Inventory Survey and Mapping of White House Trail, Tunnel Trail, and Twin Trail (West Segment) in Canyon de Chelly National Monument

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Table of Contents

List of Figures

List of Tables

This report presents the result of a cultural resources survey and assessment of three historic trails in Canyon de Chelly National Monument, Arizona. The project was undertaken in advance of maintenance work on White House Trail, Tunnel Trail, and the west segment of Twin Trail. The goal of the project was to document the trails and the cultural features along and adjacent to the trails in order to ensure that the maintenance activities did not adversely impact the historic character of the trails or adjacent cultural resources. Fieldwork took place in June, August, and December 2010, and information in this report reflects the condition of the trails at that time. Trail maintenance commenced on White House Trail in June 2010, therefore some features described in this report may have been modified or replaced since the documentation occurred.

Objectives

A cooperative agreement between the National Park Service (hereafter referred to as the Service) and the Museum of Northern Arizona (hereafter referred to as the MNA) was established to facilitate intensive cultural resource inventory survey of the White House, Tunnel, and western segment of Twin Trails in Canyon de Chelly National Monument (hereafter referred to as CACH). The project was completed under a Colorado Plateau Cooperative Ecosystem Study Unit (CPCESU) agreement (#H1200-09-0005) between CACH and the MNA. The work is consistent with the objectives of the CPCESU in that it was a cooperative venture between the Service and the MNA whereby both entities contributed to development and implementation of the inventory activities, and provided an opportunity for research with CACH historic and archaeological resources.

The objectives of the project were to identify and record historic and archaeological features and materials in advance of trail maintenance activities. The proposed project was designed in accordance with, and authorized under, the Antiquities Act of 1906, the National Historic Preservation Act of 1966 (as amended), the Archaeological Resources Protection Act of 1979 (as amended), the Native American Graves Protection and Repatriation Act of 1990, and in conformance with approved policies and guidelines of the Service.

The three trails included in this project are scheduled to undergo intensive maintenance work over the next two years. This work will involve significant ground disturbance including, but not limited to, excavation and resurfacing of the trail tread, reconstruction of retaining walls, and replacement of stone steps and wood retainer bars and steps. Also of concern is that sediment for tread resurfacing may be obtained by excavating in areas adjacent to the trails. Due to the lack of previous survey, CACH had not documented cultural resources that could be impacted by such activity. One objective of this project was a complete inventory of cultural resources adjacent to the trails so they can be avoided during maintenance.

Finally, the trails themselves constitute significant cultural resources, both because they traverse routes that have likely been used for many centuries to access the canyon, and because they are important resources that reflect the history of the National Monument's development. Documenting in detail the extensive built environment of the trails will provide CACH with an important record that can be consulted when future projects have a potential for adverse impacts.

Description of the Project Area

CACH was established by Presidential proclamation on April 1, 1931. It is unique in being the only National Park Service unit that is not owned by the U.S. Government. Instead, sovereignty of land and mineral rights is retained by the Navajo Nation and the Service administers the "ruins [and] other features of scientific and historical interest" (Brugge and Wilson 1976:11). In support of their administrative function, the Service is allowed to build roads, trails, and other visitor facilities. The right to traditional use of the canyons, including habitation, grazing and farming, was granted to local Navajos, who were also given the exclusive right to provide horses to visitors wishing to access the canyon and its splendors; these rights continue to the present.

CACH occupies nearly 131 square miles (83,840 acres) in northeastern Arizona (Figure 1). The three major portions of the monument are Canyon de Chelly, approximately 27 miles long, Canyon del Muerto, about 18 miles long, and Monument Canyon, around 10 miles in length (Figure 2). Numerous smaller tributary canyons also lie partially within the monument. The majority of these canyons contain ruins that demonstrate many centuries of human occupation. Alluvial processes have no doubt removed or buried some sites on the canyon bottoms, but the numerous alcoves in the canyon walls contain masonry structures, storage cists, petroglyphs and pictographs, and myriad artifacts that attest to prehistoric and historic occupation. The canyon rims also harbor a large number of sites related to habitation, resource procurement and agriculture, and other activities (eg., de Harport 1959). The high, steep walls of the canyon system limit access between rim and canyon bottom, and routes into or across the canyon follow fault planes, fractured joints in the massive sandstone walls, or steep tributary drainages.

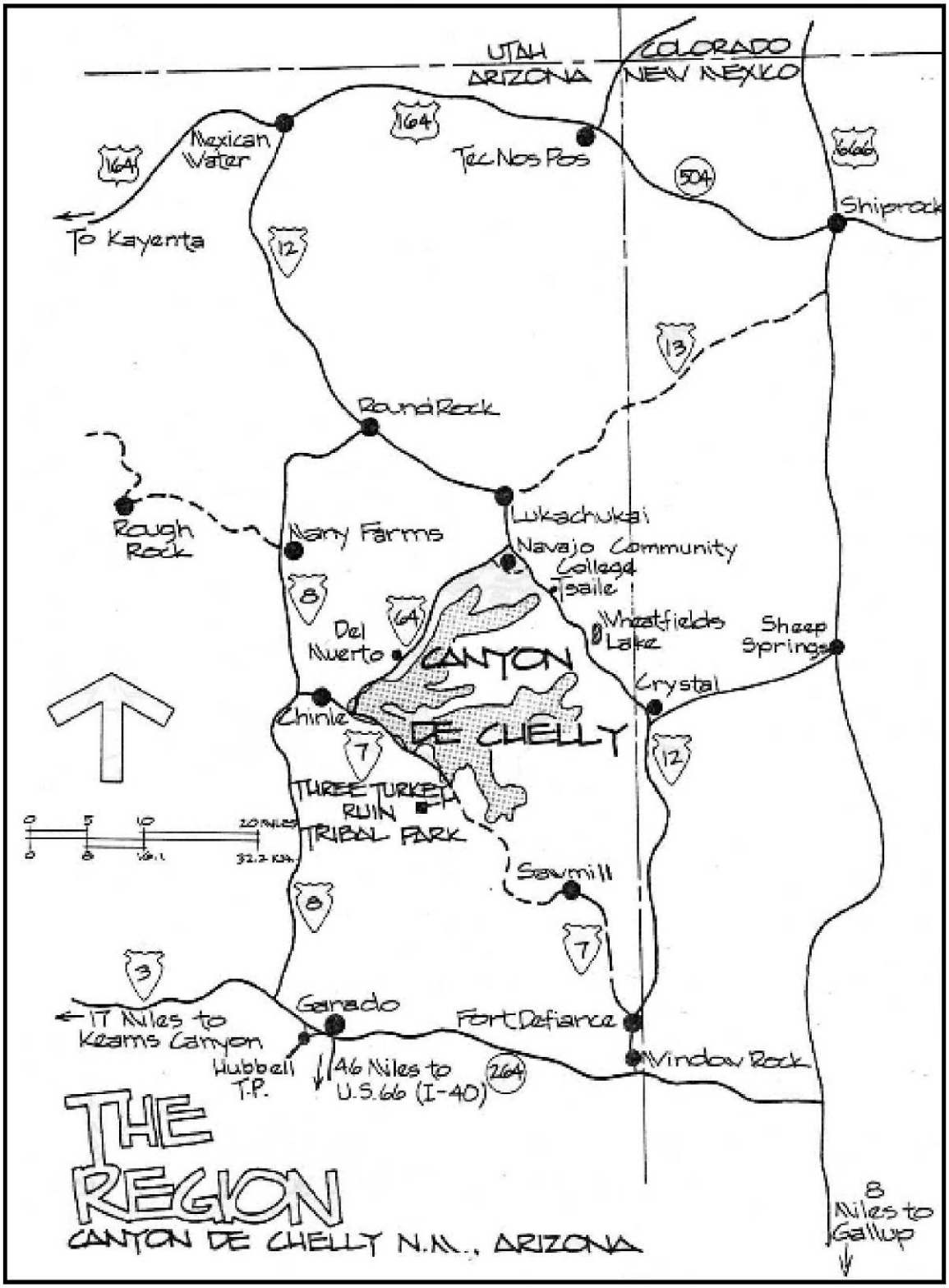

Figure 1. Location of Canyon de Chelly National Monument in northeastern Arizona (from Brugge and Wilson 1976, THE REGION figure, http://www.nps.gov/history/history/online_books/cach/images/map1.jpg.

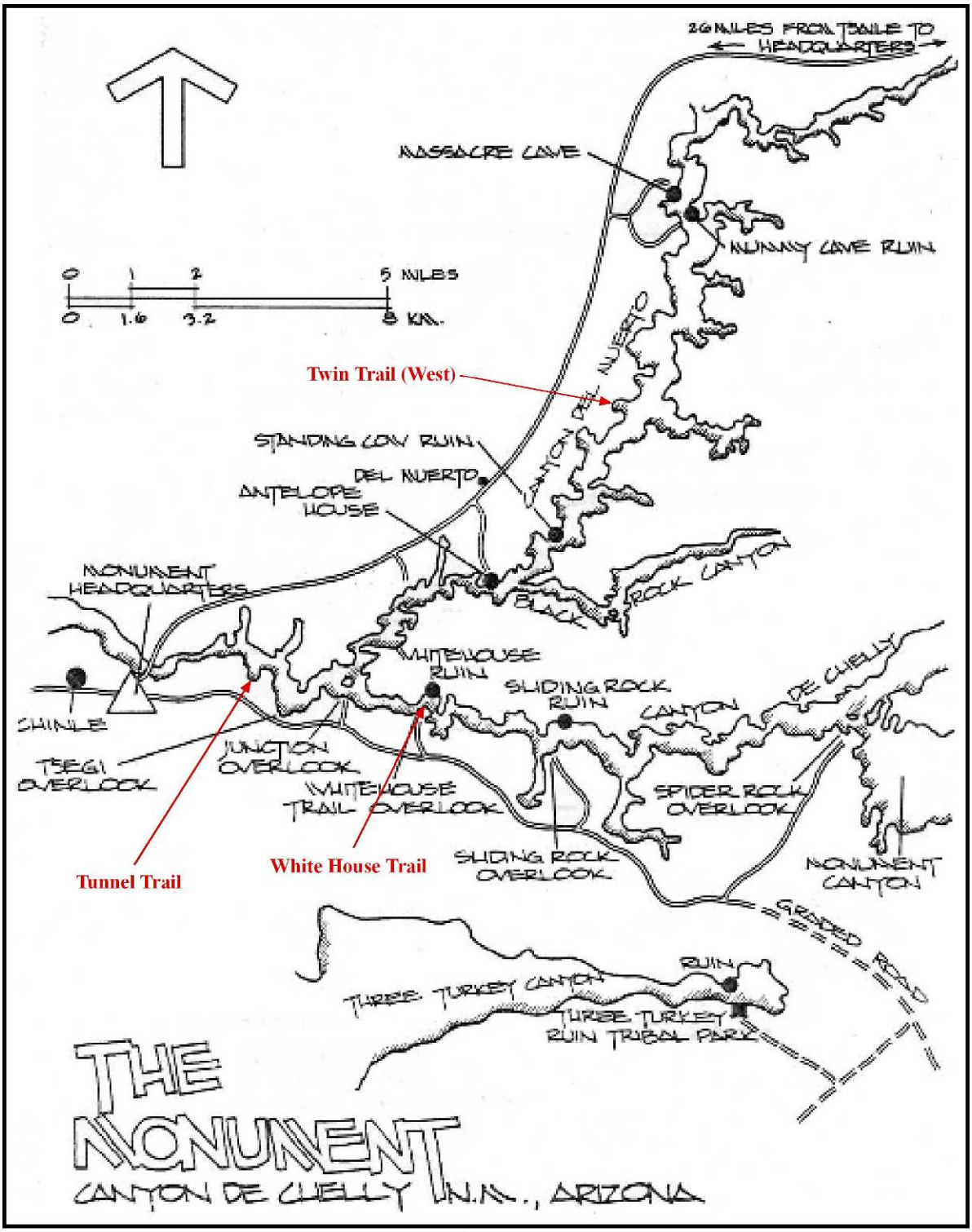

Figure 2. Map showing layout of Canyon de Chelly National Monument and location of the three trails documented for this project (from Brugge and Wilson, figure THE MONUMENT, http://www.nps.gov/history/history/online_books/cach/images/map2.jpg) .

Although most visitors focus on the human history of the canyons, the Monument offers an excellent tutorial in regional geology as the dramatic canyons cut into the western edge of the complex anticline forming the Defiance Plateau (see Baars 2002:145-149). The resistant caprock of this formation is the Shinarump Conglomerate, the lowest member of the Chinle Formation, formed of well-cemented coarse gravels. In exposures farther southeast, the Shinarump contains abundant petrified logs and other evidence of ancient broad rivers emerging from forested highlands.

The high, sheer cliffs enclosing the canyons comprise the fine-grained De Chelly Sandstone, deposited as huge desert dunes. Large-scale cross-bedding of these pale red dunes remains visible on the canyon walls. Water seeping through the permeable sandstone concentrates along fractures and vertical joints. Expansion of the cracks through freeze-thaw cycles and dissolution of the sandstone matrix eventually causes slabs to peel off the cliff faces, enlarging the alcoves that hold prehistoric ruins. Spider Rock is the only place in Canyon de Chelly where the upper and lower boundaries of the De Chelly Sandstone are visible concurrently; there the formation is 825 feet thick.

The canyon system was carved during periods of increased moisture and post-glacial climates when outwash streams were far more powerful than the modern drainages. Current sediment conditions, with deep sand in the canyon bottoms and relatively shallow arroyos in most areas, demonstrate much less erosional ability for the modern de Chelly and del Muerto washes. Although stream flow is adequate to inhibit travel through the canyons at times, especially during spring run-off and late summer monsoon rains, actual downward erosional force of the current streams is negligible. Construction of Tsaile Dam in 1962 at the head of Canyon del Muerto created as many problems as benefits in terms of stream flows and agricultural potential (Brugge and Wilson 1976).

Previous Research

This project focused on three established trails that link the rim country with the interior of Canyon de Chelly and Canyon del Muerto. Although emphasis was placed on field documentation of the 'built environment' of the trails, it was evident based on both field and archival research that the trails follow routes used for hundreds or thousands of years. Abundant scientific and popular literature has documented the natural history, geology, prehistoric and historic occupation, and cultural and political history of the Canyon de Chelly area (for example Baars 1998; Brugge and Wilson 1976; Grant 1978, McDonald 1976; Magers 1981, Noble 1998; Simonelli 1997; Supplee 1993). In the interest of minimizing repetition, this report will emphasize previous research associated directly with each trail included in the field investigations.

The history of the built trail system in the Monument began at a meeting on July 1, 1932 (Brugge and Wilson 1976:46). Attended by the regional and national Service directors, as well as superintendents from other Southwestern parks, that meeting laid concrete plans for such things as roads, trails, and other infrastructure to accommodate visitors. Due to the canyon topography, it was decided that access would be best served from roads built some distance from the rim, with side roads extending to overlooks for views of ruins in the canyons. The first trail selected for improvement was one offering access from the south rim to White House Ruin. Other trails were eventually built or improved, but White House Trail is arguably the best-known pedestrian route in the monument, being the only trail open to the public without a Navajo or Service guide.

Specific archival information about each trail included in this study is presented below. A general history of the monument, including development of trails and canyon infrastructure, is presented by Brugge and Wilson (1976). Previous studies of the trail systems in Canyon de Chelly and Canyon del Muerto include those by Van Valkenburg (1941), James (1976), and Magers (1981). Perhaps the best known, and certainly most widely disseminated, monograph on travel routes is that by Jett (1998). Years of interviews and fieldtrips resulted in this detailed record of major trails and minor routes that access and cross the canyons. The book also presents information on landmarks associated with the trails and other important aspects of the historic and modern cultural landscape in the canyons.

Survey and Documentation Methods

One component of this project was to conduct intensive archaeological survey along White House Trail (CDC 400), Tunnel Trail (CDC 510), and the western segment of Twin Trail (CDM 046). This field effort focused on documenting previously unidentified cultural resources along or adjacent to the trails. Each trail follows a route that has been used to access the canyons for many hundreds of years, and it is likely that evidence of this long-term use remains intact. In conjunction with field inventory activities, MNA staff reviewed archival records provided by CACH for information related to the trails. Service employees also assisted in coordinating field activities of the MNA crews, as well as providing cultural resource documentation standards and forms.

The majority of the fieldwork took place between June 1 and August 6, 2010. Two additional days (December 1 and 2) were required to complete photography on Twin Trail. When working along the trails, MNA personnel wore high-visibility safety vests and badges indicating their status as Service cooperators. MNA crews had daily interaction with local Navajo residents and Monument visitors, particularly when working along White House Trail. Local residents were unfailingly friendly and provided useful information about the history and current use of the trails. Monument visitors generally gave positive feedback when informed of the scope and purpose of the project.

Fieldwork involved intensive pedestrian survey of the trails, with crew member spacing of 10 m or less at all times. This resulted in 100 percent ground coverage along the trail tread and within a 30 meter (100 foot) corridor on either side of the trail tread to identify archaeological and historic resources. Survey was possible adjacent to the trail tread for approximately 95 percent of the trail routes, but a small portion of the adjacent area did not allow for safe access and pedestrian travel. Due to the extremely steep or eroded nature of those areas, it is unlikely that cultural materials occur in unsurveyed areas.

