#93

TC 0079-12

FINAL
SITE CLOSURE REPORT

FORMER CONSTRUCTION DEBRIS LANDFILL #2

CAMP NAVAJO
BELLEMONT, ARIZONA

October 1997

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

and

Arizona Army National Guard
Camp Navajo
Bellemont, Arizona 86015-5000

Prepared by:

Tetra Tech, Inc.
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San Francisco, California 94105-1617

SITE CLOSURE
AT
CAMP NAVAJO

FORMER CONSTRUCTION DEBRIS LANDFILL #2

FINAL REPORT

Contract DACA05-93-D-0019

PREPARED BY:

TETRA TECH, INC.

Approved by: _____ 10/22/97
Bradley S. Hall, RG — Date
Tetra Tech, Inc.
Project Manager

Approved by: _____ 10/22/97
Maynardo Aala — Date
US Army Corps of Engineers, Sacramento District
Technical Manager

Approved by: _____ 10/22/97
Guy Romine — Date
National Guard Bureau, Installation Restoration Program
Manager

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LIST OF ACRONYMS

Acronym	Full Phrase
ADEQ	Arizona Department of Environmental Quality
AZNG	Arizona National Guard
bgs	below ground surface
msl	mean sea level
SWMU	solid waste management unit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

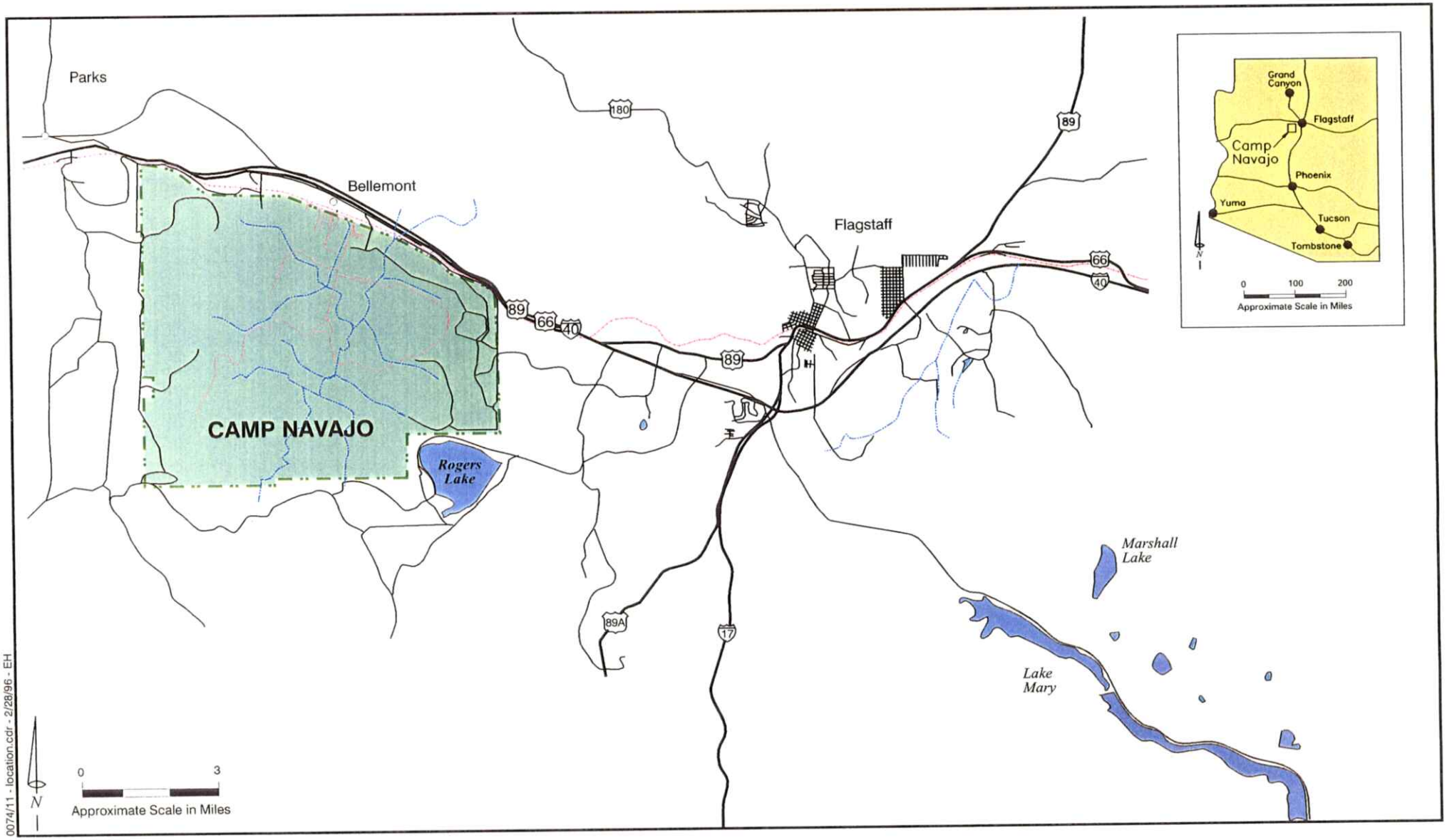
SECTION 1
INTRODUCTION

This closure report summarizes the preliminary investigation of Former Construction Debris Landfill #2 (NADA 27, AREE 43, NAAD 43) (Site) at Camp Navajo (formerly Navajo Depot Activity), in Bellemont, Arizona (Figure 1-1). Tetra Tech, Inc. (Tetra Tech) was retained by the United States Army Corps of Engineers (USACE) to investigate the environmental conditions at potential solid waste management units (SWMUs) at Camp Navajo. The Site has been listed by the United States Environmental Protection Agency (USEPA) and the Arizona Department of Environmental Quality (ADEQ) as a SWMU.

The purpose of this preliminary investigation was to document existing environmental conditions at the Site and to evaluate the environmental concerns that may require additional assessment or characterization. The scope of work for this preliminary investigation of potential SWMUs included the following tasks: (1) obtaining site-specific background data; (2) conducting a visual inspection of the Site; and (3) preparing a report containing recommendations on further action that should be conducted at the Site. Based on Tetra Tech's conclusion, outlined in Section 5, this report is intended as a closure report to obtain a "no further action" designation from the state of Arizona for the Site.

1.1. SITE LOCATION AND DESCRIPTION

Camp Navajo (Base) is an approximately 28,000-acre government facility located in north-central Arizona, approximately 12 miles west of Flagstaff in Coconino County. The Site is located within the Warehouse Area (Figure 1-2) of the northern portion of the Base and consists of a relatively flat two-acre area where volcanic red cinder rock has been dumped. The Site is located immediately east of the railroad spur that leads to the General Services Administration (GSA) warehouses, which are approximately 400 feet south of the Site (Figure 1-3).



0074/11 - location.cdr - 2/28/96 - EH

Camp Navajo is in north central Arizona about 12 miles west of the city of Flagstaff.

