). Until the stock- pile mounds are burnt, they will serve as temporary habitat for native species displaced by the removal of the exotic vegetation.

The tamarisk control methods analyzed in this EA are:

- *Cut Stump Method* - Tree trunks are cut near ground level with handsaws, loppers, or chainsaws and then stumps are sprayed using a pump sprayer with Garlon 3A (triclopyr) mixed with water. The mixture is absorbed by the plant's phloem and transported to the root; if the herbicide mixture is applied quickly (2- 10 minutes), 90- 95% control is

possible. Pressurized hand or backpack sprayers allow precision herbicide application with minimum overspray or drift risk. Up to four sprayers will be active at any one time. This method will be used on a limited number of larger trees in dense stands and for smaller trees where manual removal will cause extensive soil disturbance.

- *Basal Bark Application* - The entire stem is treated with Garlon 4 (triclopyr) from near ground level up for about 30- 38 centimeters. The chemical is applied with a backpack sprayer or hand held pressurized sprayer, both of which have small nozzles with coarse spray settings that allow for direct spraying with minimal drift or overspray. A paintbrush may also be used for small sapling application. This method is much less labor intensive, but is less effective on mature trees and will be used for smaller saplings and some seedlings. It is effective on trees up to one year and three meters tall.
- *Native Plant Restoration* - Restoration will occur immediately after or within one year of herbicide treatment. All restoration efforts will use site- adapted native seed and/or plants. Restoration will seek to restore the natural conditions prior to *Tamarix* arrival and to prevent *Tamarix* re- invasion. Active restoration will include the collection of seed and/or cuttings from native plants in the project area. Any seed spreading or planting of cuttings will seek to replicate the composition and structure of the native plant communities. Extensive monitoring and maintenance will be conducted in these areas to document and ensure project success.

Cardaria

The preferred alternative will control *Cardaria* through chemical methods in June or when the species is beginning to blossom. Work crews of 10 people or less will walk to riparian zones near the Kin Klizhin outlier. The dead plants will remain in situ to accurately assess control effectiveness and provide shade and mulch for encouraging native grass growth.

- *Foliage Application* - The entire plant is treated with Escort (metsulfuron methyl). The chemical is applied with a backpack sprayer or hand held pressurized sprayer, both of which have small nozzles with coarse spray settings that allow for direct spraying with minimal drift or overspray. The use of wick applicators may provide an additional technique for precision application of herbicides otherwise high quality sites.

Implementation

Implementation of the preferred alternative will occur in the growing seasons before seeding can further exotic population growth or further propagation. The initial phase of the *Tamarix* removal will begin in early spring 2006 utilizing the cut stump method followed by an immediate application of Garlon 3A (triclopyr). Follow- up work for tamarisk removal will continue in the fall 2006 with basal bark application of Garlon 4 (triclopyr) to any new regeneration surviving the spring 2006 work. Concurrently with the basal bark applications in fall 2006, further cut stump methods treatment will be initiated to additional untreated *Tamarix* stands as work crews' schedules permit.

Initial *Cardaria* control measures are scheduled for June 2006 with foliage application of Escort (metsulfuron methyl). Follow- up herbicide application will be applied during the flowering season (typically in June) over the next five years, as needed, until the *Cardaria* stands have been successfully eradicate.

For the 2006 field season, work crews will consists of 15 to 20 people (volunteer groups, the NPS Exotic Plant Management Team, and/or Southwest Conservation Corps). These crews will access the project areas along existing two- track roads and then hike to the work sites. Park staff will

always accompany work crews and will supervise exotic control work to ensure safety and resource protection. At the Kin Bineola detached unit, a “Navajo Nation Backcountry User Permit” will be obtained to facilitate camping on abandoned roadbeds juxtaposition to park lands (see Map #1). Camping will be restricted to the CHCU VIP campground only while project crews work in either Kin Klizhin or in the main park unit (See Maps #2 and #3). To ensure maximum efficacy and efficiency, exotic control work will not occur when it is raining, snowing, or when temperatures drop below 32 degrees Fahrenheit. Natural Resource staff will treat approximately 179 acres at Kin Bineola (see Map #1), 114 acres at Kin Klizhin (see Map #2), and 10 acres along avenues of infestation: Gambler’s, Mockingbird and Wijiji Springs (see Map #3). Accepted personal protective equipment (PPE) will be used by workers at each of these sites. NPS staff will return twice a year and assess control effectiveness.

2.3 Mitigation Actions:

The following mitigation measures have been selected to minimize, reduce, or eliminate impacts of the preferred alternative:

- Chaco archeologists will be consulted about existing cultural resources in the project area. Every effort will be made to minimize impact on existing cultural resource by selecting routes of travel for field crews and areas to temporarily stock- pile cut material that avoid known cultural resources. NPS staff will be on site during project implementation to select appropriate management actions should undocumented cultural resource be discovered.
 - Tribal representatives will be invited to coordinate project implementation in locations of concern.
 - It is recommended that non- NPS work crews meet with the park archaeologist before starting work to review rules concerning activities on cultural resources.
 - To protect cultural features associated with the park springs and seeps, all treatment work prescribed for these areas will be conducted exclusively by NPS staff.
 - All workers will be informed of penalties for illegally collecting artifacts or intentionally damaging any archaeological or historic property in the vicinity.
 - All workers will be informed of rules and regulations for land use on the surrounding Navajo Nation lands.
 - During project implementation, additional invasive plant species will be mapped with a GPS unit, and the park's NR manager will be notified. If exotic plant species are found in project areas, all workers clothing, footwear, and all tools and equipment would be cleaned at the project site to ensure that seeds or propagules are not transported to new locations.
 - Triclopyr (Garlon 3A and Garlon 4) and metsulfuron methyl (Escort) are general use herbicides, and pesticide certification is not required for application. All project participants will receive herbicide training from the project leader.
 - All information and instructions on the herbicide label will be strictly followed. All herbicide containers will show the product label and will be leak- and spill resistant. All
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application equipment and chemicals will be transported and stored in plastic bins to reduce contamination and provide an additional level of spill protection. All storage containers will have the product's specimen labels and the Material Safety Data Sheets (MSDS's) clearly displayed in a waterproof plastic sheet. MSDS's contain fire and explosive hazard data, environmental and disposal information, health hazard data, handling precautions, and first aid information. All project participants will review the MSDS with the project leader and understand first aid instructions described on the MSDS.