The majority of documented cultural features were directly associated with the trails. These included features such as retaining walls to support the trail tread, modifications to bedrock to widen the trail or facilitate drainage, steps or stairs cut into bedrock, steps built of rock or wood, wood retainer bars to stabilize the trail tread or direct drainage, and pedestrian amenities such as signs and benches. All trail features, whether historic or archaeological, were assigned a designation associated with the master site number, for example, CDM 046-01 for archaeological site CDM 046 (Twin Trail) Trail Feature 01; trail features are listed in tabular form in the following sections. Each trail was documented using a CACH Site Inventory Form, Site Feature Catalog and Feature Forms, ASMIS Form, Site Environmental Context Form, Site Vandalism Form, and Cultural Resource Survey Area Information and Strategy Form.

Trails were photographed with black-and-white print film and in color digital format, and documented with detailed photo logs. Each feature on Tunnel and Twin Trails was photographed with both digital and film cameras, as were all newly-identified features along White House Trail. Due to extensive digital photography completed by CACH crews in 2007, the previously documented features along that trail were only photographed with black-and-white film for this project. Photos were also taken to record some isolated occurrences, specifically those containing features or unusual artifacts.

All three trails have old alignments that are not currently in use. In some cases, most of the old alignment was within the 30 m corridor adjacent to the current trail, in which case the entire route was documented. In situations where the old trail diverged from the modern route, only the portion within the 30 m survey corridor was fully documented as a trail feature; the portion of the old trail beyond that corridor was not mapped or recorded. The same method was used for the multitude of 'social trails' that cross the dune fields along the lower portion of White House Trail and at the base of western Twin Trail.

All of the trails documented for this project have been in use for many generations, but their exact routes have changed over time. In some cases, the application of new construction methods allowed routes to traverse previously impassable terrain; this is particularly true for the bedrock cuts along White House Trail. A desire to upgrade trails to improve visitor access after Monument designation resulted in the expenditure of large amounts of money and labor for engineering and construction. Many of these original built trail features are still in use, and often remain in excellent condition. During trail documentation, decisions made regarding the age of various trail features was guided by visual assessment of the feature condition and construction techniques. Massive bedrock modification, for example, was most often associated with trail construction in the early to mid-20th century. Railroad ties used as retainer bars in the trail tread date to the later part of the century. Juniper log retainer bars that still exhibit bark on the tread surface have been in place only a year or two. Using these criteria, features were divided into 'Trail Features' that signify original, historic, or older modern (>10 years) features versus 'New Features' that consist mainly of retainer bars and steps constructed within the last 5 years. Although somewhat arbitrary, this categorization follows that used by Service crews in their initial documentation of White House Trail features prior to emergency trail maintenance in 2007.

Each trail feature was also assessed for condition and integrity, using a subjective scale of excellent, good, fair, or poor for condition and high, moderate, or low for integrity. The latter refers to the ability of the feature to communicate its original function, and contribute to overall trail character. Type and degree of threats to the trail features were also assessed. Finally, any recommended treatments that would improve the condition or integrity of the trail features were noted. These included stabilization, replacement, or reconstruction of features such as retaining walls and retainer bars. Most new features require no treatment, whereas most original or historic features are in need of some amount of work to ensure continued functionality. Because trail maintenance was initiated on

White House and Tunnel Trails subsequent to this survey in 2010, some condition assessments and treatment recommendations are now superfluous.

All trail treads and trail features, as well as polygon boundaries for all sites, were mapped using RTK-GPS and/or Total Station technologies to provide sub-decimeter accuracy data. MNA sub-contracted with Western Mapping, Inc., of Tucson for this service. Crews from Western Mapping undertook field mapping of the trails and preliminary maps were submitted to MNA for verification of features and necessary modifications were made; final maps for each trail are appended to this report (Appendix B, D, and F).

Prior to fieldwork, Service personnel provided MNA with location and descriptive information for all previously documented sites located along or adjacent to the three trails. When previously unidentified cultural resources were encountered in the survey area, they were assigned an appropriate designation as a site or isolated occurrence. The criteria for designating non-linear cultural remains as a site followed the Arizona State Museum standards:

1) Has more than 30 artifacts of a single class within an area 15 meters in diameter, except when all pieces appear to generate from a single source, such as a broken pot; OR
2) has more than 20 artifacts which include at least two classes of artifact types within an area 15 meters in diameter; OR
3) has one or more archaeological features in temporal association with any number of artifacts; OR
4) has two or more temporally associated archaeological features without artifacts.

When previously unidentified archaeological or historic sites were encountered, they were briefly documented regarding the type and number of features and artifacts present. The location of each new site was plotted to facilitate relocation by Service personnel. These areas should be protected from disturbance related to trail maintenance until the sites can be fully documented.

Isolated occurrences (IOs) are those objects or features that do not meet the site definitions described above per the Arizona State Museum. These resources were documented on CACH Isolated Occurrence forms, photographed, and included on the RTK-GPS maps for each trail.

All original forms, photo logs, sketch maps, and field notes produced by MNA crews will be submitted to CACH for long-term curation at the conclusion of the project. A letter report was submitted on October 20, 2010, which included descriptive information for features associated with Tunnel Trail so that maintenance crews could begin work on the trail during the 2010 season. Results reported in that letter are subsumed within this report.

Project Findings and Site Descriptions

The goal of this cooperative project was to document all features associated with, and directly adjacent to, three trails at CACH. Included in this project were White House Trail and Tunnel Trail, both of which access lower Canyon de Chelly, and the west segment of Twin Trail, which traverses between Canyon del Muerto and the western rim. The following sections provide descriptions of each trail and trail feature, as well as discussions of the context and cultural history of each trail. An evaluation of National Register eligibility for each trail is provided in the final section of this report.

White House Trail (CDC 400)

Just three years after the Monument was established, a meeting was held to plan work on White House Trail. The basic route had long provided local residents access between the rim and canyon (Jett 1998). The Service intended to produce a built trail for pedestrians and horses, which would offer locals and visitors alike “safety and convenience…according to the best Park Service standards” (Brugge and Wilson 1976:50). A route was surveyed and the trail was well underway by July 1934. A crew of 33 Navajo men, supervised by Service engineers and foremen, completed the work in November of that year; the final trail was reported as 4,085 feet long with a descent of approximately 548 feet (Brugge and Wilson 1976:48-51). Tunnels near the top and bottom of the trail allowed for a wide path that could accommodate livestock and horses. Jett (1998:77) reported that the trail work was funded by the Indian Service Emergency Conservation Works, whereas Brugge and Wilson (1976:48) stated that the Bureau of Indian Affairs paid for the trail construction, but since “they could not authorize funds for building a tourist trail, they approved the project as a path for sheep and goats”. Initial trail improvements in 1934 also involved construction of a small overlook on the south rim, across the canyon from White House Ruin, which required building a short access road from the South Rim Drive.

In 1940 and 1941, the Civilian Conservation Corps – Indian Division completed additional maintenance work on White House Trail (Brugge and Wilson 1976:53), although this is not documented by the official history of the CCC in the National Parks (Paige 1985). No specific details were provided regarding the nature and extent of this trail work, but perusal of the Service correspondence referenced by Brugge and Wilson (1976) could clarify the work involved. Monthly reports by the Monument superintendent also report maintenance on White House Trail in 1948, 1949, 1955, and 1963 (Brugge and Wilson 1976:Chp 6-8).

A wet winter in 1952 resulted in slides that blocked White House Trail in three places (Brugge and Wilson 1976:120). Rehabilitation work took place throughout the year and involved use of a horse-drawn cart to haul debris along the narrow path. In 1953, diversion walls were constructed to stabilize portions of the road to the trailhead. That year also witnessed the installation of two interpretive signs at the White House overlook and plans for a self-guided trail brochure (Brugge and Wilson 1976:124). The brochure was completed by the Southwest Monuments Office and stocked at the trailhead by April 1955. The brochures were noted as the only interpretive service provided for White House Trail during an inspection of the monument by the Service Regional Director in 1958 (Brugge and Wilson 1976:146). The trail guide was revised in 1958 but was discontinued in 1960, replaced by additional interpretive signs at the trailhead. A revised version of the trail guide has been sold in the Visitor Center for the last several decades. White House Trail is currently the only route that can be legally accessed by Monument visitors without a Navajo or Service guide. The trail is also heavily used by local Navajo residents for a variety of purposes, including livestock movement into and out of the canyon.

In 2007, a strong monsoon storm caused extensive damage to the upper section of White House Trail. Numerous retaining walls, drains, and other features were heavily damaged and several sections of trail tread were washed out (Figure 3). CACH archaeologists moved quickly to document the original trail features prior to reconstruction efforts. The project expanded to include documentation of features along the entire length of the trail. CACH crews returned after trail reconstruction was complete, and compiled a list of New Features that were placed to rehabilitate the trail (Figure 4). The list and map of original and new features produced by CACH crews formed the basis for the MNA feature lists for this trail (Tables 1 and 2); comments about each feature in Table 1 reflect those of the CACH crew in 2007, supplemented by additional information based on MNA's fieldwork in 2010.

Initial reconnaissance of White House Trail by the MNA crew occurred on June 1, 2010. Survey of the 30 m (100 foot) corridor on each side of the trail took place on June 2 and 3, resulting in discovery of two sites and five IOs. Trail documentation and photography took place on June 3 and 6 – 8. On June 8, as the MNA archaeologists completed their first session of fieldwork, the Service trail maintenance crew was scheduled to arrive and be shown the location of the newly-identified sites and sensitive dune areas that should be avoided during maintenance. Because the trail crew did not arrive that day, the perimeters of the sites and dune area were marked at 5 – 7 m intervals with pinflags pushed deep into the ground, and the areas were shown to Service archaeologists, who were also provided with maps indicating the areas to be avoided.

MNA's documentation of White House Trail comprised 228 trail features and 73 new features, which are listed in Tables 1 and 2, respectively. The original and historic features include 37 retaining walls, 12 rock trail curbs, 2 tunnels cut through bedrock, 36 areas of bedrock modification to increase trail width or facilitate drainage (Figure 5), 6 culverts and 6 'French drain' systems adjacent to the trail, 5 sets of steps cut into bedrock, 24 wood or stone retainer bars, 5 arrows cut into bedrock and 2 wooden signs to mark the trail, 4 benches, and 1 metal footbridge at the base of the trail. There are also three alignments of prehistoric hand-and-toe holds and two petroglyph panels that long predate the current trail route. Historic Navajo use is demonstrated by one old trail alignment documented by Jett (1998) and a trail shrine on the canyon rim.

The majority of the New Features (n = 45) are retainer bars made of juniper logs and stone; most of these were installed in 2007 (see Figure 4). Other New Features include 2 trail curbs, 3 drains, 13 steps (which also serve as retainer bars), 2 borrow pits that also serve as water retention areas, and 5 alignments of reinforcing posts set along the Canyon de Chelly wash to stabilize the trail and prevent erosion.

Jett (1998:77) reports that the lower part of White House Trail (in Navajo, *Tséghá' íldoní* or *'Adáooldoní* or *Ha'ashoní*) corresponds to the historic Woman's Trail (*Asd**áá** Habitiin*). The upper portion of the Woman's Trail, replaced by the modern White House Trail in 1934, was identified during MNA's survey. It diverges from the modern trail above a long bedrock cut (400-064) between the second and third switchbacks. From the divergence, the old trail can be followed northeast along a bedrock ledge for about 60 m, evident as a cleared pathway that is intermittently lined with cobbles, but the route then becomes vague. Jett (1998) does not indicate exactly where the original Woman's Trail emerged onto the rim, stating only that it was "toward the head of the alcove into which the two trails descend" but it is unclear which two trails he refers to. Although cliff walls below the peninsula that holds the White House Overlook appear quite sheer, at least two other trails are documented by Jett (1998:72-73) as

Figure 3. Upper White House Trail showing extensive damage from a rainstorm in 2007.

Figure 4. Series of retainer bars installed along upper White House Trail in 2007 to repair damage.

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-01	Bedrock feature and trail curb	Fair	Moderate	Moderate	Repair curb	
400-02	Footer for sign post	Fair	Moderate	Minimal	None	Sign/post has been removed
400-03	Bedrock feature - arrow	Good	High	Minimal	Repaint	On bedrock ledge above trail
400-04	Bedrock feature - arrow	Good	High	Minimal	Repaint	Cut into bedrock
400-05	Bedrock feature - steps	Good	High	Minimal	None	4 stairs cut into bedrock
400-06	Posthole	Good	High	Minimal	None	New railing or sign could be placed in hole
400-07	Trail curb	Fair	Moderate	Moderate	Repair	East corner is filled with sediment
400-08	Bedrock feature - arrow	Good	High	Minimal	Repaint	Cut into bedrock
400-09	Pulley system	Good	High	Minimal	None	Trench and 5 holes cut into bedrock plus 5 grooves along rim
400-10	Bedrock feature - drain	Good	High	Minimal	None	
400-11	Bedrock feature - arrow	Good	High	Minimal	Repaint	Cut into bedrock
400-12	Footer for sign post	Fair	Moderate	Minimal	None	Sign/post has been removed
400-13	Footer for sign post	Good	High	Minimal	None	Posthole in good condition; sign/post has been removed
400-14	Bedrock feature - steps	Good	High	Minimal	Repair	Stair tread exhibits some erosion
400-15	Bedrock feature - cut	Good	High	Minimal	None	
400-16	Trail curb	Fair	Moderate	Moderate	Repair	Rocks along trail edge to protect drain
400-17	Post hole for gate	Good	High	Minimal	None	Post has been removed
400-18	Retainer bar	Good	High	Moderate	None	Railroad tie; replaced by NF-01
400-19	French drain	Good	High	Moderate	Repair	Re-cement portions of drain, repaired in 2007
400-20	Retainer bar	Good	High	Moderate	None	4 rocks covered with concrete
400-21	Retainer bar	Good	High	Moderate	Repair	Rocks covered with concrete; east edge needs repair
400-22	Bedrock feature - tunnel	Good	High	Minimal	Repair tread	Top and sides are in excellent condition, floor has lost some tread
400-23	Temporary stairs	Poor	Low	Severe	Repair	Replaced by NF-02 to 04; now good condition
400-24	Retaining wall	Good	High	Moderate	Repair	Wall blown out by flood and repaired in 2007; now good condition
400-25	French drain	Fair	Moderate	Minimal	Repair	Re-cement portions of drain
400-26	Culvert and retainer bar	Good	High	Moderate	Repair	Culvert needs to be cleaned out
400-27	Retaining wall	Good	High	Moderate	None	
400-28	Petroglyphs	Good	High	Minimal	None	Prehistoric glyphs adjacent to trail
400-29	Retaining wall	Good	High	Minimal	Repair	Top of wall should be rebuilt up, bottom may be bowing
400-30	Retainer bar	Fair	High	Moderate	Repair	RR tie is splitting at south end; removed in 2007
400-31	French drain	Good	High	Moderate	None	
400-32	Retaining wall	Good	High	Moderate	None	Tread behind wall was repaired in 2007; now good condition
400-33	Bedrock feature - pecking	Good	High	Minimal	None	Pecked and chiseled to widen trail
400-34	Culvert	Good	High	Moderate	None	Replaced by NF-08
400-35	Retaining wall	Good	High	Moderate	None	Wall replaced in 2007; now 3 courses of stone set into concrete

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-36	Retainer bar	Good	High	Moderate	None	Replaced by NF-12
400-37	French drain	Fair	Moderate	Moderate	Repair	Repairs needed along the length of drain
400-38	Retainer bar	Poor	Low	Severe	None	RR tie; gone in 2010
400-39	Retaining wall	Good	High	Moderate	Repair	Repairs needed along the length of wall, fill eroding out
400-40	Retainer bar	Good	High	Moderate	None	Replaced by NF-14
400-41	Trail curb	Fair	Moderate	Moderate	None	Rocks set along trail
400-42	Culvert	Good	High	Minimal	None	Double metal culvert under trail; carries water from french drain (400-037)
400-43	French drain	Good	High	Moderate	None	Repaired in 2007
400-44	Culvert	Good	High	Moderate	None	Replaced by NF-16 to channel water across trail
400-45	Step	Good	High	Moderate	None	Replaced by NF-16
400-46	Bedrock feature - drill holes	Good	High	Minimal	None	In large talus boulder, to widen trail
400-47	French drain	Good	High	Moderate	None	Repaired in 2007
400-48	Retainer bar	Good	High	Minimal	None	Replaced by NF-17
400-49	Bench	Good	High	Minimal	Repair	Bench posts eroding out of soil
400-50	Retainer bar	Good	High	Minimal	None	Exposed on the north end; replaced by NF-18 (2 stacked RR ties)
400-51	Switch back	Good	High	Moderate	None	
400-52	Retainer bar	Good	High	Moderate	None	Replaced with NF-19
400-53	Bedrock feature - cut	Good	High	Minimal	None	
400-54	Retaining wall	Good	High	Moderate	None	
400-55	Retaining wall	Fair	Moderate	Moderate	Repair	Majority has eroded downslope
400-56	Natural drainage	Good	High	Minimal	None	Minor damage to trail
400-57	Retaining wall	Good	High	Severe	Repair	Top portion washed out along with fill
400-58	Step	Good	High	Moderate	None	Replaced by NF-20
400-59	Step	Good	High	Moderate	None	Replaced by NF-67
400-60	Retainer bar	Good	High	Moderate	None	Replaced by NF-68 and 69
400-61	Retainer bar	Good	High	Moderate	Repair	Replaced by NF-21 and 22
400-62	Bedrock feature - pecking	Good	High	Minimal	None	Pecking on 2 talus boulder faces to widen trail
400-63	Retaining wall	Fair	Moderate	Moderate	Repair	Top of wall washed out/bottom end eroding downslope
400-64	Bedrock feature - cut	Good	High	Minimal	Repair	Bedrock feature in good condition; tread need repair
400-65	Concrete remnant	Poor	Low	Moderate	Repair	Concrete and rip rap on trail tread; replace or repair
400-66	Retaining wall	Good	High	Moderate	None	Built of rocks and RR tie
400-67	Step	Poor	Low	Moderate	Repair	Step in place, but fill eroding out around it
400-68	Retainer bar	Good	High	Moderate	Repair	Undercutting of RR tie on north end
400-69	Retaining wall	Good	High	Minimal	Repair	Top needs built up, fill eroding over
400-70	Bench	Fair	Moderate	Minimal	Repair	Incised and painted graffiti cover top of bench
400-71	Retaining wall	Good	High	Minimal	Repair	Top of wall should be built up; not original trail feature