LEGEND:

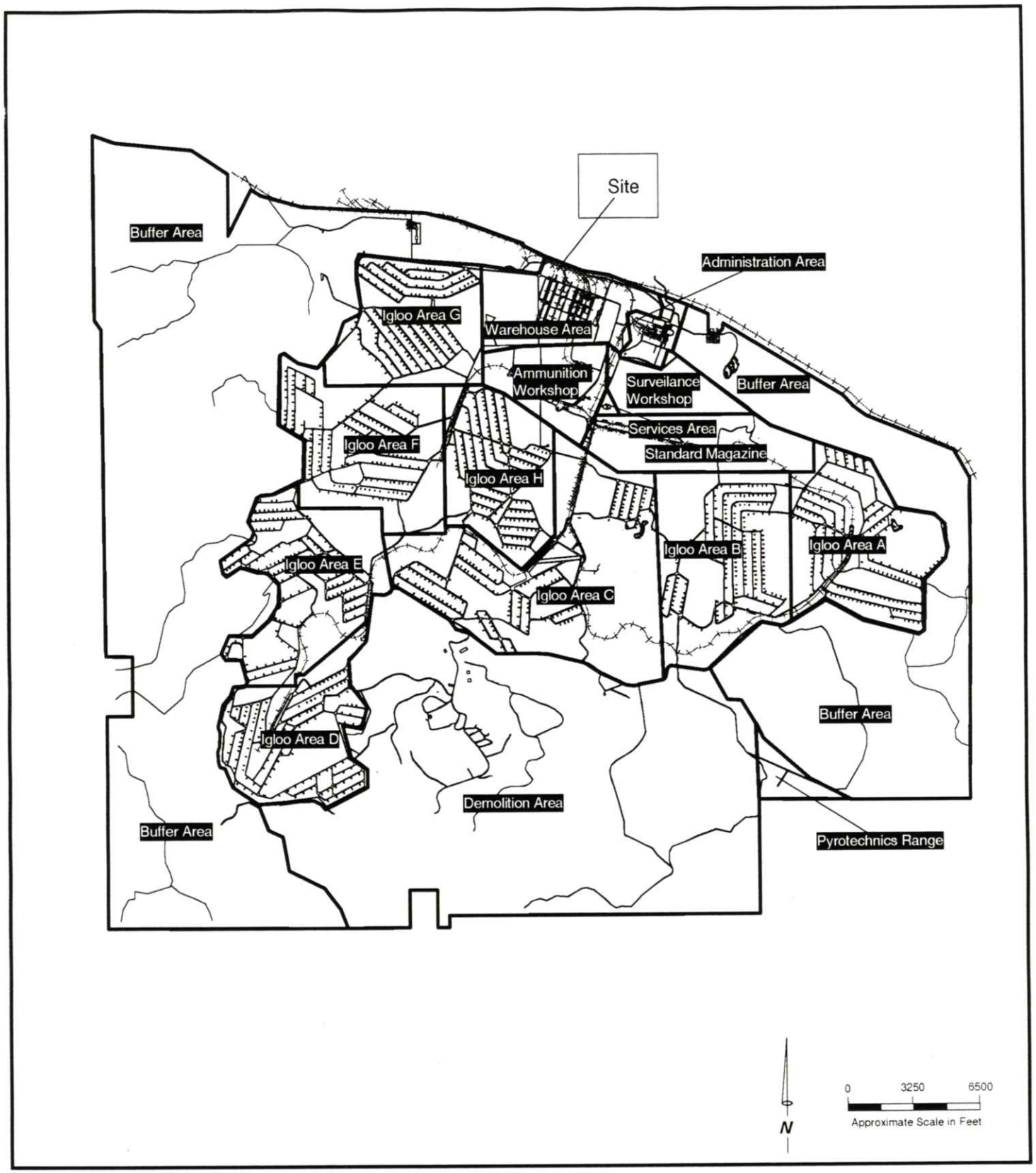
- Highways
- Roads
- Railroad
- Rivers/Streams

Camp Navajo Location Map

Camp Navajo
Bellemont, Arizona

Figure 1-1

Tetra Tech, Inc.



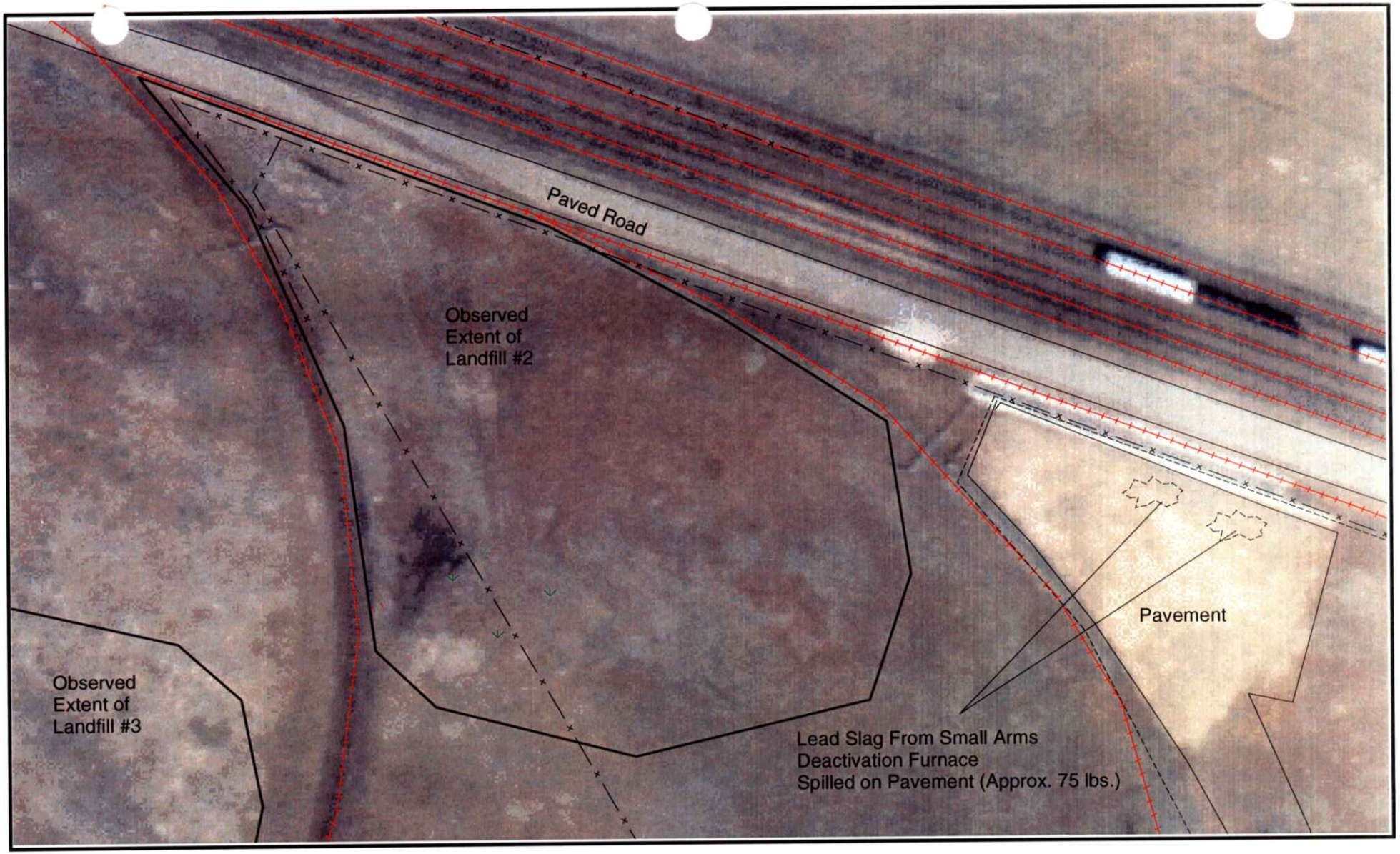
Camp Navajo encompasses approximately 28,300 acres and is divided into 18 functional areas.

Site Map

Camp Navajo, Bellemont, Arizona

Figure 1-2

Tetra Tech, Inc.



Legend:

Fence
Grass
Railroad

N

0 40 80
Approximate Scale in Feet

Tetra Tech, Inc.

Former Construction Debris Landfill #2

Site Plan

Camp Navajo, Bellemont, Arizona

Figure 1-3

1.2. SITE BACKGROUND

The federal government established the Base as an ordnance depot in 1942, and the Base has been used by various military branches of the government since this time. In 1975, the government granted permission to the Arizona National Guard (AZNG) to use the facility for training and support activities. Operational control of the Base was turned over to the AZNG in 1982. AZNG uses the Base for training, support activities, and for the storage of US Air Force Minuteman and US Navy Trident rocket motors.