- All herbicide and application equipment will be stored separately from food and personal items. Additional storage bins will be provided for disposal of used PPE (such as gloves, goggles, etc.); empty herbicide containers will be stored in separate disposal bins as well.
- Project participants will understand and abide by the established Personal Protective Equipment (PPE) requirements and rules outlined in the safety plan. Chemical resistant gloves, long sleeve shirts, shoes, and goggles are part of the PPE necessary for this project. A job safety analysis (JSA) for exotic plant removal and herbicide application has already been prepared and will be reviewed with all project participants.
- All project participants will receive instruction on *Leave No Trace* (LNT) procedures before working in the park's backcountry. These (LNT) procedures will also apply to camping etiquette and project implementation on Navajo allotments under directions of the backcountry use permit conditions. To further mitigate the impacts of the project, during project implementation in the Kin Bineola area, campsites on Navajo Nation land will be selected on abandoned road beds.
- To minimize soil compaction, the following mitigation measures will be incorporated into all action alternatives: The project leader will determine the access route that will cause minimal disturbance to sensitive soils (i.e. microbiotic soils) and vegetation. Access to areas will use existing game/livestock trails wherever possible. If no trails exist, the project leader will determine whether single or multiple paths will be used to access the project work area. The minimum number of trips to sensitive areas will be conducted for follow-up maintenance and monitoring.
- All project participants will be informed about special status species and what actions should be taken if a special status species is encountered. To the extent possible, a wildlife biologist and botanist will be on site during project implementation. If a previously unknown or undiscovered threatened, endangered, or special status species is discovered in the project area, all work will cease until the park staff evaluates the project impact on the discovery and conducts additional Section 7 consultation with the U.S. Fish and Wildlife Service.
- The proposed project will be conducted outside of breeding seasons for the majority of park wildlife species in order to minimize impacts on productivity.

2.4 Environmentally Preferred Alternative

Environmentally preferable is defined as "the alternative that will promote national environmental policy as expressed in the National Environmental Policy Act §101." Section 101 of

the National Environmental Policy Act states that "...it is the continuing responsibility of the Federal Government to:

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
5. achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The environmentally preferable alternative for this EA is based on these national environmental policy goals.

The Preferred Alternative (2.2) is the environmentally preferable alternative. This alternative strives to integrate the 2003 Resource Management Plan objectives and the Natural Resources Division Strategic Performance Management Objectives:

- To protect Chaco Culture National Historical Park by such means as will leave the natural resources and their systems unimpaired for the enjoyment of present and future generations.
- To identify, monitor, protect, and perpetuate the natural resources and natural processes within Chaco.
- To minimize and compensate for unnatural human- caused disturbances originating from inside and outside Chaco that could impact natural resources and natural processes.
- To never sacrifice one park resource for convenience or compete one resource against another, but still allow for appropriate, careful, and deliberative management of natural resources to mitigate serious and imminent threats to human health and safety, unique natural features, rare and sensitive species, cultural resources, and park facilities.
- To develop and support an increase of professional natural resource technicians to manage Chaco's natural resources using the best available techniques and technologies.
- To develop and maintain professional and productive working relationships with other natural resource management agencies and institutions, researchers, volunteers, park neighbors, and the public towards improving the knowledge, protection, and management of the park's natural resources.
- Preserve Chaco's natural genetic integrity and species composition consistent with ecosystem processes, including the elimination of nonnative plant and animal species wherever possible.

Through use of an Integrated Pest Management (IPM) approach, the preferred alternative realizes the above objectives and promotes the most comprehensive protection and enhancement of natural resources in Kin Bineola and Kin Klizhin washes, Chaco Canyon side canyons, springs and avenues of infestation. This alternative surpasses the no action alternative in realizing the full range of national environmental policy goals as stated in §101 of the National Environmental Policy Act. Although the no action alternative may achieve greater levels of protection for cultural resources in the short- term, long- term adverse impacts on cultural resources may be expected as a result of continued degradation of the ecological/landscape context of these resources resulting from further colonization by exotic species. The preferred alternative provides a high level of protection for natural and cultural resources while concurrently attaining the widest range of

neutral and beneficial uses of the environment without degradation, maintains an environment that supports diversity, tribal partnerships, and integrates resource protection.

3.0 Resource Impact Analysis

3.1 Resource Duration Intensity

Table 1: Duration Intensity Definitions

Duration Intensity	Duration Intensity Definition
Short- term	Conditions associated with project persist for no longer than 60 days.
Intermediate	Conditions persist for a period no longer than 2 years, but more than 60 days.
Long- term	Conditions persist for more than 2 years.

3.2 Resource Impact Intensity Definitions

Table 2: Soils

Impact Intensity	Intensity Definition, Soils
Negligible	Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soils would be slight
Minor	The effect to soils would be detectable. Effects to soil area, including soil disturbance and erosion would be small and localized. Mitigation may be needed to offset adverse effects and would be relatively simple to implement and likely to be successful.
Moderate	The effect on soils would be readily apparent and result in a change to the soil character over a relatively wide area, erosion of soils over a wide area or soil disturbance over a wide area. Mitigation measures would be necessary to offset adverse effects and likely to be successful
Major	The effect on soils would be readily apparent and substantially change the character of the soils over a large area, substantial erosion would occur resulting in a large amount of soils loss. Mitigation measures to offset adverse effects would be needed, extensive, and their success could not be guaranteed.

Table 3: Water Quality and Quantity

Impact Intensity	Intensity Definition, Water Quality and Quantity
Negligible	The action will produce no detectible or probable changes of water quality or quantity at any point in the system, including surface water and shallow groundwater.
Minor	Very slight detectible or probable changes of water quality including Total Dissolved Solids (TDS) within the immediate project area. Very slight or no changes in quantity of surface water or ground water within the project area. Water quality and quantity still well within historical records.
Moderate	Moderate impact on water system. May include detectable or probable changes to water quality and/or quantity within the project area. Water quality and/or quantity in project area may be measurably divergent from

	historical records.
Major	Action produces measurable impact on water system both within and beyond the project boundaries. Includes detectable changes to water quality and/or quantity within and beyond the project area. Water quality and/or quantity in and beyond the project area is measurably divergent from historical records.