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-72	Retainer bar	Poor	Low	Minimal	None	Gone in 2010
400-73	Retaining wall	Good	High	Moderate	Repair	Portions of wall are eroded; not original trail feature
400-74	Trail curb	Poor	Low	Moderate	Repair	Curb is now a few scattered rocks
400-75	Retainer bar	Good	High	Minimal	Repair	Good condition but fill is eroding
400-76	Retainer bar	Good	High	Moderate	None	
400-77	Step	Good	High	Moderate	None	
400-78	Gully plug	Fair	Moderate	Moderate	Repair	Wall needs repair
400-79	Retaining wall	Fair	Moderate	Moderate	Repair	Wall looks as through it is slumping
400-80	Retainer bar	Good	High	Minimal	None	
400-81	Trail curb	Poor	Low	Moderate	Repair	
400-82	Bedrock feature - cut	Good	High	Minimal	Tread repair	Bedrock feature in good condition, trail tread needs repair
400-83	Retainer bar	Good	High	Minimal	None	
400-84	Retaining wall	Good	High	Moderate	Repair	Fill is encroaching over top of wall
400-85	Retaining wall	Fair	Moderate	Moderate	Repair	Wall is deteriorating
400-86	Retainer bar	Good	High	Moderate	None	RR tie
400-87	Retaining wall	Fair	Moderate	Moderate	Repair	Top of wall needs to be built up, bottom may be deteriorating
400-88	Step	Fair	Moderate	Moderate	Repair	Some concrete exposed and undercutting occurring
400-89	Step	Fair	Moderate	Moderate	Repair	Sediments are eroding around step, needs tread
400-90	Retainer bar	Good	High	Minimal	None	
400-91	Bedrock feature - pecking	Good	High	Minimal	None	
400-92	Retaining wall	Fair	Moderate	Moderate	Repair	Rehabilitate wall
400-93	Bedrock feature - cut	Good	High	Minimal	None	
400-94	Step	Fair	Moderate	Moderate	Repair	Single flat stone (2 ft long)
400-95	Concrete remnant	Poor	Low	Minimal	None	Gone in 2010
400-96	Bedrock feature - drain	Fair	Moderate	Minimal	None	Eroded but functional
400-97	Retaining wall	Fair	Moderate	Moderate	Repair	Retaining wall need repair
400-98	Retaining wall	Good	High	Minimal	Repair	Fill is eroding over top of wall
400-99	Step	Good	High	Moderate	None	Replaced by 400-222
400-100	Step	Good	High	Moderate	Repair	Replaced with rock as NF-25
400-101	Step	Good	High	Moderate	None	Rebuilt in 2007
400-102	Retaining wall	Fair	Moderate	Moderate	Repair	Top of wall is deteriorating, needs stabilization
400-103	Retaining wall	Good	High	Moderate	Repair	
400-104	Concrete remnant	Poor	Moderate	Moderate	Repair	Sections remain intact but will continue to erode
400-105	Step	Poor	Low	Severe	Repair	Completely eroded
400-106	Bedrock feature - pecking	Fair	High	Minimal	None	Pecking on talus boulder to widen trail
400-107	Retainer bar	Good	High	Moderate	None	Replaced by NF-33
400-108	Retaining wall	Fair	Moderate	Moderate	Repair	Top portions of wall are degraded
400-109	Bedrock feature - pecking	Fair	High	Moderate	None	Pecking on talus boulder, facing away from trail
400-110	Retainer bar	Good	High	Moderate	None	RR tie
400-111	Step	Poor	Low	Moderate	Repair	Tread needs repair

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-112	Bedrock feature - cut	Fair	Moderate	Minimal	None	
400-113	Retaining wall	Good	High	Minimal	None	
400-114	Bedrock feature - drain	Good	High	Minimal	None	
400-115	Bedrock feature - cut	Good	High	Minimal	Repair	
400-116	Trail curb	Fair	Moderate	Moderate	Repair	Curb is now stable rubble
400-117	Bedrock feature - drain	Good	High	Minimal	None	
400-118	Bedrock feature - drain	Good	High	Minimal	None	
400-119	Bedrock feature - drain	Fair	Moderate	Moderate	None	Worn down from water/sand
400-120	Retaining wall	Good	High	Moderate	Repair	Rocks missing within wall
400-121	Retaining wall	Fair	Moderate	Moderate	Repair	Wall needs repair and stabilization
400-122	Step	Fair	High	Moderate	None	
400-123	Step	Good	High	Moderate	None	Replaced by NF-40
400-124	Bench	Fair	High	Minimal	None	Minimal graffiti on seat, some undercutting of cement footing
400-125	Bedrock feature - pecking	Good	High	Minimal	None	Spalling is occurring
400-126	Retaining wall	Fair	Moderate	Minimal	Repair	Some parts of stacked wall have fallen in or smaller rocks have been washed out from under larger ones
400-127	Step	Poor	Low	Severe	Repair	
400-128	Bedrock feature - cut	Good	High	Minimal	None	
400-129	Retaining wall	Fair	Moderate	Severe	Repair	Only boulder remains in wall, smaller rocks have fallen
400-130	Retaining wall	Good	High	Minimal	None	
400-131	Step	Good	High	Moderate	None	Replaced by NF-45
400-132	Retainer bar	Good	High	Moderate	None	Replaced by NF-46
400-133	Retaining wall	Good/Fair	Moderate	Moderate	Repair	Needs repair/stabilization
400-134	Trail curb	Poor	Low	Moderate	Repair	Consists of a few scattered rocks
400-135	Step	Good	High	Minimal	None	Repaired in 2007
400-136	Step	Good	High	Minimal	None	Repaired in 2007
400-137	Step	Good	High	Minimal	None	4 large rocks, repaired in 2007
400-138	Retaining wall	Good	High	Minimal	None	Built around tree; not original trail feature
400-139	Bedrock feature - cut	Good	High	Minimal	None	
400-140	Step	Good	High	Minimal	None	
400-141	Step remnant	Destroyed	Low	Minimal	None	Old step remnant adjacent to trail
400-142	Step	Good	High	Moderate	Repair	Stabilized by NF-55
400-143	Bedrock feature - drill holes	Good	Low	Minimal	None	
400-144	Retainer bar	Good	High	Moderate	Repair	RR tie
400-145	Step	Good	High	Moderate	None	3 large rocks
400-146	Step	Good	High	Moderate	None	2 large rocks
400-147	Bedrock feature - drain	Fair	High	Minimal	None	Eroded but functional
400-148	Step	Fair	High	Moderate	None	
400-149	Causeway	Fair	High	Moderate	Repair	Walls/fill/tread are slightly eroded
400-150	Culvert	Good	High	Moderate	None	
400-151	Bedrock feature - cut	Good	High	Minimal	None	
400-152	Bedrock feature - cut	Good	High	Minimal	None	

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-153	Bedrock feature - drain	Fair	High	Minimal	None	Eroded but functional
400-154	Retaining wall	Fair	High	Moderate	Repair	Buried in recent sediments, some wall fall evident
400-155	Bedrock feature - drain	Good	High	Minimal	None	
400-156	Bedrock feature - drain	Good	High	Minimal	None	
400-157	Causeway	Fair	Moderate	Moderate	Repair	Tread is eroded
400-158	Culvert	Fair	High	Moderate	None	East opening is partially blocked by a small tree
400-159	Rock alignment	Poor	Moderate	Moderate	None	Probably associated with newly identified site 2; high potential for cultural deposits buried in dunes adjacent to trail
400-160	Bench	Fair	High	Moderate	Stabilize	Minimal graffiti on bench; sediment loss below concrete
400-161	Bedrock feature - drain	Good	Moderate	Moderate	Repair	Should be redone, wearing in some areas
400-162	Bedrock feature - cut	Good	High	Minimal	None	
400-163	Retaining wall	Fair	Moderate	Moderate	Repair	East portion and top layer needs rebuild
400-164	Step	Good	High	Moderate	None	3 stone steps, rebuilt in 2007
400-165	Trail curb	Poor	Low	Severe	Repair	Rocks dispersed by drainage; needs to be rebuilt
400-166	Step	Poor	Low	Moderate	Repair	Disturbed by drainage; needs rebuild
400-167	Drainage	Fair	Moderate	Severe	Repair	Need to build drainage system, cutting into trail
400-168	Retainer bar	Poor	Low	Severe	Repair	Eroded by drainage
400-169	Retaining wall	Poor	Low	Severe	Repair	Tread eroded, wall fallen
400-170	Step	Poor	Low	Severe	Repair	4 sq ft of rubble remain on side of trail
400-171	Bedrock feature - drain	Fair	Moderate	Moderate	Repair	Eroded but functional
400-172	Gully	Fair	Moderate	Severe	Repair	Gully/drain is full of rubble/rocks preventing flow
400-173	Trail curb	Poor	Low	Moderate	Repair	Consists of scattered rocks along trail; need to rebuild
400-174	Gully plug	Poor	Low	Severe	Repair	5x5 m mound of rocks; does not protect trail
400-175	Bedrock feature - cut	Good	High	Minimal	None	
400-176	Trail curb	Fair	Moderate	Moderate	Repair	Entire length exhibits some degree of wash out
400-177	Retaining wall	Good	High	Moderate	None	
400-178	Bedrock feature - HTH	Fair	High	Minimal	None	Series of deep divots along drainage wall; long predates tunnel
400-179	Bedrock feature - drain	Fair	High	Minimal	None	Eroded but functional
400-180	Retainer bar	Good	High	Minimal	None	Diverts water off trail into drainage; missing some concrete on downslope side
400-181	Poles for gate	Good	High	Minimal	None	2 metal posts, 5 ft high, 3 inch diameter
400-182	Bedrock feature - tunnel	Good	High	Minimal	Tread repair	Tread eroded and uneven
400-183	Gate remnant	Good	High	Minimal	None	Holes in bedrock ca. 10 ft above trail on both sides, also upright pole on west side
400-184	Bedrock feature - drill	Good	High	Minimal	None	

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
	holes					
400-185	Retaining bar/ drain	Good	High	Moderate	None	
400-186	Retaining wall	Good	High	Minimal	None	Up to 15 courses; 2 holes in bedrock below wall probably held posts or rail for original wall
400-187	Step/ retaining bar	Good	High	Minimal	None	
400-188	Bedrock feature - drill holes	Good	High	Minimal	None	5 holes in bedrock wall
400-189	Trail curb	Good	High	Moderate	None	Replaced by NF-73
400-190	Metal footbridge	Good	High	Moderate	Repair	Some undercutting on both ends
400-191	Bedrock feature - drain	Good	High	Minimal	None	
400-192	Culvert	Fair	High	Minimal	Clean out	
400-193	Bedrock feature - drain	Fair	Moderate	Minimal	None	
400-194	Quarry	Good	High	Minimal	None	
400-195	Bedrock feature - steps	Good	High	Minimal	None	Steps cut into bedrock ledge, now along alternate trail alignment
400-196	Bedrock feature - HTH	Good	High	Minimal	None	Series of pecked divots above drainage, may connect with 400-178
400-197	Retainer bar	Good	High	Minimal	None	RR tie braced with 2 metal posts
400-198	Retainer bar	Good	High	Minimal	None	RR tie braced with 2 metal posts and 2 rocks
400-199	Bedrock feature - arrow	Good	High	Minimal	Repaint	Arrow cut into the bedrock and painted
400-200	Trail material	Good	Low	Minimal	None	RR tie and pipe in drainage below trail
400-201	Bedrock feature - drill holes	Good	Low	Minimal	None	6 large talus boulders with drill holes on multiple sides, result of blasting for trail
400-202	Trail material	Good	Low	Minimal	None	Discarded juniper post below trail
400-203	Trail shrine	Good		Minimal	None	Rocks and wood placed within rock recess near trailhead
400-204	Pulley grooves	Good	High	Minimal	None	In bedrock between switchbacks
400-205	Historic trail	Fair	High	Minimal	None	Original upper alignment of woman's trail
400-206	Petroglyphs	Fair	Moderate	Severe	None	Historic mapping datum symbol, possibly related to trail construction
400-207	Bedrock feature - steps	Good	High	Minimal	None	Steps cut into bedrock ledge, probably old trail alignment
400-208	Petroglyphs	Good	High	Minimal	None	Pecking in bedrock above rim
400-209	Wooden sign	Good		Minimal	None	At trailhead
400-210	Step	Good	High	Minimal	None	3 rocks set across tread
400-211	Retainer bar	Good	High	Minimal	None	Log mostly buried
400-212	Petroglyphs	Fair	High	Minimal	None	Pecked into talus boulder; along old trail alignment?
400-213	Bedrock feature - HTH	Fair	High	Minimal	None	Series of HTH, runs nearly horizontal above modern trail cut (400-064); 18 obvious steps and 5-10 others that are heavily eroded
400-214	Pulley grooves	Good	High	Minimal	None	12 pulley grooves (20-50 cm) on large talus boulder, is directly below (in line with) pulley grooves on rim (400-09)

Table 1. Original or historic features associated with White House Trail (CDC 400).

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
400-215	Bedrock feature - pecking	Fair	High	Minimal	None	Pecking on talus boulder near 400-037
400-216	Retainer bar	Good	High	Minimal	None	3 large rocks
400-217	Retainer bar	Good	High	Minimal	None	Short RR tie
400-218	Retainer bar	Good	High	Minimal	None	Tie with rocks at east end
400-219	Wooden sign	Good	High	Minimal	None	Just before upper tunnel
400-220	Bedrock feature - drain	Good	High	Moderate	None	Chiseled groove/trench to define trail and direct drainage
400-221	Retainer bar	Good	High	Moderate	None	Short RR tie
400-222	Retainer bar	Good	High	Moderate	None	Log that replaced 400-99
400-223	Step	Good	High	Minimal	None	3 rocks across trail
400-224	Trail curb	Good	High	Minimal	None	RR tie blocking social trail (lays off main trail)
400-225	Trail material	Good	Low	Minimal	None	RR tie discarded from trail
400-226	Step	Good	High	Moderate	None	Bedrock step (4 rocks) just below wht 86
400-227	Bedrock feature - steps	Fair	Moderate	Moderate	None	On trail tread
400-228	Step	Good	High	Moderate	None	2 large rocks

Figure 5. Example of bedrock cut along White House Trail to increase tread width and standardize grade.

Table 2. New features associated with White House Trail (CDC 400); most relate to maintenance activity in 2007.

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comment
400-NF01	Retainer bar	Good	High	Moderate	None	Replaced 400-018
400-NF02	Retainer bar	Good	High	Moderate	None	Replaced 400-004
400-NF03	Retainer bar	Good	High	Moderate	None	Replaced 400-004
400-NF04	Retainer bar	Good	High	Moderate	None	Replaced 400-004
400-NF05	Retaining wall	Good	High	Moderate	None	Built over damaged wall (400-024)
400-NF06	Retainer bar	Good	High	Moderate	None	
400-NF07	Retainer bar	Good	High	Moderate	None	
400-NF08	Retainer bar	Good	High	Moderate	None	Replaced 400-034
400-NF09	Retainer bar	Good	High	Moderate	None	
400-NF10	Retainer bar	Good	High	Moderate	None	
400-NF11	Retainer bar	Good	High	Moderate	None	3 vertical rocks and log
400-NF12	Retainer bar	Good	High	Moderate	None	Replaced 400-036
400-NF13	Retainer bar	Good	High	Moderate	None	
400-NF14	Retainer bar	Good	High	Moderate	None	Replaced 400-040
400-NF15	Retainer bar	Good	High	Moderate	None	
400-NF16	Retainer bar	Good	High	Moderate	None	Replaced 400-044 and 400-045
400-NF17	Retainer bar	Good	High	Moderate	None	Replaced 400-048
400-NF18	Retainer bar / French drain	Good	High	Moderate	None	Replaced 400-050
400-NF19	Retainer bar	Good	High	Moderate	None	Replaced 400-052
400-NF20	Retainer bar	Good	High	Moderate	None	Replaced 400-058
400-NF21	Retainer bar	Good	High	Moderate	None	Replaced 400-061
400-NF22	Retainer bar	Good	High	Moderate	None	Replaced 400-061
400-NF23	Retainer bar	Good	High	Moderate	None	
400-NF24	Step	Good	High	Moderate	None	
400-NF25	Retainer bar	Good	High	Moderate	None	Replaced 400-100
400-NF26	Steps	Good	High	Moderate	None	
400-NF27	Retainer bar	Good	High	Moderate	None	
400-NF28	Step	Good	High	Moderate	None	
400-NF29	Step	Gone in 2010	N/A	Moderate	None	
400-NF30	Step	Good	High	Moderate	None	
400-NF31	Step	Good	High	Moderate	None	
400-NF32	Retainer bar	Good	High	Moderate	None	
400-NF33	Retainer bar	Good	High	Moderate	None	Replaced 400-107
400-NF34	Retainer bar	Good	High	Moderate	None	
400-NF35	Retainer bar	Good	High	Moderate	None	
400-NF36	Step	Good	High	Moderate	None	
400-NF37	Water bar / trail curb	Good	High	Moderate	None	
400-NF38	Step	Good	High	Moderate	None	
400-NF39	Step	Good	High	Moderate	None	
400-NF40	Step	Good	High	Moderate	None	Replaced 400-123
400-NF41	Trail curb	Good	High	Moderate	None	
400-NF42	Retainer bar	Good	High	Moderate	None	
400-NF43	Retainer bar	Good	High	Moderate	None	

Table 2. New features associated with White House Trail (CDC 400); most relate to maintenance activity in 2007.