The United States Army Environmental Hygiene Agency (USAEHA) conducted an investigation of the Base in 1987 to identify, describe, and evaluate SWMUs. As part of this investigation, historical aerial photographs taken of the Base were reviewed, a Base reconnaissance was conducted, and personnel familiar with historic operations at the Base were interviewed. During the investigation, the Site was identified as a SWMU, and USAEHA concluded that the period in which materials were deposited at the Site was unknown. However, the landfill at the Site appeared to be active in 1959 and 1974, as indicated by the aerial photographs taken in those years (USAEHA 1988).

SECTION 2
PHYSICAL SETTING

2.1. TOPOGRAPHY AND VEGETATION

The topography at the Base is characterized by the relatively flat Bellemont Flat (plateau) in the northern portion of the Base. The Base is surrounded by rolling hills of low to moderate relief in the eastern and southern portions. More rugged terrain is evident along the western portion of the Base in the vicinity of Volunteer Mountain. Steep-sided hills and knobs from eroded volcanic vents are generally scattered across the northwestern and eastern portions. Elevation ranges from 6,780 feet above mean sea level (msl) at the bottom of Volunteer Canyon in the southwest corner of the Base to 8,047 feet above msl at the top of Volunteer Mountain in the western portion. Volunteer Canyon is an incised, predominately northeast-southwest trending canyon in the south-central portion and drains the northern portion of the Base southward.

The hills and higher elevations of the Base support a forest of ponderosa pine, blue spruce, and Douglas fir. The low-lying areas generally support grasses and low-lying shrubs.

The Site is located in a relatively flat portion of the plateau at an elevation of approximately 7,140 feet above msl.

2.2. GEOLOGY

The Base is within the western portion of the Colorado Plateau Province on the Flagstaff-Mogollon slope. In addition, the Base is located in the southwestern margin of the San Francisco Volcanic Field within an up-thrown block (horst) between the Oak Creek Fault, three miles east of the Base, and the Volunteer Fault, which trends along the western portion of the Base. The San Franciscan Volcanic Field consists of Pliocene- to Pleistocene-age basalt flows that encompass an area of more than 2,000 square miles surrounding the San Franciscan Peaks, which are approximately 15 miles northeast of the Base. These volcanic rocks

have been extruded through and deposited on Paleozoic- and Mesozoic-age sedimentary rocks.

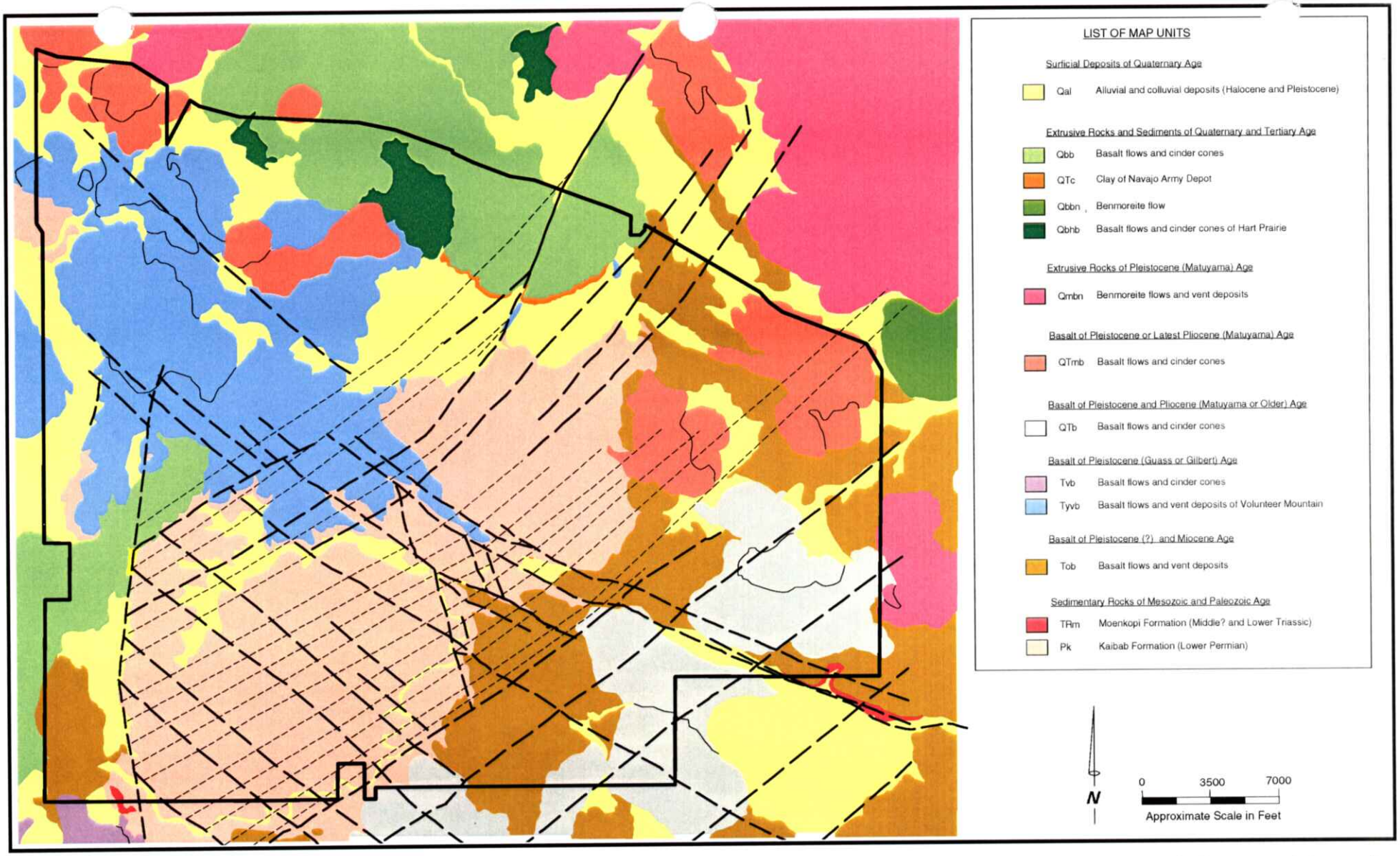
The youngest strata beneath the Base consist of unconsolidated Quaternary-age alluvial deposits and consolidated Quaternary- and Tertiary-age volcanic rocks. The alluvial sediments and volcanic rocks have been deposited onto an irregular erosional surface composed of the rocks of the Kaibab Formation (Figure 2-1). The Kaibab Formation is conformably underlain by the stratagraphic sequence of Paleozoic-age sedimentary rocks of the Colorado Plateau, such as the Toroweap Formation, Coconino Sandstone, and Supai Group.

The alluvium deposits generally are found along the drainages and in low-lying areas at the Base. These deposits vary in thickness from a few feet up to approximately 100 feet and are composed of silt, sand, and gravel detritus. The alluvium sediments were derived from the volcanic and sedimentary rocks that compose the surrounding highlands of the Base.

Volcanic rocks of Quaternary- and Tertiary-age have been deposited throughout the western, northern, and eastern portions of the Base. The volcanic rocks consist of late Holocene- to Pliocene-age scoria (cinder) cones with associated basalt flows and ash fall deposits, and Miocene- to late Pliocene-age basalt flows. Thirteen cinder cones have been identified at the Base, the largest of which is Volunteer Peak. The volcanic deposits in the western and eastern portions of the Base generally are associated with the local vents and cinder cones. The volcanic deposit in the northern portion of the Base generally are associated with the San Franciscan Volcanic Field and have been buried by alluvium deposits in many areas.

Bentonite clay (sometimes referred to as the Navajo Army Depot Clay), derived from Pliocene-age or older rhyolitic ash deposits, is exposed along a scarp south of the ammunition workshop and administration areas (Figures 1-2 and 1-3). The clay unit underlies the ammunition workshop, the warehouse area, and the administration area (Figures 1-2 and 2-1). The clay unit's extent northward of the Base is not known.