Table 4: Jurisdictional Wetlands

Impact Intensity	Intensity Definition, Jurisdictional Wetlands
Negligible	No effects because action would not result in loss of jurisdictional wetlands or compromise hydric soil, wetland hydrology, hydrophytic vegetation values or processes.
Minor	The action could result in a change or disturbance of at least one but not all jurisdictional wetlands values or processes. The change would be measurable, but small and localized and of little consequence. Mitigation measures, if needed to offset the adverse effects, would be simple and successful.
Moderate	Impacts on jurisdictional wetlands values or processes or the natural processes sustaining them would be detectable and occur over an extensive area of the wetland area. Mitigation measures, if needed to offset adverse effects, would be extensive and likely to be successful. This impact intensity equates to a U.S. Fish and Wildlife Service “may effect, likely to adversely affect” determination.
Major	The action would compromise jurisdictional wetlands values over more than 50% of the wetland area, alter water quality, and modify hydrological processes sustaining the wetland. Mitigation measures to offset the adverse effects would be required, extensive, and success would not be guaranteed.

Table 5: Vegetation (non- T&E)

Impact Intensity	Intensity Definition, Vegetation (non T&E)
Negligible	No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be on a small scale.
Minor	The alternative would affect some individual native plants and would also affect a relatively limited portion of that species’ population. Mitigation to offset adverse effects could be required and would be effective.
Moderate	The alternative would affect some individual native plants and would also affect a sizeable segment of the species’ population over a relatively large area. Mitigation to offset adverse effects could be extensive, but would likely be successful.
Major	The alternative would have a considerable effect on native plant populations and affect a relatively large area in and out of the park. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation measures would not be guaranteed.

Table 6: Wildlife (non- T&E)

Impact Intensity	Intensity Definition, Wildlife (non T&E)
Negligible	There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well

	within natural fluctuations.
Minor	Impacts would be detectable, but they would not be expected to be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Breeding animals are present, animals are present during particularly vulnerable life- stages such as migration or juvenile stages; mortality or interference with activities necessary for survival can be expected on an occasional basis, but is not expected to threaten the continued existence of the species in the park unit. Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Table 7: Noise/Soundscape

Impact Intensity	Intensity Definition, Noise/Soundscape
Negligible	Impacts noticeable only with close observation in a localized area. Hearing protection not required for workers on site. Impact is temporary and of short duration (daytime hours only, one day or less).
Minor	Impacts noticeable, but confined to localized area. Noise not noticeable or easily distinguishable from background noise from more than 500 meters away in developed areas or two kilometers in backcountry. Impact is temporary and of short duration, daytime hours only – if lasting more than one day, then timed or spaced to avoid significant visitor contact. Hearing protection may be required as mitigation for workers on site.
Moderate	Impacts readily noticeable for a moderate duration (more than one week to one month) over a localized area, or for a short duration over a large area (clearly audible and distinguishable from background noise from more than one kilometer away in developed areas or five kilometers in backcountry). Hearing protection required as mitigation for workers on site. Visitor access to immediate area may need to be temporarily denied due to risk of hearing loss (does not apply to areas that visitors do not normally have access to anyway). Impact may occur for short duration at night or early morning.
Major	Impacts readily noticeable for a long duration (one month to permanent) in localized or wider area (clearly audible from more than one kilometer away in developed areas or five kilometers in backcountry). Hearing protection required as mitigation for workers on site. Visitor access to localized areas may need to be denied (up to permanently) due to risk of hearing loss (does not apply to areas that visitors do not normally/ previously have access to anyway). Impact may occur at night or early morning.

Table 8: Visitor Experience

Impact Intensity	Intensity Definition, Visitor Experience
Negligible	The impact would be so small that it would not be of any measurable or perceptible consequence. Negligible impacts were effects considered not detectable to the visitor and therefore expected to have no discernible effect.
Minor	Minor impacts were effects that would be slightly detectable, though not expected to have an overall effect on the visitor experience. Impact is slight but would be small and localized and of little consequence.
Moderate	Moderate impacts would be clearly detectable and could have an appreciable effect on the visitor experience. The impact is readily apparent, would be measurable and consequential, but more localized.
Major	Major impacts would have a substantial, highly noticeable influence on the wilderness experience, such as the permanent closure of a campground. The impact is severely adverse or exceptionally beneficial. The change would be measurable and the consequences could be permanent.

Table 9: Intensity Definition, Flood- plains/Waters of the U.S.

Impact Intensity	Intensity Definition, Flood- plains/Waters of the U.S.
Negligible	No effects because action would not result in loss of wetlands, compromise floodplain values or processes, or involve permanent placement of fill in the waters of the United States (US)
Minor	Effects would be minimal, but would cause minor disturbance of floodplain values or processes locally, or involve local permanent placement of fill in waters of the US.
Moderate	The action would require a Section 404 if the Clean Water Act (CWA) Army Corps permit, compromise floodplain values over more than 10% of the floodplain, or increase risks of flood- related property loss or reduce public safety. Mitigation would be required, on a local scale, and would have a high success rate
Major	The action would compromise floodplain values over more than 20% of the floodplain, greatly increases risks of flood- related property loss, or reduce public safety over a large area. Mitigation measures to offset the adverse effects would be required, extensive, and success would not be guaranteed.

Table 10: Archeology/Cultural Resources

Impact Intensity	Impact Type	Intensity Definition, Archeology/Cultural Resources
Negligible	Adverse or Beneficial	Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for section 106 would be “no adverse effect”.
Minor	Adverse	Disturbance of a site(s) results in little, if any loss of integrity. The determination of effect for section 106 would be no adverse affect.
	Beneficial	Maintenance and preservation of a site(s). The determination of effect for section 106 would be “no adverse effect”.
Moderate	Adverse	Disturbance of a site(s) results in loss of integrity. The determination of effect for section 106 would be “adverse effect”. A memorandum of agreement is executed among the

		National park Service and applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the memorandum of agreement to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate.
	Beneficial	Stabilization of a site(s). The determination of effect for section 106 would be “no adverse affect”.
Major	Adverse	Disturbance of a site(s) results in loss of integrity. The determination of effect for section 106 would be “adverse effect”. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the National Park Service and applicable state or tribal historic preservation officer and/or advisory council are unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).
	Beneficial	Active intervention to preserve a site(s). The determination of effect for section 106 would be “no adverse effect”.