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comment
400-NF44	French drain	Good	High	Moderate	None	
400-NF45	Retainer bar / step	Good	High	Moderate	None	Replaced 400-131
400-NF46	Retainer bar / step	Good	High	Moderate	None	Replaced 400-132
400-NF47	Retainer bar / step	Good	High	Moderate	None	
400-NF48	Retainer bar / step	Good	High	Moderate	None	
400-NF49	Step	Gone in 2010	N/A	Moderate	None	
400-NF50	Retainer bar / step	Good	High	Moderate	None	
400-NF51	Step	Good	High	Moderate	None	2 rocks with drill holes
400-NF52	Retainer bar	Good	High	Moderate	None	3 rocks with drill holes
400-NF53	Retainer bar	Good	High	Moderate	None	3 rocks with drill holes
400-NF54	Borrow pit / drainage basin	Good	High	Minimal	None	
400-NF55	Step	Good	High	Moderate	None	Stabilizes 400-142
400-NF56	Stairs	Good	High	Moderate	None	8 rocks
400-NF57	Drain	Good	High	Moderate	None	
400-NF58	Retainer bar	Good	High	Moderate	None	
400-NF59	Drain	Good	High	Moderate	None	
400-NF60	Trail curb	Good	High	Moderate	None	
400-NF61	Reinforcing posts	Good	High	Severe	None	along del Muerto Wash
400-NF62	Reinforcing posts	Good	High	Severe	None	along del Muerto Wash
400-NF63	Reinforcing posts	Good	High	Severe	None	along del Muerto Wash
400-NF64	Reinforcing posts	Good	High	Severe	None	along del Muerto Wash
400-NF65	Reinforcing posts	Good	High	Severe	None	along del Muerto Wash
400-NF66	Retainer bar	Good	High	Moderate	None	
400-NF67	Retainer bar	Good	High	Moderate	None	Replaced 400-059
400-NF68	Retainer bar	Good	High	Moderate	None	Replaced 400-060
400-NF69	Retainer bar	Good	High	Moderate	None	
400-NF70	Retainer bar	Good	High	Moderate	None	
400-NF71	Retainer bar	Good	High	Moderate	None	
400-NF72	Borrow pit / drainage basin	Good	High	Minimal	None	
400-NF73	Steps / trail curb	Good	High	Moderate	None	Built of logs; replaced 400-189

heading in this vicinity. The multitude of trail references from Jett's informants (1998:72-77) likely reflects the many routes that would be expected near a major habitation site such as White House.

In June 2010, White House Trail was generally in good condition, although the tread showed minor to extensive erosion in some areas. Several retaining walls and steps were in need of stabilization but overall the route was functional. On-going causes of disturbance to the trail include erosion of the tread from run-off and pedestrian and animal traffic, undercutting and slumping of retaining walls and steps due to erosion; and graffiti on benches, signs, and bedrock surfaces.

Newly-Identified Sites Associated with White House Trail

New Site 1 is a large thermal feature, possibly a roaster, situated in the dunes below the steep portion of White House Trail. The feature consists of a rather conical pile of large cobbles, many of which appear thermally altered. The pile measures 5 – 6 m in diameter and about 1 m high. Several unburned sandstone slabs were found on the steep slope below the feature. Only a few artifacts are associated with the feature, including one polished gray-brown sherd that may indicate a Basketmaker age for the feature. The perimeter of this site was marked by MNA archaeologists to prevent disturbance during trail maintenance; the site boundary was also plotted by Western Mapping.

New Site 2 comprises a dense artifact concentration in an area of deep dunes on the south side of the trail, high on a ridge overlooking the canyon bottom. Ceramic and lithic artifacts are exposed in a blow-out basin near the dune crest, and it is likely that additional buried artifacts and features occur in the vicinity. One rock alignment is visible on the dune slope below the artifact concentration; it was previously thought to be associated with the trail (Feature 400-159) but appears unlike any trail features and more like a prehistoric feature. The entire dune ridge between the artifact concentration and the trial should be avoided during trail maintenance activities and protected from disturbance due to the high potential for buried cultural materials. The artifact concentration and the dune area to be avoided were included on trail maps by Western Mapping.

Newly-Identified Isolated Occurrences Adjacent to White House Trail

In addition to two sites, survey adjacent to White House Trail documented five isolated occurrences. Four relate to prehistoric activity, and one is likely a modern pet burial.

White House Trail IO-1 consists of two prehistoric sherds, one Chuska Grayware jar body sherd and one Escovada Black-on-white bowl body sherd. These were found in a small drainage adjacent to the trail. White House Trail IO-2 is a single Cibola Whiteware sherd, heavily weathered, also found adjacent to the trail.

White House Trail IO-3 comprises one Cibola Grayware jar body sherd and three lithic artifacts; the latter are two non-cortical core reduction flakes of white and brown chert and a biface tip made of gray-white chert. These artifacts were found on a dune slope above the trail, southwest of New Site 2. Although no artifacts were identified in more than 50 m between the site and the IO, they are probably related and additional cultural material may be buried within the active dunes in this area.

White House Trail IO-4 is a probable recent pet burial on a bedrock ledge near the bottom of the trail. The feature consists of a pile of small unmodified sandstone slabs and rocks that measures 1.1 x 0.7 m and 30 cm high. The 'capstone' slab has fallen northward but would have added 10 cm height. Visible within the rock pile is an animal carcass that appears recent and desiccated. There are no associated artifacts. The location of the rock pile next to a small tree, adjacent to a social trail that cuts off the main trail, suggests it was placed by a local resident.

White House Trail IO-5 consists of a series of linear grooves incised into a bedrock ledge just above the lower tunnel. The grooves are partially repatinated and appear quite old, but there are no associated artifacts or features so the age is uncertain. There are 10 grooves, each 6 – 20 cm long and about 1 cm wide, concentrated in a 1.5 x 1 m area on a ledge face exposed to the northeast. Several small trees currently grow adjacent to the ledge and the incised panel is not evident from more than a few meters away. A short series of historic steps cut into the bedrock ledge (400-195) occurs a short distance to the west.

Tunnel Trail (CDC 510)

Tunnel Trail is a short route that provides access between the south rim of Canyon de Chelly and the canyon bottom, slightly less than 1.5 miles below the junction of de Chelly and del Muerto. The presence of two prehistoric sites and one historic Navajo habitation at the base of the trail suggests this route has been used during all periods that the canyon has been occupied or traversed. The trail continues to provide access to lower Canyon de Chelly for Navajo residents of the area and Monument visitors.

In contrast to White House Trail, there is no discussion in the CACH administrative history of an initial Service project to construct Tunnel Trail. The only specific discussion of Tunnel Trail is that guided tours were implemented in 1966 to access prehistoric ruins in lower Canyon de Chelly (Brugge and Wilson 1976:235). According to Jett (1998:58), the Navajo name for the trail is *Tséghájí' nahí Ha'atiin[í]* and the English name refers to a wedge of sandstone that once existed across the top of the narrow lower canyon section. When the trail was upgraded from a foot trail to a horse trail by Service crews in the early 1940s, the sandstone wedge was blasted away. Several sections of the current trail route follow relatively unmodified drainage bottoms or slopes, but other portions required extensive labor to construct. Jett (1998:58) also noted that the modern metal stairway (Figure 6) and parking area at the trailhead were installed by the Service about 1971 to facilitate tours to the Newspaper Rock petroglyphs near the trail base.

Initial reconnaissance of Tunnel Trail by MNA personnel occurred on June 1, 2010. At that time, the crew met Mary Becenti, who lives to the west of the trailhead and has use rights to 9 acres of land within the canyon at the trail bottom. Ms. Becenti maintains a small orchard with peaches, apples, and cherries, and periodically plants corn and tomatoes in an old field at the base of the trail. Ms. Becenti provided MNA with useful information on the history and construction of Tunnel Trail. Her grandfather was a member of trail construction crews in the 1930s and 1940s, and assisted in construction of White House Trail. Ms. Becenti also provided information on the older alignments of Tunnel Trail, which were briefly documented for this project.


Figure 6. Metal staircase at the head of Tunnel Trail, installed about 1971.

Survey of the 30 m corridor adjacent to Tunnel Trail took place on June 3 and 4, with trail documentation continuing on June 5 and 6. No previously unidentified sites were located, but three IOs were documented. Thirty-nine trail features were identified, as well as 31 New Features associated with recent trail maintenance work; these features are described in Tables 3 and 4. Original and historic features of Tunnel Trail include 7 retaining walls, 5 trail curbs, 9 retainer bars built of wood or stone, 6 areas where the bedrock was pecked or chiseled to widen the trail tread (3 of these are associated with cut stone steps), 1 wooden platform built to support the trail tread, and 1 series of pecked hand-and-toe holds. Two old trail alignments were identified, one completely within the surveyed corridor and the other mostly outside the corridor.

Past maintenance of the trail is evident in the presence of six railroad ties used as retainer bars and one set of stairs that incorporates railroad ties and juniper logs. These features probably date to the 1970s – 1980s. As noted, a large metal staircase was installed near the upper end of the trail about 1971 (Jett 1998:58). This modification also involved rerouting the trail to the head of the canyon and construction of a new parking area adjacent to the South Rim Drive. This upper trail segment has since been surfaced to provide access to the top of the staircase for individuals with limited mobility. Construction of the metal staircase and upper trail section cut off the original upper trail (510-022), which is no longer maintained by Service crews. This trail segment is still used by local residents and has been maintained to a minimal degree to allow canyon access by livestock and pedestrians.

The majority of the New Features were installed in 2009, after an intense thunderstorm washed out the lowest area of stone steps that descended to the canyon bottom near the trail end. As noted in Table 4, juniper logs used to replace the original stone steps are currently in good condition. A pile of surplus logs stored at the base of these stairs was recorded as a New Feature but may have been used during maintenance work later in 2010.

In June 2010, the trail tread was generally in good condition, with minor erosion in some areas. Several retaining walls and steps were in need of stabilization but overall Tunnel Trail was fully functional and in good repair. The primary causes of disturbance to the trail are erosion of the tread from rain, run-off, and livestock movement; undercutting and slumping of retaining walls and steps due to erosion; and damage to some areas by high-energy flash floods associated with rainstorms.

Table 3. Original or historic features associated with Tunnel Trail (CDC 510).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comment
510-01	Retainer bar (RR tie)	Good	High	Moderate	None	2-3 rocks at each end
510-02	Retainer bar (RR tie)	Good	High	Moderate	None	
510-03	Trail curb	Fair	Low	Moderate	Reset rocks	Rocks along trail edge
510-04	Retainer bar (RR tie)	Fair	Moderate	Moderate	Stabilize 2nd tie	2 ties laid end to end
510-05	Retainer bar (RR tie)	Good	High	Moderate	Fill under east end	Undercut on east end
510-06	Stone culvert	Good	High	Moderate	Verify integrity	Built of masonry and cement; runs under trail tread
510-07	Retainer bar (rock) and drainage	Good	High	Moderate	Stabilize drainage	Drainage cuts across trail, needs to be lined
510-08	Metal fence and stairs	Fair	High	Moderate	Recover stair treads	Several stairs have holes in wire tread
510-09	Trail curb	Good	High	Moderate	Stabilize	Unmortared rock at outer trail edge
510-10	Stone stairs	Good	High	Moderate	None	7 steps below metal stairs; stabilized by large rocks along edge
510-11	Retaining wall	Fair	Moderate	Moderate	Stabilize/rebuild	Extends from metal stairs to first switchback; includes logs, ties and small rocks
510-12	Step (rock)	Good	High	Moderate	Fill undercut	1 large rock
510-13	Retainer bar (RR tie)	Good	High	Moderate	None	
510-14	Retaining wall	Fair	Moderate	Moderate	Stabilize/rebuild	Up to 5 courses but eroded/collapsed
510-15	Retainer bar (log)	Fair	High	Moderate	Reset log	Offset and tilted
510-16	Retaining wall	Poor	Low	Severe	Stabilize/rebuild	1-3 courses, eroded/collapsed, includes logs and ties
510-17	Retaining wall	Good	High	Moderate	None	Large rocks, incorporates talus boulders at west end
510-18	Stairs (logs and RR ties)	Good	Moderate	Moderate	Stabilize/rebuild	9 wooden steps, some have associated stones; ties undercut, trail eroded, rocks out of place
510-19	Retaining wall and drainage	Poor	Low	Severe	Rebuild/add culvert?	Originally 2-3 courses, now mostly collapsed and washed out
510-20	Trail curb	Fair	High	Moderate	Maintain	Along east side of trail
510-21	Retainer bar (RR tie)	Fair	Moderate	Moderate	Reset tie, add another	Undercut
510-22	Historic trail junction	Fair	Moderate	Moderate	None	Original trail route, replaced by metal stairs, still used by local residents
510-23	Retaining wall	Fair	Moderate	Moderate	Extend wall/rebuild	1-3 courses to define and support trail
510-24	Historic trail (Elderly's trail)	Fair	High	Moderate	None	Old trail alignment that follows drainage below modern trail; has few built features
510-25	Retainer bar (rock)	Good	High	Moderate	None	Large and small rocks embedded in trail
510-26	Bedrock feature and steps	Good	High	Moderate	None	7 steps cut into bedrock, associated with pecked area to widen trail tread
510-27	Trail curb	Good	High	Moderate	None	Large rocks along west edge of trail
510-28	Trail curb	Fair	Moderate	Moderate	Stabilize/rebuild	Large rocks with small gaps
510-29	Bedrock feature and	Good	High	Low	Sweep	2 sets of steps (with 18 and 17

Table 3. Original or historic features associated with Tunnel Trail (CDC 510).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comment
	steps					steps) cut into bedrock, associated with pecked/shaved areas to widen trail
510-30	Steps (stone)	Good	High	Moderate	Fill undercuts	2 steps in drainage
510-31	Tread foundation	Poor	Moderate	Severe	Rebuild/add railing?	At least 4 logs wired together to widen bedrock ledge; eroded and showing gaps
510-32	Bedrock feature (pecked)	Good	High	Low	None	Along south edge of trail to widen tread
510-33	Bedrock feature and steps	Good	High	Moderate	Sweep	7 steps cut into bedrock, associated with chiseled area to widen trail and post sockets
510-34	Stone steps and bedrock feature	Good	High	Moderate	None	Large rock steps in chute, some replaced with log steps and bars (NF03-NF30); post sockets also present
510-35	Discarded logs	Poor	Low	Low	None	At least 3 logs, bound with wire, laid in drainage
510-36	Bedrock feature (pecked)	Good	High	Moderate	None	Pecking and chiseling
510-37	Bedrock feature (pecked)	Good	High	Moderate	None	Associated with 510-18 (wood stairs) but appears older
510-38	Hand and toe holds (HTH)	Good	High	Low	None	2 pecked holes in bedrock
510-39	Retaining wall	Good	High	Moderate	None	Supports NF13-NF17 but probably older and rebuilt

Table 4. New features associated with Tunnel Trail (CDC 510); most relate to maintenance activity in 2009.

Feature	Feature type	Condition	Integrity	Threat	Treatment	Comment
510-NF01	Retainer bar (log)	Good	High	Moderate	None	Rocks stacked at west end to stabilize
510-NF02	Retainer bar (log)	Good	High	Moderate	None	Rocks stacked at west end to stabilize
510-NF03	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF04	Step (2 logs)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF05	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF06	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF07	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock; has metal pin to stabilize
510-NF08	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF09	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF10	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF11	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF12	Step (log)	Good	High	Moderate	None	Replaced stone steps, used old sockets in bedrock
510-NF13	Step (log)	Good	High	Moderate	None	
510-NF14	Step (log)	Good	High	Moderate	None	
510-NF15	Step (log)	Good	High	Moderate	None	
510-NF16	Step (log)	Good	High	Moderate	None	
510-NF17	Step (log)	Good	High	Moderate	None	
510-NF18	Step (log)	Good	High	Moderate	None	
510-NF19	Step (log)	Good	High	Moderate	None	
510-NF20	Step (log)	Good	High	Moderate	None	
510-NF21	Step (log)	Good	High	Moderate	None	
510-NF22	Step (log)	Good	High	Moderate	None	
510-NF23	Step (log)	Good	High	Moderate	None	
510-NF24	Retainer bar (log)	Good	High	Moderate	None	Diagonal to trail to divert drainage
510-NF25	Retainer bar (log)	Good	High	Moderate	None	Parallel to trail
510-NF26	Retainer bar (log)	Good	High	Moderate	None	
510-NF27	Retainer bar (log)	Good	High	Moderate	None	
510-NF28	Retainer bar (log)	Good	High	Moderate	None	
510-NF29	Retainer bar (log)	Good	High	Moderate	None	
510-NF30	Retainer bar (log)	Good	High	Moderate	None	
510-NF31	Log and tie pile	Good	High	None	None	Material cached for future trail maintenance work

Newly-Identified Isolated Occurrences Adjacent to Tunnel Trail

No previously unidentified sites were encountered during survey of Tunnel Trail, but three isolated occurrences were documented. All are modern features that result from use of the area by local Navajo individuals.