The rocks of the Kaibab Formation generally are exposed in the central portion of the Base and consist of yellowish to light gray, well-bedded silty dolomite, dolomitic sandstone, and dolomitic limestone of Permian Age. The unit is up to 450 feet thick and has individual beds from one to three feet thick. These rocks are moderately to extensively jointed and/or fractured in some locations of the formation. Approximately 350 feet of massive sandstone from the Toroweap Formation underlies the Kaibab Formation, followed by the sandstone of the Coconino Sandstone Formation.



Legend:

Lithologic Contact

Camp Navajo Boundary

Faults

Lineaments/ Fracture Zones

Geologic Map of Camp Navajo

Camp Navajo, Bellemont, Arizona

Tetra Tech, Inc.

Figure 2-1

The fault traces of several generally north-south trending faults have been mapped on the Base. The fault trace of the Bellemont Fault, the dominant North –South trending fault, transects through the central portion of the Base. The strata on the eastern side of this fault appear to have been vertically displaced upward between 100 and 500 feet. Several ponds have developed along the fault.

2.3. HYDROGEOLOGY

Shallow ground water beneath plateau, west of the Bellemont Fault, is found in up to three discontinuous perched water-bearing zones above the regional aquifer, which is within the Supai Formation. These perched zones are encountered to depths of approximately 350 feet below ground surface (bgs) and occur under confined and unconfined conditions in the alluvial sediments and volcanic rocks. These zones are the primary source of ground water in the vicinity of the Base. The primary aquifer for ground water supply to the Base is a water-bearing zone that occurs within a fractured zone in the uppermost basalt unit and overlies the Navajo clay unit west of the Bellemont Fault.

Shallow ground water beneath the plateau east of the Bellemont Fault is found in one perched water bearing zone above the regional aquifer. The perched zone is encountered at the surface along the southeast edge of the plateau and increases in depth to about 80 feet bgs beneath the Site. The aquifer exists in a basalt flow and is perched on the Navajo Army Depot Clay which has been determined to directly overlie the Kaibab Formation.

Water-bearing zones in the alluvial sediments are found above aquitards of less permeable materials, such as clay deposits and unfractured consolidated basalt flows and the Kaibab Formation. Ground water in the basalt flow deposits is found in interbedded layers of fractured basalt, lava tubes, basalt derived alluvium and/or permeable volcanic air fall deposits that are underlain with less permeable volcanic deposits. Ground water flow in the alluvial sediments and volcanics generally mimics the local topography. Ground water in the Kaibab Formation (if present) generally is found above interbedded chert and siltstone lenses, in extensively fractured or joints areas, and in solution cavities within the limestone rocks.

The regional water table at the Base is encountered at a depth of approximately 1,300 feet bgs and is found approximately 200 feet below the top of the Supai Formation. The Supai Formation becomes increasingly more shaley and less permeable with depth. The regional aquifer is tapped by a number of large production wells owned by the city of Flagstaff. These wells are located approximately three miles east of Base in the Woody Mountain Well Field (EBASCO 1990).

2.4. SITE SPECIFIC HYDROGEOLOGY

The Site is located on a thin veneer of alluvial sediments approximately 10 to 25 feet thick that overlies basalt flows associated with the Franciscan Volcanic Field.

Ground water beneath the Site is likely to be encountered in the basalt rocks at a depth of approximately 35 to 45 feet bgs. Ground water flow beneath the Site is likely to flow southward. The closest ground water well to the Site is approximately 2,100 feet east of the Site.

SECTION 3
PREVIOUS INVESTIGATIONS

Based on our review, no previous environmental investigations at the Site are known to have been conducted.

SECTION 4
VISUAL ASSESSMENT

On October 18, 1995, a site inspection was conducted to observe and document the existing conditions. Color photographs of the Site are presented in Appendix A. The Site was observed to consist of the area debris previously outlined in Section 1.1.

The surface of the Site was observed to be relatively flat and generally covered with a thin veneer of volcanic red cinder rock. The cinder rock, which is commonly used as a roadway and railway construction material at the base, appears to have been dumped on top of the native surface. No visual evidence of excavations and/or burial of debris was apparent at the Site. The areas of the Site covered with the cinder rock are estimated to be less than approximately one to two feet above the natural undisturbed areas surrounding the Site. No individual piles of debris were apparent, and the maximum thickness of the cinder rock appears to be less than two feet. Natural vegetation, such as grasses and weeds, grows in the areas where the cinder rock cover is relatively thin.

Minor quantities of additional debris were observed to be mixed in with the cinder rock in a few areas of the Site and are estimated to compose less than approximately 20 percent of the total material dumped at the Site. Rubber gaskets were observed on the surface in the western portion of the Site along the railroad spur. Concrete, metal, and wood debris were observed in the central portion of the Site.

At the time of the inspection, no distressed vegetation, chemical staining, or disposal of potentially hazardous wastes were observed. In addition, no visual evidence of features that may be of environmental concern, such as clarifiers, oil-cooled transformers, underground storage tanks, or hazardous material containers, were observed at the Site.

SECTION 5
SUMMARY AND CONCLUSIONS

Based on the information presented in this report and on the professional judgment of Tetra Tech the following conclusions have been reached:

- The Site appears to have been used generally for the disposal of excess materials used for the construction of roadways and/or railways at the Site. The cinder rock is likely to have originated from one of the cinder cones that are mined at the Site

- No current or historical evidence was identified during this investigation that suggests municipal wastes or materials of potential environmental concern have been disposed of at the Site; and

- The Site is not likely to have an adverse environmental impact to the quality of the soil and/or ground water beneath the Base.

SECTION 6
RECOMMENDATIONS

Based the conclusions presented in this report, it is the professional judgment of Tetra Tech that additional environmental work at the Site is not warranted, and the Site should be listed as a no further action SWMU.

SECTION 7
REFERENCES

EBASCO Environmental (EBASCO). 1990. *Enhanced Preliminary Assessment Report: Navajo Army Depot Activity, Bellemont, Arizona*. March 1990.

United States Army Environmental Hygiene Agency (USAEHA). 1987. *Ground Water Contamination Survey, No. 38-26-0878-88, Evaluation of Solid Waste Management Units, Navajo Army Depot Navajo, Bellemont, Arizona.*

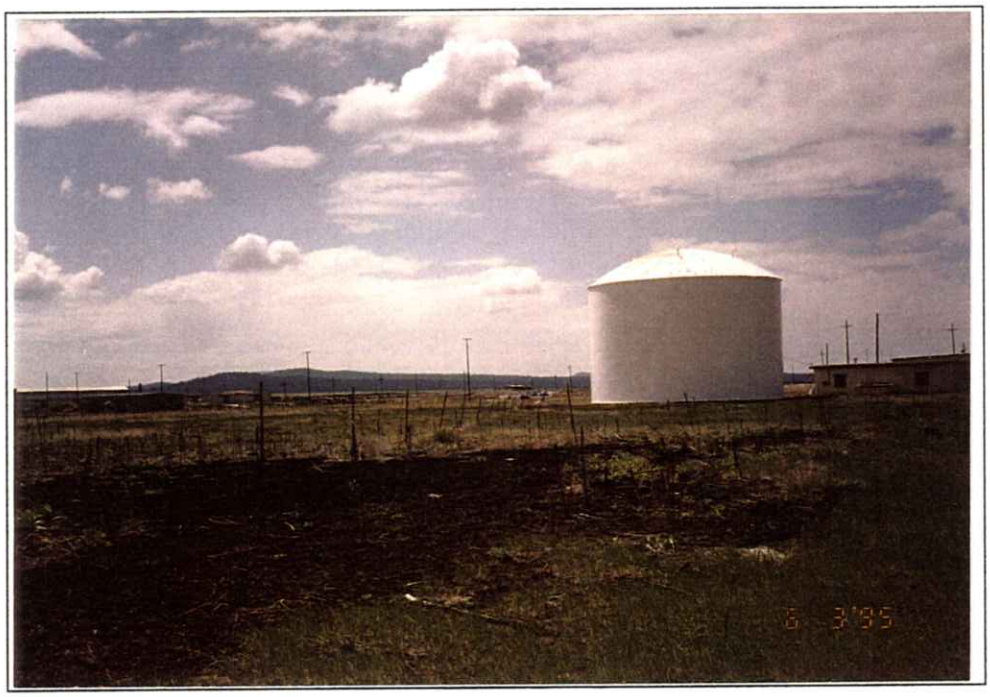
Uribe & Associates (Uribe). 1994. *Final RCRA Facility Assessment Report, Camp Navajo.* Prepared for Environmental Protection Agency, Region IX. *May 1994.*