3.3 *Tamarix* and *Cardaria* Control Issue Topics Dismissed From Further Consideration

Additionally, environmental impact topics that may be analyzed during NEPA environmental assessment were dismissed from further consideration as follows:

Air Quality

Section 118 of the 1963 Clean Air Act (42 U.S.C. 7401 *et seq.*) requires a park unit to meet all federal, state, and local air pollution standards. Further, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality- related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts. Chaco is listed as a Class II airshed. Air quality in CHCU is generally good, due to its remote location and setting. *Tamarix* and *Cardaria* control activities such as accessing remote regions of the park could result in temporary but negligible increases of vehicle and gas- powered equipment (chain saws) exhaust, particulate emissions, and fugitive dust in the area of the park. The burning of removed exotic plant material in slash piles could cause an increase in particulate emissions. However, any emissions generated during this project will not exceed negligible intensity levels. Any degradation would be short- term in duration and cease upon completion of the project. There are no beneficial or adverse cumulative effects on air quality associated with this project. Therefore air quality was dismissed as an impact topic.

Threatened and Endangered Species/Sensitive species (Plants and Animals)

Endangered species are those in danger of extinction throughout all or a significant portion of its range (Endangered Species Act §3(6)). *Threatened species* are those likely to become endangered within the foreseeable future throughout all or a significant portion of its range (ESA §3(20)). Federal, state, county, regional, Navajo Nation, and park resources were reviewed to identify threatened and endangered species and species of concern in Chaco Culture NHP. A Threatened

and Endangered Species Survey was completed in July 2001 (North Wind, 2001) for the purposes of assessing the presence or absence of such species in the project area. These surveys did not identify any threatened or endangered species within park lands. In addition, a series of biological inventories have been conducted over the past five years by the Southern Colorado Plateau Inventory and Monitoring Network for the purposes of assessing the presence or absence of species across park habitat types. This park-wide inventory identified no suitable habitat for the threatened and endangered species, including the southwestern willow fly-catcher, in Chaco Culture NHP (North Wind, 2001). As a result of these studies, the topic of threatened and endangered species was dismissed as an impact topic.

Sensitive species or species of concern is an informal term that refers to those species which the U.S. Fish and Wildlife Service believes might be in need of concentrated conservation actions. A riparian vegetation survey was conducted and finished in 2004 (Floyd-Hanna et al., 2004) and a rare plants survey (Barlow-Irich, in progress) is currently gathering data park wide. *Aletes macdougallii* (San Juan False Carrot), a state sensitive species, has been surveyed atop cretaceous sandstone benches in the main park unit consisting of gravelly/sandy soils. No *Aletes* species, or suitable habitat is located in the project area. The only wildlife species of concern which may occur in the vicinity of the project area are two species of bat (Fringed Myotis and Townsend's Big-eared Bat), the burrowing owl, and the loggerhead shrike. All four are listed as species of concern by the US Fish and Wildlife Service. There would be no adverse effects on any of these species. As a result of these studies, the topic of sensitive species/species of concern was dismissed as an impact topic.

Prime and Unique Farmlands

Prime or unique farmland is defined as soils that produce specialty crops such as fruits, vegetables, nuts, forage, fiber, and oil seed. Although limited areas in CHCU were used for crop production historically and prehistorically, currently none of these soils are used for crop production nor are they planned to be used as such in the future (Zschetzsche, S. and Clark, G. H., 2004). For this reason the topic of prime and unique farmlands was dismissed as an impact topic.

Environmental Justice

Executive Order 12898, General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed action would not have health or environmental effects on minorities or low-income populations or communities as defined in the U.S. Environmental Protection Agency's Environmental Justice Guidance (1998). Environmental justice was dismissed as an impact topic.

Regional Economy

The National Environmental Policy Act requires analysis of the effects of proposed actions on the regional economy. The local economy and most businesses within the communities adjacent to the park are based on professional services, construction, tourism, and light industry. Implementation of the preferred alternative would have no economic benefits or detriments on the local and regional economy. Therefore, regional economy was dismissed as an impact topic.

Concessions

There are no concessions at Chaco Culture National Historical Park. Therefore, concessions were dismissed as an impact topic.

Lightscape Management

Work on the project is anticipated to be performed during daylight hours. The park would not authorize illumination of the work site at night. The work crews at the Kin Bineola detached unit would be camping with a permit on adjacent Navajo Nation lands (see Map #1). This could introduce a limited amount of light associated with night camp activities. The proposed camp locations are not within line-of-sight of any communities or designated public night-use areas. (the Kin Bineola unit is closed to public access between sunset and sunrise). Furthermore, the crews will keep light use to the minimum required for night camp activities. These considerations will keep adverse lightscape impacts from exceeding negligible, short-term duration levels. For these reasons, lightscape management was dismissed as an impact topic.

Visitor Safety

The vast majority of project activities would take place in areas closed to visitor access. Some Tamarix individuals, however, are located along the “avenues of infestation” or roadsides where one or two individual exotics would be treated. Impacts resulting from these activities upon visitor safety would be negligible. Accordingly visitor safety was dismissed from further consideration as an impact topic.

3.4 *Tamarix* and *Cardaria* Control Issue Topics Retained For Consideration

Soils

According to the National Park Service’s Management Policies (2001a), the National Park Service will strive to understand and preserve the soil resource of park units and to prevent, to the greatest extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources. Soils within the project area are silty fine sandy/clay alluvium that are susceptible to erosion from water and wind unless stabilized. Since the preferred alternative would involve removing invasive plant species that may be modifying soil mobility, the project may produce changes in soil mobility within the riparian areas as a result of both the physical activity involved with the removal of the invasive species and the elimination of any stabilization associated with the invasive plants. Mitigating measures to reduce soil mobility concerns include removing only the above ground portions of the invasive plants thereby eliminating soil disturbance associated with removing the roots and planning and enforcing crew access routes to and around worksites to minimize soil compaction and disturbance.

The preferred alternative use of herbicides has the potential for introducing contaminants into the soil. The herbicides selected for use in this project have been chosen to minimize the impact of the herbicides in soil chemistry. Both herbicides (trichlorpyr and metsulfuron methyl) target plant material, will not leach from plant material into the soil, are not readily absorbed by soil particles, and have a typical soil half-life of 30- 45 days (per. comm. Gerald McCrea, March 9, 2006; Metsulfuron methyl Pesticide Fact Sheet, Prepared for the U.S. Department of Agriculture, Forest Service by Information, Ventures, Inc; EXTOWNET. 1996c. Pesticide Information Profiles: Sulfometuron- methyl. <http://ace.orst.edu/cgi-bin/mfs/or/pips/sulfomet.htm>; EXTOWNET. 1996d. Pesticide Information Profiles: Triclopyr. <http://ace.orst.edu/cgi-bin/mfs/or/pips/triclopy.htm>).