Tunnel Trail IO-1 consists of a large talus boulder with 8 – 10 incised grooves that are clearly of cultural origin, but do not appear to be of significant age. The grooves are 8 – 15 cm long, 3 – 6 cm wide, and 1 – 3 cm deep. Several unmodified rocks are stacked at the base of the boulder but do not form a wall. There are no associated artifacts. Given the location of this feature near the trailhead and parking lot, it seems most likely that it results from activity by visitors or children of vendors who utilize the parking area.

Tunnel Trail IO-2 is a small enclosure formed by stacking unmodified rocks between talus boulders and bedrock outcrops (Figure 7). The interior dimensions are 2.7 x 1.4 m and the walls are 75 cm high. There are no associated artifacts. This feature is also near the trailhead, just 15 m from IO-1. There is no evidence the enclosure was roofed, and it is too poorly constructed to serve as a storage feature. Given the proximity of the feature to the trail and parking lot, this feature likely relates to activity by children.

Tunnel Trail IO-3 is a cairn of nine stacked sandstone slabs with one angular rock on top. The cairn stands 80 cm high and was built on a bedrock boulder within a short tributary canyon. The only associated artifact is a spray paint can, found just up the drainage. The cairn does not appear old and was built in a location that is not visible from the trail or main canyon. This tributary canyon does not offer access to the rim. The feature most likely results from activity by local juveniles and may be associated with a panel of spray-painted graffiti on the south wall of the tributary canyon.

Previously-Identified Sites Adjacent to Tunnel Trail

Three previously-identified archaeological sites occur near the bottom of Tunnel Trail. Site forms and photographs were supplied to MNA crews by CACH prior to trail documentation. These sites were not re-recorded or evaluated, but two were included on the maps produced by Western Mapping.

Site CDC 027 consists of fewer than a dozen pictographs on the back wall of a small alcove near the mouth of a tributary canyon entering Canyon de Chelly from the south, just west of the canyon containing Tunnel Trail. The alcove is about 75 feet above the canyon floor. The pictographs consist primarily of trapezoidal-bodied anthropomorphs, which may date to the Basketmaker period, although they differ somewhat from typical Basketmaker-style figures (cf. Grant 1978). The site has been inaccessible since 1947 due to a rock fall that obliterated the original hand and toe hold trail to the alcove. This has likely contributed to preservation of the pictographs, which appear in good condition when viewed through binoculars. The site is visible from Tunnel Trail but will not be impacted by maintenance activities.

Site CDC 365 consists of a small masonry structure built against the canyon wall under a slight overhang, situated along the east wall at the north end of the canyon containing Tunnel Trail. The site was documented and photographed in 2006. The single-room structure is moderately well preserved, although the roof and much of the front (southwest) wall have collapsed. Masonry consists of shaped rocks of various sizes set into copious mortar. Numerous rocks scattered within and in front of the room represent fallen wall segments. The single artifact found on the surface was a ceramic vessel handle, which was used by the recording crew to assign a Pueblo III age to the site. One wood beam lying within the room may have been part of the roof construction. Although there is no direct evidence of reuse, this site is within 50 m of an historic Navajo habitation (CDC 366) and could have been utilized by residents of that site. Future trail maintenance should avoid CDC 365, but the standing masonry is obvious and unlikely to be disturbed by work crews.

Site CDC 366, also documented and photographed in 2006, consists of two collapsed masonry structures related to historic Navajo occupation of the canyon. The site occupies the flat canyon floor at the north end of the canyon containing Tunnel Trail, just west of the trail. Structure 1 is a stone hogan, built of semi-shaped sandstone blocks set into mud mortar. One portion of the east wall still stands about 1 m high, comprising seven courses, and extends nearly 1.5 m south from the door. The remaining circumference is marked by the lowest course of wall stones, fallen masonry, and a berm of melted mud mortar. One large roof beam and several smaller beam fragments remain within the hogan. Structure 2 is a square stone structure of unknown function, currently represented only by the lowest one or two courses of masonry. This 5 x 5 m room has an east-facing doorway and the interior is slightly depressed. Structure 2 lies at the base of the canyon wall and Structure 1 is 38 m to the southeast, adjacent to large sandstone outcrops. There are no associated artifacts to assess the site age but Mary Becenti, who maintains the orchard adjacent to this site, stated that her grandfather lived at the site in the early 21st century. The structures are visible from the trail but lie west of a fence line and are unlikely to be disturbed by trail maintenance activities.


Figure 7. Isolated Occurrence 2 at head of Tunnel Trail (TT IO-2) with stacked rocks and talus boulders.

Twin Trail, West Segment (CDM 046)

Twin Trail is a cross-canyon route accessing Canyon del Muerto about 9.7 miles above its confluence with Canyon de Chelly. Also known as Cross Canyon Trail (*'Alnaashii Ha'atiin* in Navajo), this route follows a long canyon on the east side of del Muerto and a shorter canyon on the west side. This project documented only the western segment of the trail, which follows a steep talus slope. Jett (1998:154) noted that Twin Trail has long been one of the most important routes between the rim and bottom of Canyon del Muerto. Use of the long eastern arm of the trail decreased with the advent of automobiles that can access the Peninsula area from Tsaile, but the western trail segment is still heavily used for access to the central section of Canyon del Muerto. The poor condition of the trail reflects this heavy use, which MNA crews observed first-hand during fieldwork.

The first report of maintenance on Twin Trail in the CACH administrative history took place in November 1958 (Brugge and Wilson 1976:148). The project provided employment for 10 local Navajo men and involved substantial hand labor; the MNA crew was continually impressed with the extremely large rock slabs that were moved into place to serve as tread steps. Several talus boulders inscribed with names or initials of the 1958 trail crew were recorded for this project (Figure 8). The 1958 work was funded through the Navajo Nation government, with expertise offered by Service personnel. Due to its potential to facilitate local travel, the trail work was listed by the Monument Superintendent as one of the three most significant events of 1958 (Brugge and Wilson 1976:155).

In 1963, a substantial masonry dam was built at the head of the western Twin Trail, after heavy rain and flooding destroyed an earlier erosion control feature (Brugge and Wilson 1976:199). The 1963 dam remains intact and functional (Figure 9), although its capacity has diminished due to soil buildup within the reservoir. Service crews also made improvements along Twin Trail in 1963 and 1983 (Brugge and Wilson 1976:197; Jett 1998:154).

MNA's initial reconnaissance of Twin Trail occurred on June 2, at which time it was evident that this route was in the poorest condition of the three due to heavy use by local residents, natural erosion and slumping, and years of maintenance neglect. Survey of the 30 m corridor on each side of Twin Trail occurred on June 4. This effort resulted in discovery of four previously unidentified sites and nine IOs. Trail documentation took place on August 3 – 6, with final photography of features on December 1 and 2.

Figure 8. Inscription on bedrock along the western segment of Twin Trail, probably produced by the Navajo trail crew that completed the initial formal trail construction.


Figure 9. Masonry dam at the head of western Twin Trail, built in 1963.

Essentially the entire upper half to two-thirds of the trail was built by chiseling bedrock to widen the tread or constructing retaining walls that were filled with rock and dirt to support the trail tread. The trail was lined in many areas with stone pavers or steps laid on the fill, requiring a massive outlay of effort. As of June 2010, the trail was overall in poor condition (Figure 10), heavily eroded and difficult to traverse, and only the upper half-mile or so was in reasonably good condition. In some areas nearly the entire tread has eroded and only intermittent steps or pavers were evident; in those areas only definitive trail features were recorded. The lower end of the trail is poorly defined and consists of numerous routes, some marked by vehicle tracks. Below the built trail features, the route traverses the canyon bottom along and within the wash until it meets the two-track road that follows Canyon del Muerto.

The MNA crew documented 443 original or historic trail features and 106 New Features, which are listed in Tables 5 and 6. These include 37 retaining walls, 2 trail curbs, 2 box culverts, 47 wood retainer bars, 11 log sockets cut into bedrock, 8 areas of modified bedrock to widen the trail (Figure 11), 59 steps cut into bedrock, and 299 built stone steps, in addition to the dam at the trail head. In its original configuration, the trail probably boasted at least another 100 to 150 built stone steps, but many have been displaced by erosion. Jett (1998:34 and Figure 11) reported a trail shrine at the southeastern end of Twin Trail, but no evidence of a similar feature was found on at the top of the western trail segment. Five historic petroglyph panels and four isolated inscriptions were also documented, most related to construction or maintenance crews working along the trail. Other peripheral evidence of trail construction includes two displaced talus boulders that exhibit drill holes.

All but one of the New Features along western Twin Trail are retainer bars made from juniper logs. The recent age of these is evident by the presence of residual bark. Most of these logs are in good condition, although a few need to be stabilized. One new stone step was also identified. Most of these features were installed by Service crews in 2009, although a small amount of trail work was completed by Americorp volunteers in 2006.

Numerous alignments of the trail are evident, proof that this route has been used for a long time. Evidence of prehistoric use includes the petroglyphs and pictographs found near the upper end of the trail and Twin Trail Ruin, the large cliff dwelling in an alcove on the north side of the canyon. Several sherds of historic Navajo pottery found on the talus slope (IO-3) adjacent to the trail indicate early Navajo use. Jett (1998:154) lists Sunnyside Trail (***Sháá*** *Ha'atiin*) as a route that "climbs the right-hand (northeastern) wall of Twin Trail Canyon, about two-thirds of the way up" and it is likely that this trail refers to one of the numerous old alignments identified by the MNA crew.

Four 'old trail alignments' were designated during trail documentation. Old Trail Alignment 1 (OTA-1) is currently occupied by a drainage along the south side of the talus slope. A 45-m-long retaining wall follows most of the distance of OTA-1, but is almost completely collapsed and can only be defined intermittently. There is no intact tread along this route. OTA-2 is probably is the main historic alignment, and is still shown on the USGS 7.5' topographic map. This route is defined by several retaining walls that are now mostly collapsed, and intermittent stone steps demonstrate that it was once fully built like the current trail. The route is in poor condition due to loss of the tread and stone steps through erosion and livestock traffic. This trail segment was replaced by the long switchback that takes the current trail to the north edge of the talus slope. OTA-3 is an old alignment that runs down a steep chute to cut off the last few switchbacks near the bottom of the current trail. No evidence of trail features remains along OTA-3, and it may always have been a more informal route. The trail here is uneven and rocky, due in part to runoff that follows the chute after rainstorms. OTA-4 is an in-use alternate route that crosses the built trail near feature 046-434, a talus boulder with an historic inscription. The route follows a series of bedrock ledges and is marked by an intermittent cobble border and small rock cairns. The MNA crew observed local Navajo youths along OTA-4 several times and it seems to be the preferred route for trail runners.

Previously-Unidentified Sites Adjacent to Twin Trail, West Segment

New Site 1 is a collapsed stone hogan foundation. The feature lies on a low bedrock ledge above the canyon bottom, near the mouth of the canyon containing west Twin Trail. There is not enough masonry present to represent full-height walls, suggesting some stone has been scavenged from the site. The poor condition of the hogan and sparse artifacts, just a few pieces of metal and glass, may indicate significant age for this site. This site is unlikely to be disturbed by trail maintenance due to its location above the canyon bottom and peripheral to the main trail.

New Site 2 is a possible corral, which may be associated with New Site 1. The rectangular stone foundation occupies the crest of a low ridge overlooking the canyon bottom. The walls currently consist of fewer that five courses, standing less than a meter high. There are no associated artifacts, so the age and exact function of the feature are problematic. This site is unlikely to be disturbed by trail maintenance because it is on a ridge above the canyon bottom.

Figure 10. Western Twin Trail showing eroded tread, undercut steps, and generally poor condition.

Figure 11. Example of bedrock cut along western Twin Trail to widen tread.

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-001	Masonry dam	Good	High	Moderate	Repoint masonry	sediment buildup but still functional; some leakage along cracks
046-002	Bedrock feature - cut	Good	High	Minimal	None	natural cleft modified to provide access from rim to trail
046-003	Bedrock feature - step	Fair	Moderate	Moderate	None	tread somewhat eroded
046-004	Bedrock feature - step	Fair	Moderate	Moderate	None	tread somewhat eroded
046-005	Bedrock feature - step	Fair	Moderate	Moderate	None	tread somewhat eroded
046-006	Bedrock feature - step	Fair	Moderate	Moderate	None	tread somewhat eroded
046-007	Retaining wall	Fair	Moderate	Moderate	Rebuild	partially rebuilt, partially eroded; 1-4 courses of rock
046-008	Wooden sign	Good	High	Minimal	None	wooden sign at trailhead
046-009	Stone step	Good	High	Moderate	None	huge rock on edge
046-010	Stone step	Good	High	Moderate	None	3 large rocks
046-011	Stone step	Fair	Moderate	Moderate	Stabilize	1 large flat rock- undercut
046-012	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks- undercut
046-013	Stone step	Good	High	Moderate	None	1 huge rock
046-014	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks w/flat rocks behind
046-015	Stone step	Good	High	Moderate	None	2 large rocks
046-016	Stone step	Fair	Moderate	Moderate	Stabilize	2 large and 1 small rocks- undercut
046-017	Stone step	Fair	Moderate	Moderate	Stabilize	1 large flat rock
046-018	Stone step	Fair	Moderate	Moderate	Improve	2 large rocks- 1 missing at each end
046-019	Stone step	Good	High	Moderate	None	3 large rocks
046-020	Stone step	Fair	Moderate	Moderate	Stabilize	4 rocks- undercut, 1 slumped
046-021	Stone step	Fair	Moderate	Moderate	Stabilize	2 long rocks- undercut
046-022	Bedrock feature - cut	Good	High	Minimal	None	natural cleft widened for trail; contains sockets for retainer bars
046-023	Petroglyph	Good	High	Minimal	None	"1958" pecked into bedrock 1.5 m above trail
046-024	Petroglyph	Fair	Moderate	Minimal	None	linear pecking with chisel, edges weathered
046-025	Stone trail tread	Fair	Moderate	Moderate	Stabilize	sandstone slabs laid to cover trail tread
046-026	Retainer bar	Fair	Moderate	Moderate	Stabilize	RR tie; undercut, bracing log has failed
046-027	Bedrock feature - steps	Fair	Moderate	Moderate	Improve	3 short steps cut into bedrock
046-028	Retainer bar	Fair	Moderate	Moderate	Stabilize	RR tie; undercut on end
046-029	Stone step	Good	High	Moderate	None	2 large rocks
046-030	Bedrock feature - step	Fair	Moderate	Moderate	Improve	4 shallow steps cut into bedrock
046-031	Retainer bar	Fair	Moderate	Moderate	Stabilize	RR tie; undercut in center
046-032	Stone step	Fair	Moderate	Moderate	Rebuild	2 slabs, undercut and slumped
046-033	Retainer bar	Fair	Moderate	Moderate	Rebuild	RR tie; undercut completely
046-034	Stone step	Fair	Moderate	Moderate	Rebuild	1 large rock, others missing
046-035	Retaining wall	Poor	Low	Moderate	Rebuild	4-5 m long- mostly fallen- supported by logs
046-036	Stone step	Poor	Low	Moderate	Rebuild	eroded, 2 rocks remain
046-037	Retainer bar	Good	High	Moderate	None	RR tie; undercut on west end
046-038	Stone step	Fair	Moderate	Moderate	Stabilize	2 large flat rocks

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-039	Stone step	Fair	Moderate	Moderate	Stabilize	2 large flat rocks
046-040	Retaining wall	Poor	Low	Moderate	Rebuild	ca. 8m- mostly fallen- partially rebuilt
046-041	Petroglyph	Good	High	Minimal	None	historic/recent names and dates on tilted bedrock face
046-042	Stone step	Fair	Moderate	Moderate	Stabilize	undercut, NF30 forms part of step
046-043	Stone step	Fair	Moderate	Moderate	Stabilize	2 large flat rocks
046-044	Stone step	Poor	Low	Moderate	Rebuild	3 rocks, partially slumped
046-045	Stone step	Poor	Low	Moderate	Rebuild	1 large rock remains, completed by NF32 log
046-046	Retaining wall	Fair/Poor	Moderate	Moderate	Rebuild	massive rock wall supporting trail; eroded and slumped
046-047	Stone step	Poor	Low	Moderate	Rebuild	2 flat rocks, others have slid downslope
046-048	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge and 3 large rocks, being undercut
046-049	Retainer bar	Fair	Moderate	Moderate	Stabilize	undercut in center
046-050	Stone step	Fair	Moderate	Moderate	Stabilize	2 huge and 1 flat rock, undercut
046-051	Stone step	Poor	Low	Moderate	Rebuild	1 huge and 1 large rock, eroded/slumped
046-052	Stone step	Poor	Low	Moderate	Rebuild	1 huge stone, others missing and slumped
046-053	Stone step	Fair	Moderate	Moderate	Improve	4 rocks, undercut/slumping
046-054	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, channels on each side
046-055	Stone step	Fair	Moderate	Moderate	Improve	2 large and 4 rocks, some undercutting
046-056	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, undercut/slumped
046-057	Bedrock feature - cut	Fair	Moderate	Minimal	Rebuild	cut/pecked bedrock to widen trail
046-058	Petroglyph	Good	High	Minimal	None	"H * 27-58" on cliff wall
046-059	Retaining wall	Poor	Low	Moderate	Rebuild	12m long, mostly collapsed partially rebuilt
046-060	Bedrock feature - step	Fair	Moderate	Moderate	Improve	on tread along 046-057, 4 cut/pecked steps; eroded
046-061	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others eroded
046-062	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others eroded/undercut
046-063	Stone step	Fair	Moderate	Moderate	None	1 large slab, erosion at ends
046-064	Stone step	Fair	Moderate	Moderate	Stabilize	1 large slab, others missing
046-065	Stone step	Fair	Moderate	Moderate	None	2 large slabs
046-066	Stone step	Fair	Moderate	Moderate	Improve	1 large slab, others missing/slumped
046-067	Retainer bar	Fair	Moderate	Moderate	Stabilize	log; undercut
046-068	Stone step	Fair	Moderate	Moderate	Stabilize	2 rocks, erosion has loosened
046-069	Bedrock feature - cut	Fair	Moderate	Moderate	None	pecked/cut to widen trail and tread; eroded
046-070	Bedrock feature - steps	Fair	Moderate	Moderate	Improve	6 shallow steps pecked/cut into bedrock
046-071	Retaining wall	Poor	Low	Moderate	Rebuild	ca 20 m long, mostly fallen; logs stacked/wired on wall
046-072	Bedrock feature - steps	Poor	Low	Moderate	Improve	2 steps cut/pecked into bedrock at end of 046-071
046-073	Retaining wall	Poor	Low	Moderate	Rebuild	8-10 m long, mostly fallen, base intact