APPENDIX A

PHOTO DOCUMENTATION

26-1 Looking N/NE of entire area, NNE, 6/3/95, by Kali Bronson

26-2 Close-up of rubber pile, D, 6/3/95, by Kali Bronson



26-3 Facing SE, rubber pile, SE, 6/3/95, by Kali Bronson

26-4 Unknown metal object, D, 6/3/95, by Kali Bronson

26-5 Looking E, cement pile, E, 6/3/95, by Kali Bronson

26-6 Asphalt pile, D, 6/3/95, by Kali Bronson

26-7 Looking W, rubber washers, D, 6/3/95, by Kali Bronson

26-8 Looking W, landfill overview, W, 6/3/95, by Kali Bronson

26-9 Roofing material, E, 6/3/95, by Kali Bronson

26-10 Roofing material, E, 6/3/95, by Kali Bronson

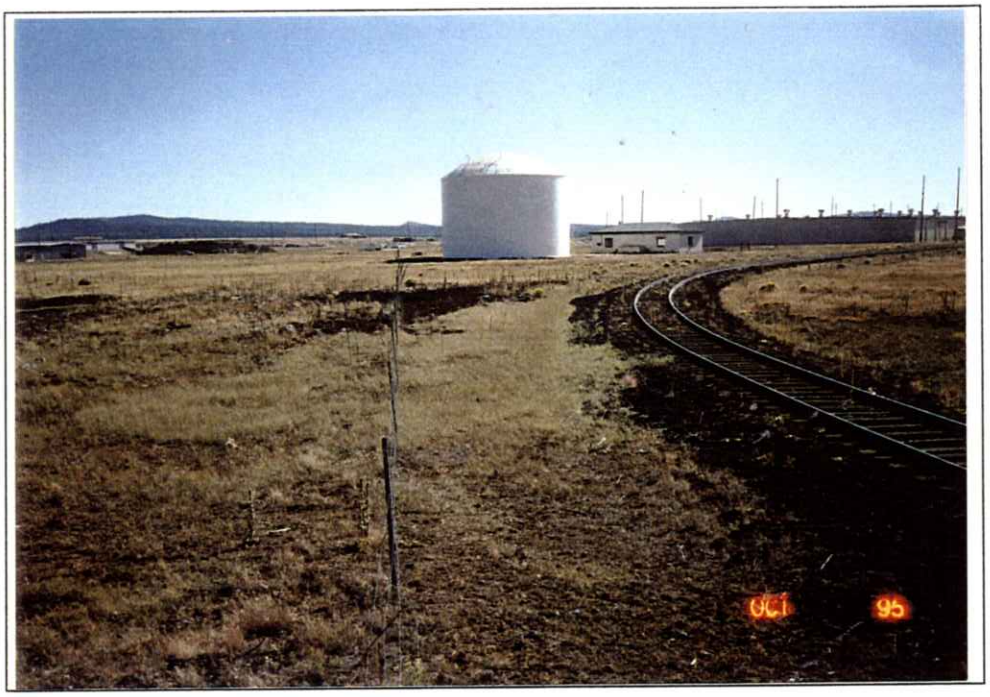
26-11 Looking N/NW, metal debris, NWW, 6/3/95, by Kali Bronson

26-12 Looking N/NW, metal debris, NWW, 6/3/95, by Kali Bronson

26-13 Looking SE, cement line cutting area, SE, 6/3/95, by Kali Bronson

26-14 Looking SE, overview, SE, 6/3/95, by Kali Bronson

40-12 From rail road spur, N, 10/18/95, by Mike Guy



40-13 From fence line and rail road spur, S, 10/18/95, by Mike Guy

40-14 Same as 13, SE, 10/18/95, by Mike Guy

40-15 Standard piles, SE, 10/18/95, by Mike Guy

APPENDIX B

COMMENTS AND RESPONSES

Document: Draft VSI, FCDLF #2

Name: Capt. J. Morrow

Comment	Response
Section 2.2. Figure 2-1; In the older February and March reports this map has one area of alluvium along the northern boundary that is shaded as basalt. In the newer November report two more areas (along eastern boundary and along Dunham fault) are incorrectly shaded. The blatant statement regarding faults as conduits on the older maps is made palatable by the addition of "potential" on the newer version, but would probably be best if deleted entirely. Also on the November report, the legend contains incorrect symbols for the railroad and suspected fault. Personally, I liked the geologically meaningful rock symbols of the older map better than the hatchured symbols of the newer map.	Figures in all closure reports will be revised to be clear and consistent.
Section 2.3. Paragraph 3; The water table is 200 feet below the top of the Supai Formation, and is not within the strata commonly assumed to be the aquifer in the Flagstaff area. Please revise this statement to reflect actual conditions below the Base. There is no justification for the statement regarding declining water levels. Only a handful of measurements exist, some of which are dubious. However, consider the following observations. Water levels since 1977 have remained higher than the 1369 feet measured then. Water levels measured during 1996 ranged from a low of 1343 (Tetra Tech) in January to a high of 1303 (USGS) in August, after a drought winter. Another 30 feet of rise is entirely conceivable in a wet year. Please remove your statement. See the comments for the Deep Well Report for further discussion.	Text will be revised in final.
Section Appendix. Will photographs in the appendices of Final Reports be in color, as stated in Sections 4 of the Draft Reports?	Yes.
Section 2. Please use the correct form of the following names; Kaibab Formation, Coconino Sandstone, San Francisco Peaks, San Francisco Volcanic field.	Text will be revised accordingly.

Name: S. Reynolds

Comment	Response
Figure 2-1: Remove paragraph on faults as conduits	Will change text to say that a fault is a potential conduit.
Signature block: Please add Mr. Aala's title	Will be revised in final.
Appendix A: Are color photos available?	Color photos will be printed in final report.
Section 1.2. 1st paragraph, last sentence; rewrite as follows: ...for the storage of ARNG material and munitions, and the United Sates Air Force...	Will be revised in final and will also include US Navy.
Include reference to Uribe & Associates VSI report for USEPA/ADEQ: RCRA Facility Assessment Report, 1994, prepared for Region 9 United States Environmental Protection Agency	Will be revised in final.
Section 2.4. 1st paragraph, 1st sentence: strike approximately	Will be revised in final.
Section 1.1. Add reference to NADA and AREE numbers/designations to tie to historic documents and to regulatory listings	Will be revised in final.
Figure 1-2 Indicate (arrow) site location	Will be revised in final.
Page 4-1. Section 4. 3rd paragraph: Could the type of rubber gasket be discerned, e.g. oil filter, building flashing, etc...	No inferences could be made as to what kind of rubber gaskets were observed at this site; however, the gaskets were not from oil filters.

APPENDIX C

SCOPE OF WORK

***Revised 30 November 1995**
16 February 1995
53490001

AMENDMENT TO THE SUPPLEMENTAL SCOPE OF WORK
dated 23 June 1994

Subject: Remedial Investigation/ Feasibility Study
Groups C-3 Sites
Camp Navajo
Bellemont, Arizona
(30 November 1995 Revisions are in bold print, preceded by an asterisk. Deleted requirement is so indicated.)