The methods and prescriptions of the preferred alternative will not exceed minor, adverse soil impacts of an intermediate duration. There are no other projects within the project area whereby

impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

Moderate, long- term beneficial effects are expected after the removal of *Tamarix* as the soil chemistry returns to more natural conditions and the soils become stabilized by native vegetation.

Water Quality and Quantity

The potentially affected environment for the preferred alternative impact topic of Water Quality includes surface water and shallow groundwater. The surface water environment consists of ephemeral flows associated with precipitation events and perennial and ephemeral spring flows. The groundwater environment consists of the shallow water table aquifer beneath the floor of Kin Bineola Wash and, to a lesser degree, beneath Kin Klizhin Wash.

New Mexico has adopted the U.S. EPA's anti- degradation policy regarding surface water and groundwater i.e., "*Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state*" (NMAC 20.6.2). Furthermore, with regard to protection of groundwater, Sections 20.6.2.3000- 3114 NMAC specifically regulate discharges onto or below the surface of the ground so as to "*protect all ground water of the state of New Mexico which has an existing concentration of 10,000 mg/l or less TDS, for present and potential future use as domestic and agricultural water supply...*",

Potential adverse water quality impacts related to use of herbicides in the riparian wildlands of Chaco will be mitigated by the choice of herbicides and prescribed usage. Both herbicides utilized in this project were chosen for their rapid breakdown in water [trichlorpyr - - half life 1- 4 days (Syracuse 1996); metsulfuron methyl - - 1 to 3 days under aerobic conditions (EXTOXNET 1996c)]. As mentioned above, both herbicides have limited soil mobility and thereby tend to stay in the upper layers of soil (95% of triclopyr stays in the upper 1 foot of soil and 95% of metsulfuron methyl stays in the upper 3 to 6 feet of soil—pers. comm. Gerald McCrea, March 9, 2006). Using George Beck's suggestion to add a two- foot buffer to prevent possible groundwater/herbicide contact (pers. comm. Gerald McCrea, March 9, 2006), the maximum depth of soil penetration by either of these two herbicides would not exceed 8 feet. The minimum buffer zone to ground water requirements are met in the Kin Klizhin and Kin Bineola riparian areas and along the avenues of infestation (Shattuck notes RAVE analysis, 2005). Under the project guidelines, four additional steps have been taken to reduce the potential of the herbicides entering Chaco water system:

- 1) the project prescribes that the herbicides will not be applied when the potential for precipitation exists within 48 hours of application
- 2) application procedures will focus on precise control of herbicides by targeting individual invasive plants with a minimum of run- off or over- spray that could create a potential for surface or ground water contact
- 3) limiting invasive plant removal in spring areas (anaerobic conditions) to *Tamarix* species and application of trichlorpyr herbicide application only
- 4) all application of herbicides will take place outside of the monsoon season to minimize the potential for surface water and fluctuations in ground water

Adverse water quality impacts associated with herbicide use will not exceed short- term minor levels due to mitigation practices included in the preferred alternative project design. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

An expected long- term, major beneficial impact of the preferred alternative will be an increase in water quantity in the riparian areas where the invasive species are removed.

Jurisdictional Wetlands

None of the Chaco Culture NHP acreage is listed in the New Mexico Wetlands Inventory (New Mexico Environment Department, 2000). Sites not listed specifically as Wetlands can still qualify for protection under Section 404 of the Clean Water Act if meeting the criteria for “jurisdictional wetlands”. Qualification as a jurisdictional wetlands area requires that the three (3) wetlands characteristics as described in the USACE Wetlands Management Handbook (Schneider et al., 2000) be present. These are: undrained hydric soils that develop anaerobic conditions, 5% or greater hydrology (persistence of water), and the presence of hydrophytic vegetation. The NRCS Chaco Culture NHP Soils Inventory (2003) indicates that there are no hydric soils located in Kin Bineola or in the Kin Klizhin project area. As a result, both these locations will be dismissed as a Jurisdictional Wetlands impact topic. However, the Wijiji, Gambler, and Mockingbird Canyon seep springs contain all three requirements for inclusion consideration as jurisdictional wetlands including hydrophytic vegetation (*Carex fillifolia*, *Salix sp.*, etc). The preferred alternative has the potential of producing short- term, minor adverse impacts on the hydrophytic vegetation of these jurisdictional wetlands. The use of herbicide will negatively affect these species should the herbicide be applied directly to arborous stems or herbaceous foliage. However, since only the cut- stump treatment (which minimizes overspray and run- off of herbicide) will be used in the spring areas to control the exotics and the herbicide treatment is prescribed for the early spring prior to the growing season for native vegetation and late fall after the native herbaceous vegetation has seeded, the risk of negative impacts native species is lessened. The preferred alternative will not exceed minor, short- term impacts on the jurisdictional wetlands included in this project. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

A major, long- term cumulative benefit to these jurisdictional wetlands will be realized once the exotics are removed: the native hydrophytic species will re- colonize where exotic infestations once existed; the extent and persistence of hydric soils may increase; and the flow and perseverance of water at these springs and seeps could increase.

Vegetation: Non- T&E

NPS Management Policies (NPS, 2001a) require maintenance of all native plant communities as part of the natural ecosystems of parks, including preservation and restoration of natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant populations. Management policies also require minimizing human impacts on native plant populations, communities, and ecosystems, and the processes that sustain them. Since the preferred alternative involves removal of both non- native plants within the riparian area, as well as associated changes in native vegetation as a result of non- native eradication, vegetation was selected as an impact topic for analysis.

Measures taken to mitigate the adverse impacts on vegetation include minimizing mechanical impacts to existing native vegetation and microbiotic soils by restricting access to invasive plants along staff designated routes of minimum impact. Both the herbicides (triclopyr and metsulfuron methyl) are selective for broadleaf plants. The dominant understory species associated with Tamarix and Cardaria are native grasses and therefore targeted by the selected herbicides. Application techniques will further focus herbicide application on the exotic species through the use of large diameter nozzles to minimize herbicide overspray onto surrounding native vegetation. Because of the mitigation measures built into the preferred alternative, the adverse effects on native vegetation will not exceed intermediate duration, minor impacts. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

The proposed actions would produce a long- term, moderate beneficial impact by presenting opportunities for native plant communities to re- colonize areas previously monopolized by invasive species.