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-074	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge rock at drainage
046-075	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks undercut
046-076	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock, extends under 046-075
046-077	Stone step	Fair	Moderate	Moderate	Stabilize	1 long slab, undercut but stable
046-078	Stone step	Poor	Low	Moderate	Stabilize	1 long slab, undercut but stable
046-079	Stone step	Poor	Low	Moderate	Rebuild	1 large slab, slumped
046-080	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut, weathered
046-081	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, 1 missing
046-082	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, 1 slumped, others missing
046-083	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, others missing
046-084	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, 1 undercut
046-085	Retaining wall	Poor	Low	Moderate	Rebuild	8-10 m long, mostly fallen, base intact
046-086	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, others missing
046-087	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, jumbled at 1 end, eroded
046-088	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, undercut, eroded
046-089	Retainer bar	Poor	Low	Moderate	Replace	log; undercut, exposed
046-090	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut
046-091	Retainer bar	Fair	Moderate	Moderate	Stabilize	log; undercut
046-092	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut but stable
046-093	Stone step	Fair	Moderate	Moderate	Replace	1 large rock, others missing/slumped
046-094	Stone step	Good	High	Moderate	Stabilize	2 huge rocks, slightly undercut
046-095	Retaining wall	Fair	Moderate	Moderate	Rebuild	ca. 20 m long, 3-6+ courses; eroded and slumped
046-096	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut/eroded
046-097	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, others missing, has retainer bar under it
046-098	Stone step	Poor	Low	Moderate	Replace	2 large rocks, slumped
046-099	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge, 1 rock
046-100	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, undercut and slumping
046-101	Stone step	Poor	Low	Moderate	Rebuild	3 large rocks, undercut and slumping
046-102	Stone step	Poor	Low	Moderate	Rebuild	1 long rock, undercut, erosion
046-103	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut
046-104	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, others missing
046-105	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, others missing
046-106	Retainer bar	Fair	Moderate	Moderate	None	log; mostly buried in trail-weathered
046-107	Retaining wall	Poor	Low	Moderate	Rebuild	5-6m long- totally collapsed/eroded
046-108	Retaining wall	Poor	Low	Moderate	Rebuild	4-5m long- totally collapsed/eroded
046-109	Bedrock feature - step	Good	High	Moderate	None	6 cut/pecked steps in bedrock
046-110	Retaining wall	Poor	Low	Moderate	Rebuild	ca 20 m long- mostly fallen/reworked/eroded
046-111	Retaining wall	Destroyed	None	Moderate	Rebuild	ca 20 m long- mostly fallen/eroded
046-112	Culvert	Fair	Moderate	Moderate	Cleanout	40x40 cm masonry box under trail, 2 large cap rocks on trail, filled with

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
						sediment/rock
046-113	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut, eroded at sides
046-114	Stone step	Fair	Moderate	Moderate	Repair	2 large rocks, others missing
046-115	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut/exposed, 1 end braced with rock
046-116	Stone step	Poor	Low	Moderate	Rebuild	1 rock, others missing
046-117	Stone step	Poor	Low	Moderate	Repair	2 large rocks, others missing
046-118	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks out of context
046-119	Retaining wall	Fair	Moderate	Moderate	Rebuild	ca 40 m long, 2-7 courses; slumped but functional
046-120	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-121	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks, other missing, some undercutting
046-122	Bedrock feature - step	Fair	Moderate	Moderate	Improve	9 steps chiseled into bedrock
046-123	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut and weathering
046-124	Stone step	Good	High	Moderate	Stabilize	1 large rock, beginning to be undercut
046-125	Stone step	Good	High	Moderate	Stabilize	1 large rock, sitting on 046-126
046-126	Stone step	Fair	Moderate	Moderate	Repair	3 large rocks, 1 slumped
046-127	Stone step	Poor	Low	Moderate	Replace	2 large rocks, undercut and hanging
046-128	Stone step	Poor	Low	Moderate	Replace	3 large rocks, undercut/slumped
046-129	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks, undercutting
046-130	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, slightly undercut
046-131	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge and 1 large rock, undercut
046-132	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge and 1 large rock, undercut
046-133	Stone step	Fair	Moderate	Moderate	Stabilize	1 rock, 1/2 trail width
046-134	Stone step	Fair	Moderate	Moderate	Stabilize	3 huge rocks, undercut
046-135	Stone step	Poor	Low	Moderate	Rebuild	1 huge rock, others missing
046-136	Petroglyph	Poor	Low	Minimal	None	"1964" pecked into boulder in 046-119; weathered
046-137	Retaining wall	Poor	Low	Moderate	Rebuild	ca. 15 m long, mostly fallen, base intact
046-138	Retaining wall	Poor	Low	Moderate	Rebuild	ca. 50 m long- mostly collapsed, rebuilt w/logs
046-139	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge rock, partially undercut
046-140	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock, others missing?
046-141	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks, partially undercut
046-142	Stone step	Fair	Moderate	Moderate	Repair	1 large rock, others missing
046-143	Stone step	Poor	Low	Moderate	Repair	2 large rocks, others slumped, undercut
046-144	Stone step	Poor	Low	Moderate	Repair	2 large rocks, others slumped, missing
046-145	Stone step	Poor	Low	Moderate	Replace	3 large rocks, others slumped, missing
046-146	Bedrock feature - notch	Fair	Moderate	Minimal	None	pecked notch, 20x10 cm on edge of trail, for retainer bar
046-147	Stone step	Poor	Low	Moderate	Replace	2 large rocks, undercut/eroded
046-148	Stone step	Poor	Low	Moderate	Replace	1 large rock, undercut/eroded

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-149	Bedrock feature - notch	Good	High	Minimal	None	2 notches cut into bedrock, 2.5m apart, for retainer bar
046-150	Retaining wall	Poor	Low	Moderate	Rebuild	12- 15 m long- mostly collapsed/rebuilt w/ some stacked logs
046-151	Petroglyph	Fair	Moderate	Minimal	None	"1958-9" pecked into boulder that has rolled over
046-152	Stone step	Good	High	Moderate	Stabilize	3 large stones, slightly undercut
046-153	Stone step	Good	High	Moderate	Stabilize	1 huge and 1 rock
046-154	Stone step	Good	High	Moderate	Stabilize	1 huge rock, slightly undercut
046-155	Stone step	Good	High	Moderate	Stabilize	1 large rock, slightly undercut
046-156	Stone step	Good	High	Moderate	Stabilize	1 huge and 1 large rock
046-157	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, 1 undercut
046-158	Stone step	Good	High	Moderate	Stabilize	1 huge rock, undercut on edges
046-159	Stone step	Good	High	Moderate	Stabilize	2 large rocks
046-160	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-161	Stone step	Good	High	Moderate	Stabilize	1 huge rock, undercut on one side
046-162	Retaining wall	Poor	Low	Moderate	Rebuild	ca 40 m long- mostly collapsed/rebuilt w/rubble
046-163	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, undercut/eroded, others missing
046-164	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut, weathered
046-165	Stone step	Poor	Low	Moderate	Rebuild	3 rocks, slumped/eroded
046-166	Stone step	Poor	Low	Moderate	Rebuild	2 rocks, slumped/eroded
046-167	Stone step	Good	High	Moderate	None	3 large rocks, slightly buried
046-168	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut and loose
046-169	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, undercut, 1 missing
046-170	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-171	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-172	Retaining wall	Poor	Low	Moderate	Rebuild	ca 20 m long, collapsed- just rubble remains
046-173	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut
046-174	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/weathered
046-175	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks; undercut, 1 missing
046-176	Stone step	Poor	Low	Moderate	Rebuild	2 rocks, undercut/exposed
046-177	Stone step	Poor	Low	Moderate	Rebuild	2 rocks, 1 missing, log buried beneath, part exposed
046-178	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-179	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks, undercut
046-180	Retaining wall	Poor	Low	Moderate	Rebuild	10-12 m long- mostly collapsed
046-181	Retainer bar	Poor	Low	Moderate	Replace	log; totally exposed and weathered
046-182	Retaining wall	Poor	Low	Moderate	Rebuild	totally collapsed- mostly small rubble
046-183	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut/exposed, just above 046-184
046-184	Stone step	Poor	Low	Moderate	Stabilize	3 rocks, eroded/undercut, just below 046-183
046-185	Retaining wall	Poor	Low	Moderate	Rebuild	ca 50 m long, totally collapsed, just piled rubble
046-186	Bedrock feature - notch	Good	High	Minimal	None	20 x 30 cm, in large talus boulder

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-187	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, other large rock slumped
046-188	Stone step	Poor	Low	Moderate	Rebuild	1 large and 1 medium rock, others missing, undercut/eroded
046-189	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed beneath 046-188
046-190	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed/loose
046-191	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut- just above 046-192
046-192	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut, just below 046-191
046-193	Stone step	Good	High	Moderate	Stabilize	1 huge and 1 large rock
046-194	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-195	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-196	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-197	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-198	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-199	Stone step	Good	High	Moderate	Stabilize	1 huge rock, undercut
046-200	Stone step	Good	High	Moderate	Stabilize	1 huge and 1 large rock
046-201	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-202	Stone step	Good	High	Moderate	Stabilize	1 huge rock
046-203	Stone step	Good	High	Moderate	Stabilize	1 huge rock, undercut
046-204	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock, sits on 046-205 and 046-206
046-205	Retainer bar	Fair	Moderate	Moderate	Replace	log; partially exposed, beneath 046-204
046-206	Retainer bar	Fair	Moderate	Moderate	Replace	log; partially exposed, beneath 046-204
046-207	Stone step	Fair	Moderate	Moderate	Rebuild	2 large rocks, undercut
046-208	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut
046-209	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, slumped, others missing
046-210	Stone step	Good	High	Moderate	None	2 large rocks, partially buried
046-211	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-212	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed
046-213	Stone step	Fair	Moderate	Moderate	Repair	2 rocks w/ set against large talus boulder
046-214	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut/partially exposed
046-215	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut/partially exposed
046-216	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing, adjacent to 046-216
046-217	Stone step	Poor	Low	Moderate	Rebuild	4 large rocks, undercut/eroded
046-218	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing, adjacent to 046-219
046-219	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut, just above 046-218
046-220	Stone step	Fair	Moderate	Moderate	Repair	3 large rocks, undercut
046-221	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing, undercut
046-222	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing, undercut
046-223	Retaining wall	Poor	Low	Moderate	Rebuild	25-30 m long, mostly collapsed, partially rebuilt

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-224	Retaining wall	Poor	Low	Moderate	Rebuild	8-10 m long, partially collapsed, base intact
046-225	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut, weathered
046-226	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks
046-227	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks
046-228	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks
046-229	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, partially undercut
046-230	Retaining wall	Poor	Low	Moderate	Rebuild	ca 40 m long, mostly collapsed/rebuilt, base intact
046-231	Stone step	Poor	Low	Moderate	Stabilize	1 large rock in central trail
046-232	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock in central trail
046-233	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks
046-234	Stone step	Poor	Low	Moderate	Rebuild	3 rocks, eroded and slumped
046-235	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock, undercut
046-236	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing, Replaced
046-237	Stone step	Poor	Low	Moderate	Rebuild	3 large rocks, 2 totally undercut
046-238	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, others missing
046-239	Retainer bar	Poor	Low	Moderate	Replace	log; undercut, exposed
046-240	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks
046-241	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge rock
046-242	Stone step	Poor	Low	Moderate	Rebuild	1 large rocks, others missing
046-243	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks
046-244	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge rock
046-245	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge rock
046-246	Stone step	Fair	Moderate	Moderate	Rebuild	3 rocks eroded
046-247	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, undercut
046-248	Stone step	Poor	Low	Moderate	Rebuild	1 rock, loose on top of 046-249
046-249	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks
046-250	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, 1 undercut
046-251	Retaining wall	Poor	Low	Moderate	Rebuild	15-20 m long, partially collapsed/rebuilt
046-252	Stone step	Poor	Low	Moderate	Rebuild	1 huge rock, undercut
046-253	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, other missing
046-254	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, undercut
046-255	Stone step	Poor	Low	Moderate	Rebuild	2 large rocks, 1 slumped
046-256	Stone step	Poor	Low	Moderate	Rebuild	3 large rocks, eroded
046-257	Retainer bar	Poor	Low	Moderate	Replace	log; exposed/weathered
046-258	Retaining wall	Poor	Low	Moderate	Rebuild	ca 20 m long, totally collapsed- just rubble remains
046-259	Stone step	Good	High	Moderate	None	1 huge rock
046-260	Stone step	Good	High	Moderate	None	1 huge rock
046-261	Stone step	Good	High	Moderate	None	4 large rocks
046-262	Stone step	Good	High	Moderate	None	4 large rocks
046-263	Stone step	Good	High	Moderate	None	2 large rocks
046-264	Stone step	Fair	Moderate	Moderate	Stabilize	1 huge and 2 medium rocks
046-265	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-266	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks
046-267	Stone step	Fair	Moderate	Moderate	Rebuild	1 large rock, undercut/eroded
046-268	Retaining wall	Good	High	Moderate	Stabilize	8-10 m long, 6-8 courses stacked masonry
046-269	Petroglyph	Fair/Good	High	Minimal	None	large talus boulder with historic names, dates, numbers; relates to trail construction/maintenance
046-270	Retaining wall	Poor	Low	Moderate	Improve	ca 20 m long; low, poorly stacked, slumped
046-271	Stone step	Good	High	Moderate	None	2 large blocks, partially buried
046-272	Stone step	Good	High	Moderate	None	2 large blocks, partially buried
046-273	Stone step	Good	High	Moderate	None	2 large blocks, partially buried
046-274	Stone step	Good	High	Moderate	None	2 large blocks, partially buried
046-275	Stone step	Good	High	Moderate	None	1 large block between talus boulders, partially buried
046-276	Stone step	Good	High	Moderate	None	1 large block, partially buried
046-277	Stone step	Good	High	Moderate	None	1 huge rock
046-278	Stone step	Good	High	Moderate	None	1 large rock
046-279	Stone step	Good	High	Moderate	None	2 large rocks
046-280	Stone step	Good	High	Moderate	None	3 large rocks
046-281	Stone step	Good	High	Moderate	Stabilize	2 large rocks, slightly undercut
046-282	Stone step	Good	High	Moderate	None	3 large rocks
046-283	Stone step	Good	High	Moderate	None	3 large rocks
046-284	Stone step	Good	High	Moderate	None	2 rocks set against talus boulder
046-285	Stone step	Good	High	Moderate	None	1 large slab against talus boulder
046-286	Stone step	Good	High	Moderate	None	2 rocks
046-287	Stone step	Good	High	Moderate	None	4 rocks
046-288	Stone step	Good	High	Moderate	Stabilize	3 large rocks, 1 has shifted
046-289	Stone step	Good	High	Moderate	None	3 rocks
046-290	Stone step	Good	High	Moderate	None	1 large slab
046-291	Retaining wall	Fair	Moderate	Moderate	Stabilize	25-30 m long; intermittent masonry with talus boulders
046-292	Stone step	Fair	Moderate	Moderate	Stabilize	1 large slab, others missing
046-293	Stone step	Good	High	Moderate	None	3 large rocks, just below NF69
046-294	Stone step	Good	High	Moderate	None	3 blocks
046-295	Stone step	Good	High	Moderate	None	3 blocks
046-296	Stone step	Fair	Moderate	Moderate	Stabilize	2 large slabs, others missing
046-297	Retaining wall	Fair/Poor	High	Moderate	Rebuild	ca 40 m long- mostly collapsed
046-298	Stone step	Poor	Low	Moderate	Rebuild	3 rocks next to tree, eroded
046-299	Bedrock feature - drill holes	Good	High	Minimal	None	talus boulder with drill holes, beside trail, out of context
046-300	Retaining wall	Fair/Poor	High	Moderate	Rebuild	ca 54 m long, mostly collapsed, mixed with talus boulders
046-301	Stone step	Good	High	Moderate	None	3 blocks, against talus block
046-302	Stone step	Good	High	Moderate	None	3 blocks
046-303	Stone step	Good	High	Moderate	None	4 blocks
046-304	Stone step	Good	High	Moderate	None	3 blocks
046-305	Stone step	Good	High	Moderate	Improve	2 blocks, 1 missing