A-E: Tetra Tech, Inc.
180 Howard Street, Suite 250
San Francisco, CA 94105

A-E Contact: ***Bradley Hall** Phone (415) 974-1221
Fax: (415) 974-5914

Contract Number: Indefinite Delivery Contract DACA05-93-D-0019

Delivery Order: No. 24, Modification No.2

Authorization: Working Authorization Directive No. 863, issued 18 June 1994

Technical Manager: Maynardo Aala
U.S. Army Corps of Engineers, Sacramento District
Attn: CESPK-ED-EB (DERP Section)
1325 J Street, 12th Floor
Sacramento, CA 95814-2922
Telephone: (916) 557-7771
Facsimile: (916) 557-7865

1. General: Camp Navajo occupies 28,347 acres of land in North Central Arizona. Beginning with activation in 1942, Camp Navajo had functioned primarily as a munitions supply depot, providing storage and limited maintenance of assigned commodities.

A preliminary assessment and site inspection of ***5** Group C-3 sites have been completed. This effort will build on that PA/SI and complete characterization of each site, develop compliance actions and conduct feasibility studies for remediation of site contamination. The sites include the Former Sanitary Landfill (NAAD 40); ***(Delete:** Cinder Pit #3 Landfill (NAAD 41)); Current Construction Debris Landfill (NAAD 42); Former 5 Construction Debris Landfills (NAAD 43); Quarry Tank Area (NAAD 45); and Construction Debris Waste Pile (NAAD 46), (all landfill sites) .

EX 1

2. DESCRIPTION OF WORK AND SERVICE:

A: Tasks Requirements: The A-E shall provide all labor, material, equipment, transportation and supervision necessary to complete the work described as follows and accomplish the tasks in accordance with ***State/ Federal** requirements.

2.A.1 Remedial Investigation ***Planning-**

2.A.1.1 Work Plan : The A-E shall prepare a Group C-3 group- specific/ sites- specific Work Plan (GS/SSWP), Sampling and Analysis Plan (GS/SSSAP), and Health and Safety Plan (GS/SSHSP) to supplement the Master Work Plan, Sampling and Analysis Plan and Health and Safety Plan prepared for the entire installation in a separate contract.. The A-E shall prepare the GS/SSWP in accordance with all applicable Federal, State and local laws and/or regulations. The GS/SSWP to be developed shall detail proposed activities for further characterization of the sites in this group. The following requirements shall be incorporated into the GS/SSWP, as a minimum-

2.A.1.1.1 a) Introduction, including sites location; b) Site features, including demography, land use, natural resources, climatology; c) Historical information, including background, site history and hazardous waste characteristics/management, statement of the problem/s at each site- perceived problem/s to be characterized, the purpose of doing this work, etc. ; d) Environmental setting, including local meteorology, regional geology, site geology (known or suspected), surface and ground water data from all previous investigations/study; and e) Site Investigation- objectives (to include gathering of data for characterizing/defining the problem), chemicals of concern, methodology, sampling techniques, sampling locations and depths, sampling rationale, analyses of samples.

2.A.1.1.2 Health and Safety Plan . The A-E shall prepare the GS/SSHSP to establish the protocol necessary for the recognition, evaluation, and control of all hazards associated with the tasks required in this contract. Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared for the phase. The GS/SSHSP shall be approved by a certified Industrial Hygienist, prior to initiation of any field effort. (See attached Appendix A- Safety and Health, HTRW Site Investigative Activities with Attachment 1 (Appendix B, Safety and Health Elements For HTRW and OEW Documents). The A-E shall execute work activities according to the accepted HSP and GS/SSHSP.

2.A.1. 1.3 Sampling and Analysis Plan . The A-E shall prepare the GS/SSSAP and execute all work according to the accepted plan. Among other issues, the GS/SSSAP shall describe the standard protocols for sampling, QA/QC sampling, taking water level measurements, decontamination procedures, and air surveillance equipment requirements. (See attached Appendix B- Environmental Data Quality Management.On a separate memo, submitted with the draft document, the A-E shall identify any variations from the Environmental Data Quality Management document which the A-E may have reason to propose in the sampling and Analysis Plan. The A-E (also referred to as "Consultant" in the EDQM document) is reminded of the task required in Section 6.14- Data Validation.)

2.A.1.1.4 The A-E shall prepare an annotated bibliography of the records which were obtained and reviewed for guidance to accomplish the tasks in this Amendment to the Supplemental Scope of Work, to include but not limited to the title, author, and publication date of the record, the agency or office from which the record was obtained, a brief description of the contents of the document, and a brief evaluation of the document. The bibliography shall be included in the Appendices of the Work Plan.

2. DESCRIPTION OF WORK AND SERVICE:

A: Tasks Requirements: The A-E shall provide all labor, material, equipment, transportation and supervision necessary to complete the work described as follows and accomplish the tasks in accordance with CERCLA requirements.

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2.A.1.1.1 a) Introduction, including sites location; b) Site features, including demography, land use, natural resources, climatology; c) Historical information, including background, site history and hazardous waste characteristics/management, statement of the problem/s at each site- perceived problem/s to be characterized, the purpose of doing this work, etc. ; d) Environmental setting, including local meteorology, regional geology, site geology (known or suspected), surface and ground water data from all previous investigations/study; and e) Site Investigation- objectives (to include gathering of data for characterizing/defining the problem), chemicals of concern, methodology, sampling techniques, sampling locations and depths, sampling rationale, analyses of samples.

2.A.1.1.2 Health and Safety Plan . The A-E shall prepare the GS/SSHSP to establish the protocol necessary for the recognition, evaluation, and control of all hazards associated with the tasks required in this contract. Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared for the phase. The GS/SSHSP shall be approved by a certified Industrial Hygienist, prior to initiation of any field effort. (See attached Appendix A- Safety and Health, HTRW Site Investigative Activities with Attachment 1 (Appendix B, Safety and Health Elements For HTRW and OEW Documents). The A-E shall execute work activities according to the accepted HSP and GS/SSHSP.

2.A.1. 1.3 Sampling and Analysis Plan . The A-E shall prepare the GS/SSSAP and execute all work according to the accepted plan. Among other issues, the GS/SSSAP shall describe the standard protocols for sampling, QA/QC sampling, taking water level measurements, decontamination procedures, and air surveillance equipment requirements. (See attached Appendix B- Environmental Data Quality Management.On a separate memo, submitted with the draft document, the A-E shall identify any variations from the Environmental Data Quality Management document which the A-E may have reason to propose in the sampling and Analysis Plan. The A-E (also referred to as "Consultant" in the EDQM document) is reminded of the task required in Section 6.14- Data Validation.)

2.A.1.1.4 The A-E shall prepare an annotated bibliography of the records which were obtained and reviewed for guidance to accomplish the tasks in this Amendment to the Supplemental Scope of Work, to include but not limited to the title, author, and publication date of the record, the agency or office from which the record was obtained, a brief description of the contents of the document, and a brief evaluation of the document. The bibliography shall be included in the Appendices of the Work Plan.

2.A.1.1.5 Project Personnel. The resumes of Tetra Tech personnel shall be included, indicating their education and qualifications to effectively perform the work. Any subsequent substitution of personnel after acceptance of the Work Plan shall be restricted to those with equal qualifications or who exceed the qualifications of the personnel originally accepted to do the work. The resumes of the replacement personnel including their qualifications shall be submitted for review and acceptance prior to assigning them to do the tasks. The A-E shall avoid any delay in tasks completion dates due to the substitution of personnel. The A-E shall shoulder any additional expense caused by this change in personnel.

2.A.1.1.6 The Master Work Plan/ GS/SSWP shall state that all field personnel understand the Master Sampling and Analysis Plan/ GS/SSSAP, and Master Health and Safety Plan/ GS/SSHSP and will comply with the provisions and procedures outlined in the plans.