Wildlife: Non- T&E

The preferred alternative would impact on wildlife species that may be using *Tamarix* as habitat. Mitigation measures built in to the preferred alternative include stacking the removed tamarisk in small slash piles to serve as temporary habitat while native vegetation is re- established. The actions of the preferred alternative will not exceed intermediate term, minor adverse impacts on native wildlife. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

Removal of *Tamarix* is likely to slightly improve habitat for bats by opening up potential flight lines for access to water and increasing the diversity and abundance of native insects, which could serve as prey. Although several native insects take advantage of *Tamarix* for as food when the plants are in flower, *Tamarix* provides habitat for only one known native species of insect (Apache cicada) throughout its life cycle(pers. comm. Gerald McCrea, March 9, 2006). By replacing the diversity of native plant species required for native insect habitat, *Tamarix* stands reduce the biodiversity of native insects and the native predators that depend on them. The preferred alternative will produce a long- term, moderate beneficial impact on native wildlife by increasing the biodiversity of the riparian habits in the project areas and by eliminating a possible browser- toxic exotic plant (*Cardaria sp.*) from park lands.

Visitor Experience/Natural Soundscapes

Enjoyment of park resources and values by visitors is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society (NPS Management Policies, 2001a). Most of the proposed project locations (south Kin Bineola unit and side canyons and springs in the main park unit (see Map #3) are inaccessible to park visitors, potential impacts to visitor experience from project activities in these locations are likely to be negligible. The project area in the Kin Klizhin Wash is adjacent to the visitor- accessible Kin Klizhin site. However, the remoteness of this site and the relatively low number of visits (approximately 70 per month), suggests that the potential for impacts to visitor experience from project activities are likely to be minor and intermediate in duration. The slash piles of removed *Tamarix* branches associated with this project in the Kin Klizhin region are likely to be noticeable by observant visitors and create a minor impact over an intermediate duration of time. Activities of the project crew will involve a minor, short- term impact on the park's natural soundscape, especially at the Kin Klizhin location. To minimize the effects of the project on the natural soundscape in areas adjacent to visitor access areas, the use of mechanized equipment (chain saws) will be suspended for the duration of visitor use. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

The Preferred Alternative is expected to contribute to long- term beneficial effects by enhancing visitor experience as a result of an improved viewshed and enhancing opportunities for a deeper understanding of the ecological context of the Chacoan Culture.

Cultural Resources

The National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*); the National Environmental Policy Act of 1969 (42 USC 4321 *et seq.*); and the National Park Service's Director's Order #28, *Cultural Resource Management Guideline (1997), Management Policies, 2001 (2000)*, and Director's Order #12, *Conservation Planning, Environmental Impact Analysis, and Decision Making (NPS, 2001b)* require the consideration of impacts on Cultural Resources, including historic sites, structures or objects listed or eligible for listing in the NRHP. Cultural Landscapes, Ethnographic Resources and Archaeological Resources meeting NRHP criteria are also included.

Impact analyses or assessments of effect are intended to comply with the requirements of both the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (Section 106). In accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources were identified and evaluated by:

- Determining the area of potential direct and indirect effects;
- Identifying cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the NRHP;
- Applying the criteria of adverse effect to affected resources either listed in or eligible to be listed in the NRHP; and
- Considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations, a Section 106 determination of either *adverse effect* or *no adverse effect* must also be made for affected historic properties.

Records and maps at CHCU were consulted to evaluate the presence of sites and the potential for effect on archaeological sites within or adjacent to the various treatment areas.

Six sites are in or near the treatment areas along Kin Klizhen Wash. The sites are Pueblo II to Pueblo III structural sites, ranging from 50 to 990 feet from the project area. None of the sites extend into the treatment area. The Preferred Alternative should produce no adverse effect in relation to these cultural resources.

Seventeen archaeological sites are in or near the treatment area along Kin Bineola Wash. The sites range from Basketmaker III to Pueblo III habitations to field houses. Three sites have historic Navajo components and one is an Archaic lithic artifact scatter. Based on topographic locations 14 sites are within the project area, but examination of site forms indicate only 8 are actually within the project area. The rest are between 25 and 150 feet outside project boundaries. Sites outside project boundaries will not be affected by the project. The 8 sites will suffer no adverse effect as the only work will involve pedestrian movement over the site and treatment of tamarisk without subsurface disturbances.

The areas in the main park unit will be accessed by existing paved roads or active backcountry access roads. There are 34 sites within about 50 feet of these roads. These include Basketmaker III to Pueblo III habitations and artifact scatters, and historic Navajo structures. As individual tamarisks are spotted, they will be treated by walking out to them, cutting above ground, and treating the stumps. There will be no adverse effect on any of the sites along these roads.

Three springs are recorded cultural resources or have recorded cultural resources nearby. The treatment methodology will be the same as the other project areas. There will be no effects on any of these sites.

The project guidelines and mitigation measures outlined in the Preferred Alternative will have no adverse effect on the cultural resources within the park. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts.

3.5 Impact Summary

This project is part of an on-going effort of Chaco Culture NHP's resource management division to sustain healthy plant communities, protect and conserve cultural resources, and restore/maintain quality wildlife habitat. Implementation of the Preferred Alternative will not result in any undue or unnecessary impairment of environmental or cultural resources, park values, or visitor experience. There are no other projects within the project area whereby impacts associated with Preferred Alternative could create or contribute to adverse cumulative impacts. The adverse impacts associated with the Preferred Alternative are summarized in Table II below.