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-306	Stone step	Good	High	Moderate	Improve	2 blocks, 1 missing
046-307	Stone step	Good	High	Moderate	None	3 blocks
046-308	Stone step	Good	High	Moderate	None	2 large blocks, one has drill holes on face
046-309	Stone step	Good	High	Moderate	None	3 blocks
046-310	Stone step	Good	High	Moderate	None	2 blocks against talus boulder
046-311	Stone step	Fair	Moderate	Moderate	Rebuild	2 uneven blocks
046-312	Stone step	Good	High	Moderate	Stabilize	4 rocks, braced against talus boulder
046-313	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock
046-314	Bedrock feature - step	Good	High	Moderate	None	2 steps cut/pecked into talus boulder
046-315	Stone step	Fair	Moderate	Moderate	Stabilize	2 rocks, eroded/slumped
046-316	Stone step	Good	High	Moderate	None	1 large block between talus boulders just about NF72
046-317	Bedrock feature - step	Fair	Moderate	Moderate	Improve	1 small step cut/pecked in talus boulder
046-318	Bedrock feature - cut	Fair	Moderate	Minimal	Widen	cut to remove portion of talus boulder in trail
046-319	Bedrock feature - step	Fair	Moderate	Moderate	Improve	1 wide step cut into talus boulder
046-320	Retaining wall	Poor	Low	Moderate	Rebuild	ca 45m long, intermittent masonry with talus boulders, mostly collapsed
046-321	Bedrock feature - cut	Fair	Moderate	Moderate	None	pecked face on talus boulder to widen trail
046-322	Bedrock feature - step	Good	High	Moderate	None	1 small step cut/pecked into talus boulder
046-323	Stone step	Fair	Moderate	Moderate	Rebuild	3 rocks, eroded/slumped
046-324	Stone step	Good	High	Moderate	None	2 large blocks
046-325	Stone step	Good	High	Moderate	None	3 large blocks, mostly buried
046-326	Bedrock feature - step	Fair	Moderate	Moderate	None	1 step cut/pecked into talus boulder
046-327	Stone step	Good	High	Moderate	Stabilize	1 large slab, undercut, eroded on sides
046-328	Stone step	Good	High	Moderate	Stabilize	1 large block, eroded on sides, pecked
046-329	Bedrock feature - pecking	Fair	Moderate	Minimal	None	pecking to flatten top of talus boulder
046-330	Stone step	Good	High	Moderate	None	3 blocks
046-331	Stone step	Good	High	Moderate	Stabilize	3 rocks, undercut
046-332	Retaining wall	Fair/Poor	High	Moderate	Rebuild	ca 63m long, mostly collapsed/rebuilt, base intact
046-333	Stone step	Poor	Low	Moderate	Rebuild	3 rocks, undercut/slumped
046-334	Bedrock feature - cut	Fair	Moderate	Moderate	Improve	chiseled/pecked bedrock, 6 m long, to flatten trail tread; also includes 2 flat-lying stones
046-335	Bedrock feature - step	Fair	Moderate	Moderate	None	4 steps cut/pecked into bedrock
046-336	Bedrock feature - cut	Fair	Moderate	Moderate	None	pecked notch/smoothed face on talus boulder
046-337	Bedrock feature -step	Fair	Moderate	Moderate	None	4 steps cut/pecked into bedrock
046-338	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut/weathered
046-339	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut
046-340	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-341	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks, partially undercut
046-342	Retainer bar	Poor	Low	Moderate	Replace	log; undercut/exposed/weathered
046-343	Stone step	Poor	Low	Moderate	Rebuild	1 large rock, undercut/slumped
046-344	Retainer bar	Fair	Moderate	Moderate	Replace	log; undercut
046-345	Bedrock feature - notch	Fair	Moderate	Minimal	None	notch (for log?) cut into bedrock 15x50 cm
046-346	Bedrock feature - notch	Good	High	Minimal	None	notch (for log?) cut into bedrock 20x40 cm
046-347	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks, undercut
046-348	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks in drainage
046-349	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks in drainage
046-350	Stone step	Fair	Moderate	Moderate	Rebuild	2 large rocks, undercut and loose
046-351	Retaining wall	Fair/Poor	Moderate	Moderate	Rebuild	82 m long, mostly collapsed/restacked
046-352	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks, slightly undercut
046-353	Stone step	Good	High	Moderate	None	4 large blocks
046-354	Bedrock feature - step	Good	High	Moderate	None	3 steps/notches pecked into talus boulder
046-355	Stone step	Fair	Moderate	Moderate	Stabilize	1 large slab, being undercut
046-356	Stone step	Fair	Moderate	Moderate	Stabilize	1 large rock
046-357	Stone step	Fair	Moderate	Moderate	Stabilize	1 large slab, being undercut
046-358	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks, undercut, 1 slumped
046-359	Retainer bar	Poor	Low	Moderate	Replace	log; exposed/loose
046-360	Culvert	Fair	Moderate	Moderate	Rebuild	50x60 cm under trail; filled with rock/dirt
046-361	Stone step	Good	High	Moderate	None	3 large rocks
046-362	Stone step	Fair	Moderate	Moderate	Stabilize	2 large rocks, 1 missing, undercut
046-363	Stone step	Good	High	Moderate	None	1 rock wedged between talus boulders
046-364	Stone step	Good	High	Moderate	None	1 huge slab
046-365	Stone step	Good	High	Moderate	None	1 large slab
046-366	Stone step	Fair	Moderate	Moderate	Stabilize	4 large rocks, extra wide step, partially undercut
046-367	Retainer bar	Fair	Moderate	Moderate	None	log; mostly buried
046-368	Stone step	Good	High	Moderate	None	2 blocks
046-369	Stone step	Good	High	Moderate	None	1 large rock
046-370	Stone step	Good	High	Moderate	None	3 large rocks
046-371	Stone step	Fair	Moderate	Moderate	Stabilize	3 large rocks, eroded around sides
046-372	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks
046-373	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks, set against talus
046-374	Stone step	Fair	Moderate	Moderate	Stabilize	3 rocks, eroded around sides
046-375	Stone step	Good	High	Moderate	None	2 rocks and talus rock
046-376	Stone step	Good	High	Moderate	None	3 rocks
046-377	Stone step	Good	High	Moderate	None	4 rocks
046-378	Stone step	Good	High	Moderate	None	4 rocks, minor erosion
046-379	Stone step	Good	High	Moderate	None	4 rocks, minor erosion
046-380	Retaining wall	Poor	Low	Moderate	Rebuild	32 m long, partially collapsed/rebuilt, base intact
046-381	Stone step	Good	High	Moderate	None	4 blocks

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-382	Stone step	Good	High	Moderate	Stabilize	4 blocks
046-383	Stone step	Good	High	Moderate	None	3 blocks
046-384	Stone step	Good	High	Moderate	None	3 blocks
046-385	Stone step	Good	High	Moderate	None	3 blocks
046-386	Stone step	Good	High	Moderate	None	3 blocks
046-387	Stone step	Good	High	Moderate	None	2 blocks next to talus boulder
046-388	Stone step	Good	High	Moderate	None	2 blocks
046-389	Stone step	Good	High	Moderate	None	2 blocks next to talus boulder
046-390	Retaining wall	Poor	Low	Moderate	Rebuild	15-20 m long, total collapsed, more cobble mound than wall
046-391	Stone step	Good	High	Moderate	None	1 huge slab
046-392	Stone step	Good	High	Moderate	None	1 large slab and 1 rock
046-393	Stone step	Good	High	Moderate	None	3 large rocks
046-394	Stone step	Good	High	Moderate	None	3 large rocks
046-395	Stone step	Good	High	Moderate	None	2 large rocks
046-396	Stone step	Good	High	Moderate	None	2 large rocks
046-397	Stone step	Good	High	Moderate	None	2 large rocks
046-398	Stone step	Good	High	Moderate	None	2 large rocks wedged against bedrock
046-399	Bedrock feature - notch	Good	High	Minimal	None	10x30 cm notch, cut into bedrock
046-400	Bedrock feature - step	Good	High	Moderate	None	10x30 cm notch, cut into bedrock next to 046-397
046-401	Stone step	Good	High	Moderate	None	3 rocks, mostly buried
046-402	Stone step	Good	High	Moderate	None	1 large rock, wedged against bedrock
046-403	Trail curb	Good	High	Moderate	None	8-10 m long; supports stone steps (046-404 to 046-412)
046-404	Stone step	Good	High	Moderate	None	2 large rocks
046-405	Stone step	Good	High	Moderate	None	1 large rocks
046-406	Stone step	Good	High	Moderate	None	3 blocks
046-407	Stone step	Good	High	Moderate	None	3 blocks
046-408	Stone step	Good	High	Moderate	None	2 blocks
046-409	Stone step	Good	High	Moderate	None	1 large block
046-410	Stone step	Good	High	Moderate	Stabilize	1 large rock, eroded along edges
046-411	Stone step	Good	High	Moderate	None	2 large blocks
046-412	Stone step	Good	High	Moderate	None	2 large blocks
046-413	Stone step	Good	High	Moderate	None	1 large block, next to talus boulder
046-414	Stone step	Poor	Low	Moderate	Rebuild	1 large slab, others missing
046-415	Stone step	Fair	Moderate	Moderate	Stabilize	1 large slab, undercut/eroded along sides
046-416	Bedrock feature - notch	Good	High	Minimal	None	15x20 cm notch, cut into bedrock
046-417	Bedrock feature - notch	Good	High	Minimal	None	10x20 cm notch cut into bedrock for retainer bar
046-418	Retainer bar	Fair	Moderate	Moderate	Replace	RR tie; undercut on one end, set into bedrock notch
046-419	Retainer bar	Fair	Moderate	Moderate	Replace	RR tie; totally undercut, set into bedrock notch
046-420	Retainer bar	Good	High	Moderate	Replace	RR tie; totally undercut, set into bedrock notch, braced against talus block

Table 5. Original or historic features associated with the west segment of Twin Trail (CDM 046).

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-421	Stone step	Good	High	Moderate	None	4 rocks
046-422	Retainer bar	Fair	Moderate	Moderate	Replace	RR tie; undercut at center, set into bedrock notch
046-423	Stone step	Fair	Moderate	Moderate	Stabilize	1 large block, eroded on one side
046-424	Stone step	Good	High	Moderate	None	2 blocks
046-425	Stone step	Good	High	Moderate	None	3 blocks
046-426	Stone step	Good	High	Moderate	None	2 blocks next to bedrock
046-427	Stone step	Good	High	Moderate	None	2 blocks
046-428	Trail curb	Good	High	Moderate	None	large boulders moved from trail; 10-12m long
046-429	Bedrock feature - notch	Good	High	Minimal	None	10x10 cm notch in bedrock for retainer bar
046-430	Bedrock feature - step	Good	High	Moderate	None	wide step cut into bedrock just above 046-431
046-431	Stone step	Good	High	Moderate	None	2 blocks
046-432	Stone step	Good	High	Moderate	None	2 blocks
046-433	Stone step	Good	High	Moderate	None	2 blocks
046-434	Petroglyph	Fair	Moderate	Moderate	None	"1959" and poem on talus boulder at junction with OTA-4
046-435	Bedrock feature - step	Poor	Low	Moderate	Improve	2 shallow pecked steps; between 046-113 and 046-118
046-436	Petroglyph	Fair	Moderate	Minimal	None	historic names, dates, figures; on sloping bedrock face
046-437	Bedrock feature - socket	Fair	Moderate	Minimal	None	pecking on bedrock to brace retainer bar
046-438	Bedrock feature - socket	Fair	Moderate	Minimal	None	pecking on bedrock to brace retainer bar
046-439	Stone step	Good	High	Moderate	None	1 large rock
046-440	Stone step	Good	High	Moderate	None	1 large rock
046-441	Bedrock feature - drill holes	Good	High	Minimal	None	on talus boulder, 2 m upslope from 046-299
046-442	Retainer bar	Good	High	Minimal	None	RR tie parallel to trail
046-443	Retainer bar	Good	High	Moderate	None	Log between F78 and F79 (stone steps)

Table 6. New features associated with the west segment of Twin Trail (CDM 046); most from 2009 maintenance.

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-NF01	Retainer bar	Good	High	Moderate	Stabilize	undercut at center
046-NF02	Retainer bar	Good	High	Moderate	None	
046-NF03	Retainer bar	Good	High	Moderate	None	
046-NF04	Retainer bar	Good	High	Moderate	None	
046-NF05	Retainer bar	Good	High	Moderate	None	
046-NF06	Retainer bar	Good	High	Moderate	None	
046-NF07	Retainer bar	Good	High	Moderate	None	
046-NF08	Retainer bar	Good	High	Moderate	None	diagonal across trail
046-NF09	Retainer bar	Good	High	Moderate	None	with 046-NF10 forms low platform for trail
046-NF10	Retainer bar	Good	High	Moderate	None	with 046-NF09 forms low platform for trail
046-NF11	Retainer bar	Good	High	Moderate	None	diagonal across trail
046-NF12	Retainer bar	Fair	Moderate	Moderate	Stabilize	parallel to trail- 2 logs
046-NF13	Retainer bar	Fair	Moderate	Moderate	Stabilize	under 046-NF12
046-NF14	Retainer bar	Good	High	Moderate	None	
046-NF15	Retainer bar	Good	High	Moderate	None	
046-NF16	Retainer bar	Good	High	Moderate	None	diagonal across trail
046-NF17	Retainer bar	Good	High	Moderate	None	
046-NF18	Retainer bar	Good	High	Moderate	None	
046-NF19	Retainer bar	Good	High	Moderate	None	
046-NF20	Retainer bar	Good	High	Moderate	None	
046-NF21	Retainer bar	Good	High	Moderate	None	
046-NF22	Retainer bar	Good	High	Moderate	None	
046-NF23	Retainer bar	Good	High	Moderate	None	
046-NF24	Retainer bar	Good	High	Moderate	None	
046-NF25	Retainer bar	Good	High	Moderate	None	
046-NF26	Retainer bar	Good	High	Moderate	None	
046-NF27	Retainer bar	Good	High	Moderate	Stabilize	beginning to be undercut
046-NF28	Retainer bar	Fair	Moderate	Moderate	Stabilize	undercut
046-NF29	Retainer bar	Fair	Moderate	Moderate	Stabilize	undercut
046-NF30	Retainer bar	Fair	Moderate	Moderate	Stabilize	short log at 046- 042 step
046-NF31	Retainer bar	Fair	Moderate	Moderate	Stabilize	undercut
046-NF32	Retainer bar	Fair	Moderate	Moderate	Stabilize	short log at 046-045 step
046-NF33	Retainer bar	Good	High	Moderate	None	partially buried, wedged against talus block
046-NF34	Retainer bar	Good	High	Moderate	None	partially buried
046-NF35	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF36	Retainer bar	Good	High	Moderate	None	half width of trail, braced with boulder
046-NF37	Retainer bar	Good	High	Moderate	None	
046-NF38	Retainer bar	Good	High	Moderate	None	
046-NF39	Retainer bar	Good	High	Moderate	None	braced with boulder
046-NF40	Retainer bar	Good	High	Moderate	None	just above 046-282
046-NF41	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF42	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF43	Retainer bar	Good	High	Moderate	None	

Table 6. New features associated with the west segment of Twin Trail (CDM 046); most from 2009 maintenance.

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-NF44	Retainer bar	Good	High	Moderate	None	
046-NF45	Retainer bar	Good	High	Moderate	None	
046-NF46	Retainer bar	Good	High	Moderate	None	
046-NF47	Retainer bar	Good	High	Moderate	None	
046-NF48	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF49	Retainer bar	Good	High	Moderate	None	
046-NF50	Retainer bar	Good	High	Moderate	None	
046-NF51	Retainer bar	Good	High	Moderate	None	
046-NF52	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF53	Retainer bar	Good	High	Moderate	None	
046-NF54	Retainer bar	Good	High	Moderate	None	
046-NF55	Retainer bar	Good	High	Moderate	None	
046-NF56	Retainer bar	Good	High	Moderate	None	
046-NF57	Retainer bar	Good	High	Moderate	None	
046-NF58	Retainer bar	Good	High	Moderate	Stabilize	braced on talus boulders, exposed
046-NF59	Retainer bar	Good	High	Moderate	None	braced on talus boulder
046-NF60	Retainer bar	Good	High	Moderate	None	
046-NF61	Retainer bar	Good	High	Moderate	None	
046-NF62	Retainer bar	Good	High	Moderate	None	
046-NF63	Retainer bar	Good	High	Moderate	None	
046-NF64	Retainer bar	Good	High	Moderate	None	braced on talus boulder
046-NF65	Retainer bar	Good	High	Moderate	None	
046-NF66	Retainer bar	Good	High	Moderate	None	
046-NF67	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF68	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF69	Retainer bar	Good	High	Moderate	Stabilize	one end exposed
046-NF70	Retainer bar	Good	High	Moderate	None	braced against talus boulder
046-NF71	Retainer bar	Good	High	Moderate	None	
046-NF72	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF73	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF74	Retainer bar	Good	High	Moderate	None	braced against talus boulder
046-NF75	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF76	Retainer bar	Good	High	Moderate	None	
046-NF77	Retainer bar	Good	High	Moderate	None	
046-NF78	Retainer bar	Good	High	Moderate	None	
046-NF79	Retainer bar	Good	High	Moderate	None	mostly buried
046-NF80	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF81	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF82	Retainer bar	Good	High	Moderate	None	
046-NF83	Retainer bar	Good	High	Moderate	None	braced against talus boulders
046-NF84	Step	Good	High	Moderate	None	3 large stone blocks
046-NF85	Retainer bar	Good	High	Moderate	Stabilize	braced against talus boulder, slightly undercut
046-NF86	Retainer bar	Good	High	Moderate	None	braced against boulder
046-NF87	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF88	Retainer bar	Good	High	Moderate	None	just above 046-323

Table 6. New features associated with the west segment of Twin Trail (CDM 046); most from 2009 maintenance.