2.A.1.1.7 The GS/SSWP shall list the individuals who will be involved in the field work and shall include as attachments, the certificates of their 40-hour safety and health for hazardous waste site training and annual follow-up refreshers; and other certifications (e.g. SCBA training, etc.) necessary to properly and safely complete the tasks required in this contract.

2.A.1.2 Field Activities-

2.A.1.2.1 At each site, the A-E shall delineate the occurrence of ground water, and soil and ground water contamination. (The proposed method and equipment to accomplish this task shall be described in the Work Plan.)

2.A.1.2.2 The A-E shall propose locations and depths of soil and ground water samples to be collected , along with the supporting rationale for choosing these locations at each of the sites requiring investigation. (The proposed sampling method and equipment shall be described in the GS/SSSAP)

2.A.1.2.2.1 The A-E shall ***perform sampling task per attached SWMU Group C-3 Investigation Summary Table. (Delete:** conduct fifty four hydropunch or similar tests, install three 150-ft, 4-inch dia. and fifteen 30-ft, 2-inch monitoring wells, and conduct thirty 20-ft. soil borings.)

2.A .1.2.2.2 The A-E shall collect ***soil samples for analyses per attached SWMU Group C-3 Analytical Summary Table. (Delete:** 60 soil samples and 18 ground water samples for VOCs, SVOCs, Pesticides & PCBs Metals, Explosives, Picric Acid, Nitrate/Nitrite, Ammonia, TPH, TRPH, BOD/COD, TOC and Asbestos, level III analysis.The A-E shall also take two screening/confirmatory samples at each site for dioxin(s) analysis.)

2.A.1.2.2.3 The A-E shall collect QA samples equal to approximately 10% of field samples ***required in the attached SWMU Group C-3 Analytical Summary Table** and shall be analyzed for the same suite of analytes as the field samples and QC samples.

2.A.1.2.3 The A-E shall propose locations of survey control points where no existing monument can be found. The Survey shall include a map of of each site, showing locations of proposed borings and monitoring wells. Survey in all borings and monitoring wells shall have a minimum accuracy of +/- 0.1 foot horizontal to +/- 0.01foot vertical. ***(Delete:** The direction of perceived or known groundwater flow information shall also be included in the Survey map.)

2.A.1.2.4 The A-E shall develop a list of potential chemicals of concern that the A-E believes must be added and provide this list for each site in the Work Plan.

2.A.1.2.5 The A-E shall conduct Visual Site Inspection (VSI) of a) the Construction Debris Waste Piles, and b) Former Construction Debris Landfills #1, #2, #3, and #4 to verify the absence of contaminants which were supposed to have been present at these sites.

***2.A.2** The A-E shall prepare a Remedial Investigation ***(Delete:** Summary) Report for ***each of the four sites including the Former Construction Debris Landfill #5** to include the result of the sampling program and the remedial alternatives applicable to each site.

***(Delete:** 2.A.2 Feasibility Study. The A-E shall prepare a plan for comparative analysis of the feasibility of at least four remedial alternatives proposed in the remedial investigation summary report. The A-E shall consider the "No Further Action" recommendation as the first option for the remediation of sites whenever feasible and identify separately in the report all the sites recommended for no further action.. Each remedial alternative shall be described in the Feasibility Study Report and shall include an evaluation of each alternative. Each alternative shall be assigned an evaluation rating. The highest ranking rating shall be proposed as the recommended remediation option for the site.)

2.A.3 The A-E shall prepare a Health-Based Risk Assessment ***for Group C-3** to specifically address the concern related to direct exposure of humans to the chemicals of concern, and to the cattle grazing activity (food chain). This task shall consist of a) compilation of applicable criteria for the chemicals of concern; ***(Delete:** and) b) conducting an exposure assessment; and ***c)** comparison of the levels within each environmental medium against the list of criteria **with the corresponding conclusion drawn from this task.**

***2.A.4** The A-E shall require the Data Validation subcontractor to prepare Data Evaluation Reports as well as other submittals specified in paragraphs 6.14.1 A, B, and C of the EDQM document. ***(Delete:** 2.A.4 Management of Investigation-Derived Waste (IDW). The A-E shall properly handle, characterize, and dispose of investigation-derived waste that will be generated. The A-E shall include in the Work Plan the proposed method of handling this waste. The A-E shall prepare a Technical Memorandum of the management of Investigation-Derived Waste.This memorandum shall include description of how the waste was handled, its transportation manifest, certification of destruction, and the name, location and telephone number of the disposal facility for this waste. (Assume the waste to be hazardous.))

***(Delete:** 2.A.5 Meetings and Presentation. The A-E shall attend meetings with the Arizona Regulatory personnel, Camp Navajo environmental staff, and/or US Army Corps of Engineers, Sacramento District Staff. Two meetings will be held in Phoenix and four meetings will be held at Camp Navajo (Bellemont), Arizona to make an oral presentation and review of the work performed, as well as projected. Attendance shall be limited to two persons from the A-E firm.)

2.A.5 Submittals and Reports-

2.A.5.1 The A-E shall***submit draft, draft final and final versions of the Group C-3 Work Plan Addendum documents and** submit draft and final versions ***for all other documents/** reports and submittals. The A-E shall not proceed with the development of the final version until all Government (Corps of Engineers), regulatory agency, National Guard Bureau and installation comments on the draft documents had been addressed and the Government has accepted the A-E's responses to the comments. The A-E shall:

2.A.5.1.1 Submit for review and acceptance the Group C-3 group-specific/site specific Work Plan (GS/SSWP), Sampling and Analysis Plan (GS/SSSAP), Health and Safety Plan (GS/SSHSP), and all the attachments required in the Work Plan (See paragraph 2.A.1.1 through 2.A.1.1.7). The A-E shall also submit for review and acceptance all subcontractors' Health and Safety Program documentations prior to subcontractors' field work activities.

***2.A.5.1.2** Submit for review and acceptance contour maps for each site, depicting ground water surface elevations and contaminant levels in soil and ground water. In addition, the A-E shall prepare geologic/geotechnical cross sections from those contour maps depicting subsurface conditions. (See paragraph 2.A.1.2.1)

***2.A.5.1.3** Submit for review and acceptance ***the** Remedial Investigation ***and the Visual site Inspection Reports applicable to each of the Group C-3 sites.**

***(Delete:** 2.A.6.1.4 Submit for review and acceptance a Feasibility Study Report and Recommendations for the remediation of each site.)

***(Delete:** 2.A.6.1.5 Submit for review and acceptance a technical memorandum on the management of Investigation-Derived waste (IDW). This report shall be submitted with the summary report of the sampling program following the completion of the investigations and shall include a discussion of the management of all IDW from all six sites.)

***2.A.5.1.4** Prepare and submit by the 10th day of the current month, Monthly Progress Report describing the work performed of the past month, the work currently underway, and work anticipated. The report shall indicate if work is on schedule and if not, the reasons for the delay and what actions are to be taken to be back on schedule.

***2.A.5.1.5** Provide documentation of activities identified in the group-specific/site-specific Work Plan, Health and Safety Plan and Sampling and Analysis Plan, including log book of daily activities.

***2.A.5.1.6** Require the Data Validation subcontractor to submit for review and acceptance the Data Evaluation Reports and submittals specified in paragraphs 6.14.1 A, B, and C. (See paragraph ***2.A.4**)

***2.A.5.1.7** Submit other technical memoranda, reports, and/or submittals referred to in other sections of the contract requirements of this amended supplemental scope of work.

***2.A.5.2** The draft GS/SSWP and its attachments shall be due within 45 calendar days after notice to proceed (NTP) is issued to the A-E. Comments to the draft documents shall be provided to the A-E no later than 65 calendar days after NTP. Resubmittals of the documents shall be 10 calendar days after the A-E receives the comments from Sacramento District. All other draft documents shall be due within 14 calendar days after completion of specific task, event, or field activity, unless otherwise specified in the other sections of this scope of work. Review time and resubmittal requirements for these other draft documents shall be the same as required for the Work Plan.