TABLE II: Summary of Adverse Impacts Associated with the Preferred Alternative

Impact Category	Intensity	Duration	Cumulative
Soils	Minor	Intermediate	No
Water Quality and Quantity	Minor	Short- term	No
Jurisdictional Wetlands	Minor	Short- term	No
Vegetation (Non T&E)	Minor	Intermediate	No
Wildlife (Non T&E)	Minor	Intermediate	No
Visitor Experience/ Natural Soundscapes	Minor	Intermediate	No
Cultural Resources	Negligible	N/A	No

Alone, the Preferred Alternative is expected to produce cumulative, long- range beneficial effects throughout the park. In the southern section of the Kin Bineola Unit, the Preferred Alternative will work in conjunction with the 2006 season contract fencing project (PMSID 86923) to produce cumulative, long- range beneficial effects. The cumulative, long- range beneficial effects resulting from the Preferred Alternative including:

- Improving biodiversity and ecological integrity of park natural systems
- Restoring the ecological context of the cultural features
- Enhancing visitor experience as a result of an improved viewshed and enhanced opportunities for a deeper understanding of the Chacoan Culture.

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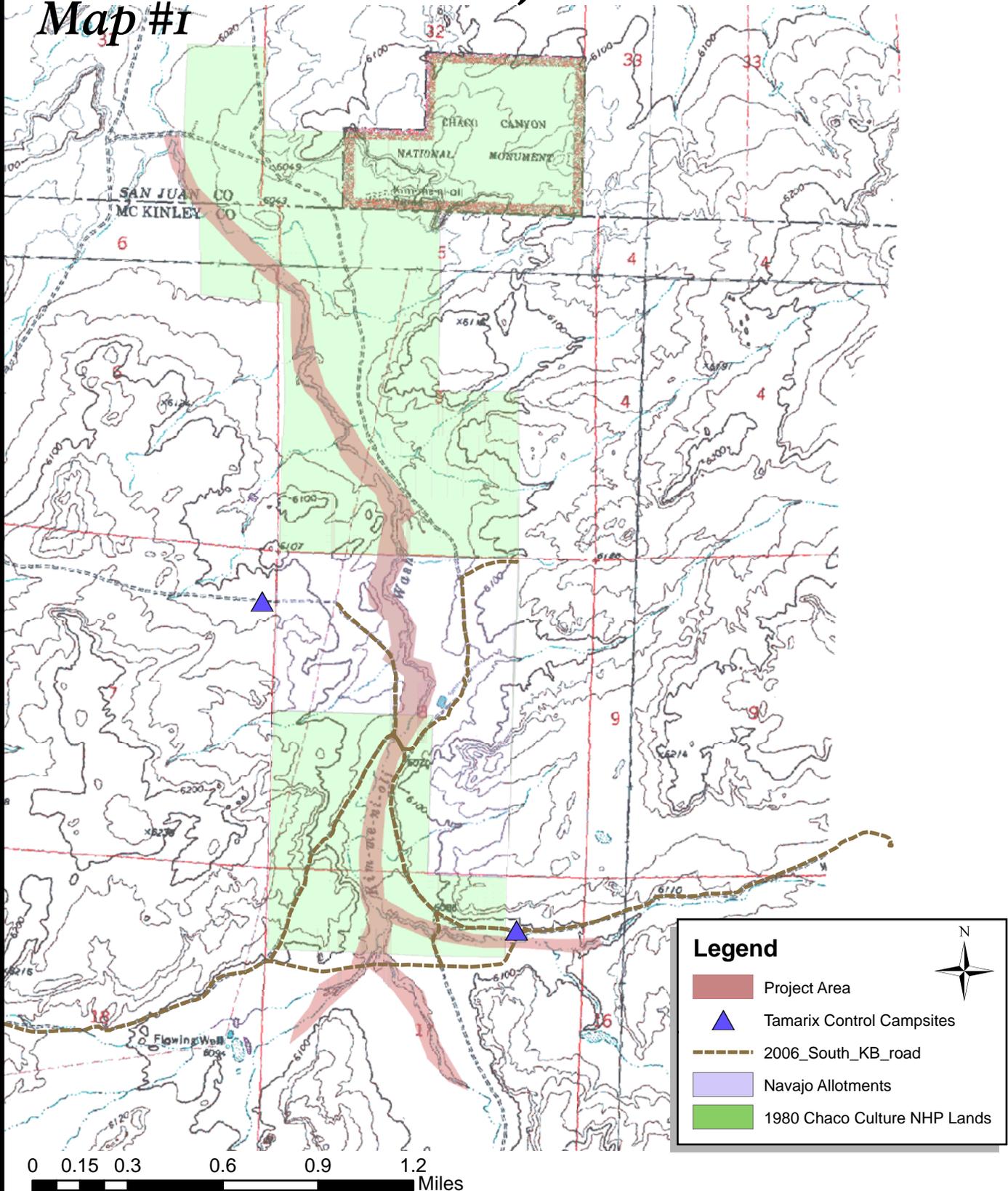
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Kin Bineola Project Area