Feature	Feature Type	Condition	Integrity	Threat	Treatment	Comments
046-NF89	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF90	Retainer bar	Good	High	Moderate	None	
046-NF91	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF92	Retainer bar	Good	High	Moderate	None	
046-NF93	Retainer bar	Good	High	Moderate	None	
046-NF94	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut
046-NF95	Retainer bar	Fair	Moderate	Moderate	Stabilize	undercut
046-NF96	Retainer bar	Good	High	Moderate	None	braced against bedrock
046-NF97	Retainer bar	Good	High	Moderate	None	
046-NF98	Retainer bar	Good	High	Moderate	None	
046-NF99	Retainer bar	Good	High	Moderate	None	adjacent to 046-354
046-NF100	Retainer bar	Good	High	Moderate	None	
046-NF101	Retainer bar	Good	High	Moderate	None	braced on talus boulders
046-NF102	Retainer bar	Good	High	Moderate	None	braced within 046-351
046-NF103	Retainer bar	Good	High	Moderate	None	
046-NF104	Retainer bar	Poor	Low	Moderate	Replace	small diameter branch, undercut/exposed
046-NF105	Retainer bar	Good	High	Moderate	None	
046-NF106	Retainer bar	Good	High	Moderate	Stabilize	slightly undercut

New Site 3 is a well-built stone corral tucked into a protected location between two large talus boulders. The site lies north of the trail as it descends onto the canyon bottom. Based on the construction technique, setting, and condition of the corral, it appears quite old and is possibly associated with New Site 1. There are no associated artifacts. This corral is difficult to access due to thick vegetation and is unlikely to be damaged during trail maintenance.

New Site 4 is a prehistoric rock art panel near the top of west Twin Trail. This panel was known to CACH personnel prior to the survey but has not been formally recorded. Although likely related to the trail in the sense that this general route has been used for thousands of years, the panel is not a trail feature and does not relate to the historic or modern trail alignments. It was therefore not included in the trail documentation and should be recorded independently. There would be no reason for this area along a bedrock ledge to be disturbed during trail maintenance.

Previously-Unidentified Isolated Occurrences Adjacent to Twin Trail, West Segment

Twin Trail West IO-1 consists of five Jeddito Yellow Ware jar body sherds from one vessel, but the sherds are too eroded to determine the type. There are no associated features. The sherds were found in a 5 x 5 m area on the canyon rim just south of the trailhead, above the bedrock cut as the trail begins its descent.

Twin Trail West IO-2 consists of three sherds found in a small drainage within a cluster of large talus boulders adjacent to the trail. The sherds are two Cibola White Ware jar body sherds (too eroded to determine type) and one Tusayan Gray Ware jar sherd. The sherds were found during initial survey of the trail but could not be relocated a few weeks later, after a large rainstorm, so may be buried or washed farther downslope.

Twin Trail West IO-3 consists of five sherds representing two historic Navajo vessels. Two sherds are light gray-brown in color and exhibit a thick applied rim coil with punctuate impressions on the exterior surface (Figure 12). These should be classified as Navajo Gray based on the relatively fine temper and rim decoration (Brugge 1981:6). Three sherds are dark gray in color with no exterior surface decoration but coarse wipe marks on the interior. These body sherds could represent either Navajo Gray or Pinyon Gray, but probably the former based on


Figure 12. Historic Navajo sherds found among talus boulders adjacent to western Twin Trail (TTW IO-3).

the relatively fine temper. The sherds were found within a cluster of talus boulders on the south slope of the canyon, and probably represent a cache of vessels along the historic trail route. Brugge (1981) gives dates of 1800 to present for these ceramic types.

Twin Trail West IO-4 is six Tusayan and Cibola Gray Ware sherds in a 20 x 20 m area on the canyon bottom along the tributary wash. The sherds probably derive from Twin Trail Ruin, a large cliff dwelling site in an alcove on the north side of the canyon, about 1/8 mile north. There is no evidence of features or other artifacts in the vicinity of the isolated sherds.

Twin Trail West IO-5 is a very recent (ca. July 2010) shade structure adjacent to the trail. The structure consists of one post (1.75 m high), one beam (3 m long), and one cross-beam (1.55 m long), which are articulated with a tree to form a shade area and hitching rail. The post is set slightly into the ground and stabilized at the bottom with several rocks. The cross-beam lies horizontally along a retaining wall behind the tree, supported by rocks and wedged into the adjacent tree. The beam bridges the area between the post and the cross-beam. This framework could support a tarp to provide shelter from rain or sun, but the interior is partially shaded by the adjacent tree. The wooden elements of this structure were likely scavenged from trail construction material that is plentiful in the area.

Twin Trail West IO-6 is a trail shrine near the bottom of the trail, along OTA-4, an alternate trail route. The feature consists of a natural recess in a sandstone bedrock ledge that contains 40 – 50 fist-size and smaller rocks. The rocks comprise sandstone and conglomerate cobbles, some of which must have been carried a short distance to be placed here. The recess is 62 x 50 x 50 cm in size and entirely natural; it has not been enlarged or altered. The amount of wind-blown sand mixed with the rocks in the recess suggests they have been in place for some time, with few recently deposited. A second, smaller recess occurs about 4 m to the southeast and contains about 15 rocks. The minimal amount of eolian sand covering these rocks suggests this may be a more recent or in-use feature.

Twin Trail West IO-7 consists of a concrete pad and associated retaining wall that are just north of the trail where it emerges onto the canyon floor. The pad is situated on a slightly elevated terrace above the drainage at the base of a bedrock outcrop. It is about 10 cm thick and measures 3.35 m east – west by approximately 4.5 m; the north – south dimension is less certain because most of the pad is covered by a thin layer of sediment eroded from

the adjacent slope. Three metal plates (15 cm square) are embedded in the southeast corner of the pad and another loose plate is present; these were once welded to something that has been removed by cutting the welds. The retaining wall is 6.85 m long and 2.1 m high. It consists of flat sandstone slabs laid within mortar along a 30-degree slope north of the pad. Just southeast of the pad is a low mound of gravel left over from construction of the retaining wall. The original mortar was gray in color, but it was later patched with finer red-gray mortar. The wall and pad are in good condition. CACH personnel indicated this feature is the remains of a toilet facility that was installed at the trail base in the late 1980s and removed in the mid-1990s (Andrew Jim, personal communication to Keith Lyons, 2011).

Twin Trail West IO-8 is a concrete cistern that measures 6 feet square and 52 inches high above the ground surface. The cistern is oriented northwest – southeast and has an opening near the north corner that is 28 inches square. The opening is raised 9 inches above the cistern surface with a neck 4 inches thick; the cistern walls are 5 – 6 inches thick. On the ground next to the north corner of the cistern is the probable cap, which is 38 inches square and is female-threaded to screw onto the male-threaded opening. Depth from the cistern opening to the sediment in the bottom is 59 inches, but it was probably originally 6 feet deep. A brass cap embedded in the top of the cistern (on the southeast side) says: A COOPERATIVE U.S. PUBLIC HEALTH SERVICE PROJECT SPR TWIN TRAIL #10-6-5 COMPLETED 6-29-66. The cistern is in good condition. A concrete wellhead and trough (IO-9) occur about 70 m to the southeast and are probably related, although it is odd that the cistern is uphill from the wellhead.

Twin Trail West IO-9 consists of a concrete wellhead box and concrete trough. The wellhead measures 3 x 5 feet and stands 42 inches above the ground. Three pipes extend from the top of the box, two measuring 25 inches and the third 45 inches tall, all 2 inches in diameter. There is no concrete pad below the box, but numerous rocks are piled around the base. A pipe once extended out of the southeast side but was cut off flush with the box. The concrete trough measures 15 feet long, 20 inches wide, 12 inches tall, and 10 inches deep inside. It is about 25 feet southeast (downhill) from the wellhead. A piece of black plastic pipe is sticking out of the ground just northwest of the trough but its relationship to the box or trough is unclear. A few pieces of thick ceramic water pipe occur on the ground near the box. Both the wellhead and trough are in good condition, with minor erosion of the concrete. A square concrete cistern (IO-8) is about 70 m northwest and probably related, but it seems odd that the cistern is upslope from the well.

Evaluation of National Register Eligibility

The final objective of this project was to evaluate the eligibility of each trail for inclusion on the National Register of Historic Places (NRHP), as stipulated by the National Historic Preservation Act of 1966, as amended. Evaluations were made by considering the applicability of the four criteria under which a historic property can be listed on the NRHP, as detailed in National Register Bulletin 16A (also see Stein 1994). Each trail was also evaluated based on the seven aspects of integrity described in Bulletin 16A (Table 7). The significance of any historic property must be considered in terms of its historic context; in this case the historic context of the trails is directly related to development of infrastructure by the National Park Service to facilitate visitor enjoyment of the natural and cultural wonders of Canyon de Chelly and Canyon del Muerto. Due to the unique relationship between the Service and the Navajo Nation, infrastructure development was also aimed as improving opportunities for local Navajo residents, both in terms of pursuing their traditional pastoral and agricultural economy and in guiding Monument visitors. Each of the trails included in this study undoubtedly was used throughout prehistory and history, long prior to the presence of the Service. Prehistoric and historic transportation and economy are also historic contexts under which the trails could be evaluated, but this NRHP evaluation will focus on the trails as built features of the historic period, associated with Service administration of CACH.

When considered within this historic context, all three trails may be eligible for nomination to the NRHP under Criteria A and C. Construction of these trails in the early 20th century corresponded to national trends during and after the Great Depression, which involved Federal construction projects to provide jobs and training for unemployed Americans, including Native Americans. It was during this period (1933 – 1942) that much of the infrastructure was developed at National Park Service units across the county (Paige 1985). Construction techniques and styles exhibited by the CACH trails mirror those seen elsewhere in the country, but with unique aspects that resulted from the particular challenges presented by the canyon topography (Figure 13). The trails also reflect construction and maintenance programs typical of the Service in the years following World War II, when a burgeoning U.S. economy resulted in exponential increases in Monument visitors. At CACH, the Service also hoped to expand economic opportunities for local Navajos through increased employment (Brugge and Wilson 1976). In response to dramatic increases in visitation, the Service established the Mission 66 initiative, a 10-year program of infrastructure improvements to be completed in time for the 50th anniversary of the Service in 1966 (Carr 2007). These historic contexts of early 20th century Park Service infrastructure development bring the CACH trails into

Table 7. Summary evaluation of National Register of Historic Places eligibility for each trail.

Criterion/ Aspect of Integrity	Description (*per NPS Bulletin 16A*)	White House Trail	Tunnel Trail	Twin Trail (west segment)
Criterion A	*Associated with events that have made a significant contribution of the broad patterns of our history.*	X	X	X
Criterion B	*Associated with the lives of persons significant in our past.*	-	-	-
Criterion C	*Embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value.*	X	X	X
Criterion D	*Have yielded, or may be likely to yield, information important in prehistory or history.*	-	-	-
Location	*Location is the place where the historic property was constructed or the place where the historic event occurred.*	X	X	X
Design	*Design is the combination of elements that create the form, plan, space, structure, and style of a property.*	X	X	X
Setting	*Setting is the physical environment of a historic property.*	X	X	X
Materials	*Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.*	X	X	?
Workmanship	*Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.*	X	X	?
Feeling	*Feeling is the property's expression of the aesthetic or historic sense of a particular period of time.*	?	X	X
Association	*Association is the direct link between an important historic event or person and a historic property.*	X	X	X

national significance under Criterion A, as well as local and regional significance in relation to development of tourism and rural economy in this part of the Navajo Nation.

The trails can be considered eligible for nomination under Criterion C due to the extensive built features that comprise the routes. Each of the trails was surveyed, engineered and built under specific Service plans. The construction styles, particularly the massive bedrock cuts along White House Trail (see Figure 5) and the grand stone steps along Twin Trail (Figure 14), evoke techniques in vogue with the Service during the early 20th century. All three trails continue to communicate the careful and directed engineering that was necessary to achieve safe and sustainable access routes between canyon and rim across challenging topography. The extensive degradation of the retaining walls and trail tread along Twin Trail reflects heavy use by people and livestock, as well as years of maintenance neglect, but the trail retains enough integrity and character that it should be considered eligible for nomination. Again, the use of Service-wide construction techniques and styles along the trails qualifies them for national significance in NRHP evaluation. Nearly all construction projects employed local Navajo men as laborers, and these individuals brought a wealth of knowledge about vernacular construction techniques that were well suited to the local environment and topography; this may qualify the trail for local significance under Criterion C. While the trails may not qualify as "works of a master" they certainly possess "high artistic value" as stipulated by Criterion C.

The trails included in this project are not eligible under Criterion B, which requires association with a person of significance. While CACH has benefitted from the leadership of several charismatic and effective superintendents who directed early Monument infrastructure development (Brugge and Wilson 1976), no specific person can be associated with the trails to the degree required by this criterion. The trails also are not considered eligible for nomination under Criterion D. Additional information could be gained from more detailed study or documentation of the trails, for example by completing a HAER-style documentation of the engineered trail features. Excavation could also provide some information, for example about the construction methods of built trail

Figure 13. Upper portion of White House Trail from the canyon rim.

Figure 14. Series of intact stone steps along western Twin Trail.

sections. But these types of "information potential" are not substantive enough to justify a nomination of the trails under Criterion D.

All three trails assessed for this project retain integrity and demonstrate characteristics that communicate their original purpose, function, and configuration (see Table 7). A more detailed discussion of the integrity evaluations for each trail is presented below. The current poor condition of western Twin Trail makes this the most tenuous evaluation, but carefully-planned restoration could return structural significance to the trail.

White House Trail

White House Trail is the most intact and well preserved of the routes documented for this project. It is also the route that required the most extensive modification of bedrock exposures to produce a trail with a wide tread and relatively gentle grade that can be traversed by horses and pedestrians. In part because this is the only trail where Monument visitors are allowed to hike without a guide, the route is maintained and kept in good repair. Regular maintenance has resulted in an historic trail that retains all seven aspects of integrity and strongly communicates its original character. The evidence for earlier trail alignments does not decrease the integrity of location, as all routes relate to the same function, movement of people and animals between canyon and rim. Integrity of setting is similarly retained due to the minimal changes to the local environment and lack of development within the trail viewshed. With its multiple bedrock cuts and tunnels, White House Trail is an excellent example of CCC-era engineering and construction techniques, and the route clearly retains integrity of design, materials, and workmanship. The well-preserved trail features have a classic Park Service feeling and embody the 'can do' spirit of construction techniques from that era.

Tunnel Trail

Tunnel Trail retains all aspects of integrity when considered within the historic context discussed above. The reroute of the upper trail segment in the early 1970s did not compromise the integrity of location, as the trail serves the same function and continues to reflect the mission of the Service to provide visitor access to the canyon. The nature and character of the constructed features along the trail remain in evidence, demonstrating integrity of design, materials, and workmanship. Although not as extensive as White House Trail, the built features on this short route also evoke typical Service style and engineering of the early 20th century. The trail tread and built features are generally in good condition, although several retaining walls and steps require stabilization or minor reconstruction; carefully-planned maintenance can preserve the integrity of Tunnel Trail, as well as ensuring the safety of trail users. Integrity of setting and feeling exist due to the minimal changes to the natural environment adjacent to the trail and the relatively small amount of traffic along the route.

Twin Trail, West Segment

The western branch of Twin Trail is in poor condition, but may still retain enough integrity to be considered eligible for nomination to the NRHP. The multiple alignments of Twin Trail do not adversely affect its integrity of location, as all the routes directly relate to the original function and purpose of the trail, namely pedestrian and livestock movement. Integrity of setting is preserved because the local environment and viewshed has not changed appreciably in the last half-century. Integrity of feeling can be difficult to assess, but the lack of development in the trail vicinity and continued use of the trail by people, horses, and livestock contributes to an appropriate historic feeling. The trail continues to demonstrate the extensive engineering and structural planning that were required to hew out a route across the rugged talus slope. Although many retaining walls and stone steps have slumped or fallen downslope, the trail still exudes the sense of 'built features' and therefore retains integrity of design, and possibly integrity of materials and workmanship. Carefully-planned and executed restoration, focused on rebuilding walls and steps in ways that mirror or emulate the original construction, could return the trail to its structural significance and improve the latter aspects of integrity.

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Appendix A

White House Trail Documentation

(Cultural Resource Survey Area Information and Strategy Form,
CACH Site Inventory Form, Site Feature Catalog and Feature Forms,
Site Environmental Context Form, Site Vandalism Form, ASMIS Form,
and Isolated Occurrence Forms)

Appendix B

White House Trail Maps

Appendix C

Tunnel Trail Documentation

(Cultural Resource Survey Area Information and Strategy Form,
CACH Site Inventory Form, Site Feature Catalog and Feature Forms,
Site Environmental Context Form, Site Vandalism Form, ASMIS Form,
and Isolated Occurrence Forms)

Appendix D

Tunnel Trail Maps

Appendix E

Twin Trail (West Segment) Documentation

(Cultural Resource Survey Area Information and Strategy Form,
CACH Site Inventory Form, Site Feature Catalog and Feature Forms,
Site Environmental Context Form, Site Vandalism Form, ASMIS Form,
and Isolated Occurrence Forms)

Appendix F

Twin Trail (West Segment) Maps