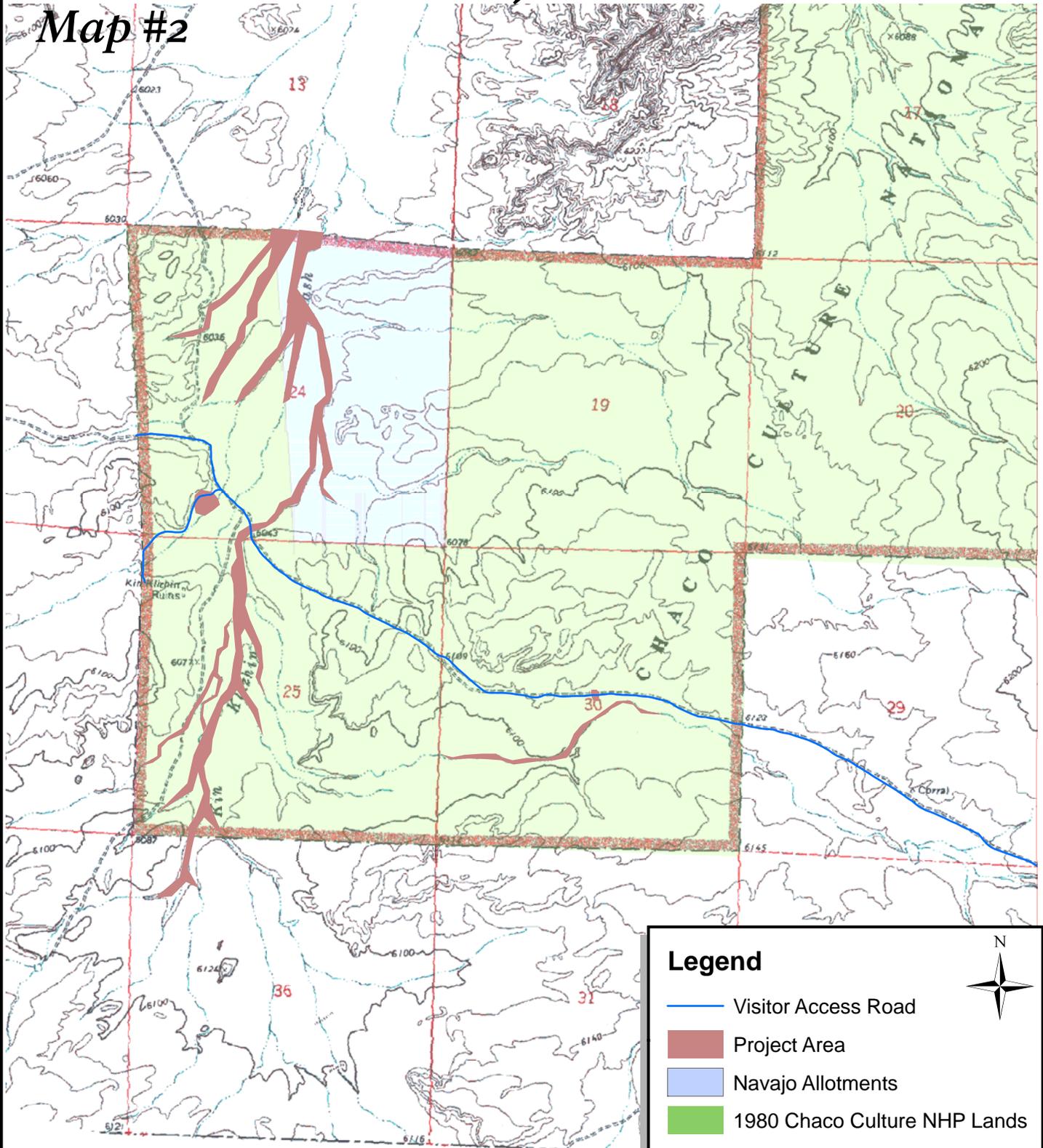
Map #1





Kin Klizhin Project Area

Map #2



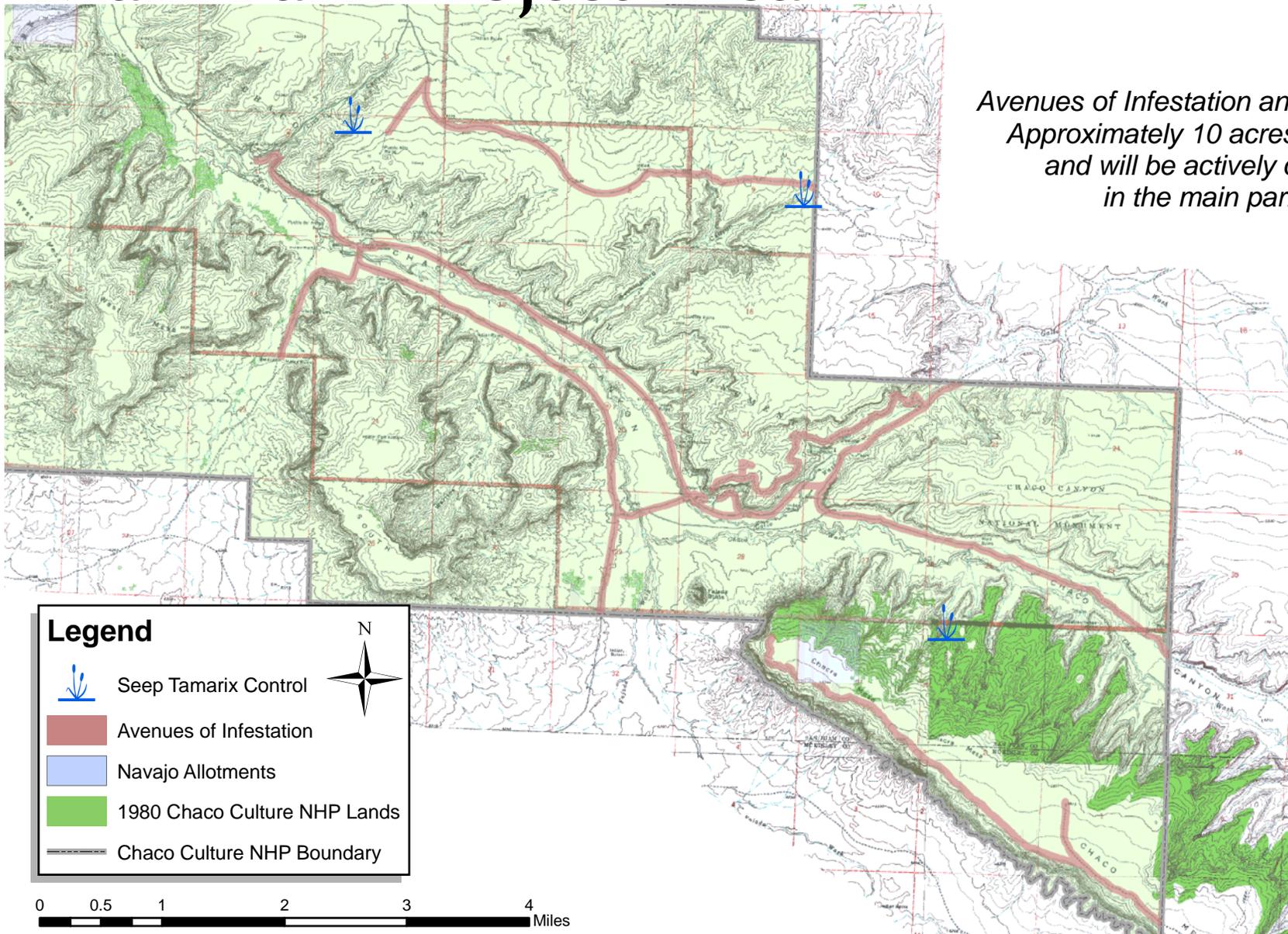
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Main Park Project Area

Map #3

*Avenues of Infestation and Seep Springs
Approximately 10 acres are infested
and will be actively controlled
in the main park unit*



Legend

- Seep Tamarix Control
- Avenues of Infestation
- Navajo Allotments
- 1980 Chaco Culture NHP Lands
- Chaco Culture NHP Boundary