***2.A.5.3** Submittals and reports shall be prepared in 8 1/2" by 11" white bond papers using a word processor (compatible with the software in use at the installation and at the U.S . Army Corps of Engineers District Office) and a quality printer. Drawings shall be engineering quality, showing sufficient details to identify interrelations of major features on the installation site map. Drawings shall include the scale used, provide a legend and show the North direction.

Drawings shall be folded to the size of the report paper. The submittals and report shall be in the draft (for review and comment) and final form. The final submittal shall incorporate all comments (submitted and processed using the Automated Review Management System Program) generated by Sacramento District Staff, State of Arizona Regulators and Camp Navajo staff. The final submittals and reports shall be provided in both hard copy and on a 3.5" HD disk. The Scope of Work, the Supplemental Scope of Work and Amendments to the Supplemental Scope of Work shall be attached as an appendix to the final **Remedial Investigation (Delete:** summary) report indicated in paragraph **2.A.2.** A section shall be provided describing the disposition of each comment made on all draft submittals. All final submittals/reports shall be sealed by a certified professional geologist ***or the engineer-in-charge, registered in the State of Arizona.**

***2.A.5.4** The A-E shall submit sixteen copies of the draft reports and submittals to the Technical Manager and four copies to Camp Navajo.

***2.A.5.5** The A-E shall submit the originals and sixteen copies of the final printed documents to the Technical Manager and four copies of the documents to Camp Navajo. The 3 1/2" disks shall be labeled with the following data: a) A-E's name; b) Project's name; c) Description of Contents; d) name of software and release number; e)Plotting scale of drawings ***and f) GIS Database..**

Submittal Addresses:

US Army Corps of Engineers
Sacramento District
1325 J Street, 12th Floor
Sacramento, CA 95814-2922
ATTN: CESPK-ED-EB (Aala)

Camp Navajo
Environmental Office
Bldg. 1
Bellemont, AZ 86015-5000
ATTN: Cpt. John A. Morrow, Jr. (AZIA-ASE)

B. Miscellaneous Requirements:

2.B.1 Notification. The A-E shall immediately notify both the Technical Manager and Camp Navajo by telephone of any data or results generated during the investigation which may indicate an imminent risk to the environment, human health or safety, or violation of federal, state, or local laws/regulations, followed by a written report within 3 days of discovering the imminent risk. The points of contact are:

a) Camp Navajo: Cpt. John A. Morrow, Jr. Tel. (***520**) 773-3208; 3207
b) Sacramento District Technical Manager: Maynardo Aala Tel. (916) 557-7771

2.B.2 Minutes of Meetings. Following each meeting, the A-E shall prepare and submit minutes of the meeting within 10 days to the Sacramento District Technical Manager.

2.B.3 Correspondence/Telephone Conversation. The A-E shall keep a record of each phone conversation and written correspondence related to the performance of this delivery order. A summary of the telephone conversations and

written correspondence of the past month shall be submitted to the Sacramento TM as an attachment to the monthly progress report.

2.B.4 The A-E shall refer all questions from the public to the Technical Manager.

2.B.5 The A-E shall be responsible to immediately notify the Technical Manager of any missing or unclear criterion required for completion of work/report so work milestones are not impacted.

2.B.6 All data, plans and other materials generated by the activities in this amendment to the supplemental scope of work are the property of the U.S. Government and shall not be released to any unauthorized person or entity by the A-E, its subcontractors, or their employees, without written authorization from the Contracting Officer.

2.B.7 The A-E is cautioned not to accept guidance from any source other than the Contracting Officer in the course of this work and shall immediately notify the Technical Manager of any such action by the said source.

2.B.8 The A-E shall notify the COE technical manager at least two weeks in advance of any planned site visit/activity.

Period of Service: The A-E shall complete all efforts in this amendment to the supplemental scope of work on or before **31 January 1997.**

References:

a) CETHA-R-CR-91040, Master Environmental Plan: Camp Navajo, Bellemont, Arizona, Final Report, October 1993.
b) CESPK-ED-EB, Installation Action Plan: Camp Navajo, Bellemont, Arizona, Draft Final, June 1994.
c) Guide to Management of Investigation-Derived Waste, EPA Publication No. 9345.3-02FS, May 1991.
d) Human Health-Based Guidance Levels for the Ingestion of Contaminants in Drinking Water and soil, Arizona Department of Environmental Quality, latest edition or revision.

Attachment:

a) Appendix A- Safety and Health, HTRW Site Investigative Activities with attachments 1- Appendix B, Safety and Health Elements for HTRW and OEW Documents.
b) Appendix B- Environmental Data Quality Management.

Maynardo Aala
Technical Manager
DERP Section

Distribution:
A-E- Tetra Tech
Camp Navajo, NADA/EM: Cpt John Morrow, Jr.
A-E Negotiation Section
DERP Section

SWMU Group C-3 Investigation Summary

Building:					
NAAD:					
SWMU Name:	Units	Former Sanitary Landfill	Current CDLF	Former CDLF #5	Quarry Tank
Investigation Areas					
Geolphysics - LL	Days				
Geophysics - Mag	Days	4	2	2	2
Geophysics - EM	Days	4		2	
Soil Gas	Points	108	21	39	
Surface Soil Sampling	Points	95	16	30	24
Sediment Sampling	Points				
Surface Water Sampling	Points	8	3		3
Subaqueous Sampling	Points				3
Excavation/Trenching	Points	5	1	2	
Hand Auger Locations	Points				
HSA Soil Borings	Feet				
HSA Hydropunch	Points				
CH Soil Borings	Feet	300		90	
CH Hydropunch	Points	10		3	
Webster's Reagent Screening	Points				
Wipe Sampling	Points				
Chip Sampling	Points				
Waste Characterization	Points				
Survey	Days	2	1	1	1

SWMU Group C-3 Analytical Summary

Investigation Sites	Former Sanitary Landfill		Current CDLF		Former CDLF#5		Quarry Tank		
	Raw	QA/QC	Raw	QA/QC	Raw	QA/QC	Raw	QA/QC	
Volatile Organic Compounds	32	19	5	9	9	9	6	9	98
Semi-Volatile Organic Compounds	127	28	5	4	58	14	6	4	246
PCDDs/PCDFs	0	0	0	0	0	0	0	0	0
OC Pesticides/PCBs	169	36	21	6	58	14	30	8	342
Explosives	0	0	0	0	0	0	30	8	38
Orghanophosphate Pesticides	0	0	0	0	0	0	0	0	0
Chlorinated Herbicides	0	0	0	0	0	0	0	0	0
TPH	169	36	21	6	58	14	30	8	342
TRPH	169	36	21	6	58	14	30	8	342
RCRA Metals	169	36	21	6	58	14	30	8	342
Beryllium	169	36	21	6	58	14	30	8	342
Hexavalent Chromium	0	0	0	0	0	0	0	0	0
Nitrate/Nitrite	8	2	3	2	0	0	3	2	20
Ammonia Nitrogen	8	2	3	2	0	0	3	2	20
Total Organic Carbon	32	4	5	2	7	2	5	2	59
Biological Oxygen Demand	8	1	3	1	0	0	3	1	17
Chemical Oxygen Demand	8	1	3	1	0	0	3	1	17
pH	58	6	2	1	25	3	0	0	95
Mustard Gas	0	0	0	0	0	0	0	0	0
Thiodigylcol	0	0	0	0	0	0	0	0	0
Redox Potential	6	1	2	1	3	1	0	0	14
Grain Size	6	0	2	0	3	0	0	0	11
Bulk Density	6	0	2	0	3	0	0	0	11

SWMU Group C-3 QA Analytical Summary

Investigation Sites	Former Sanitary Landfill	Current CDLF	Former CDLF#5	Quarry Tank	
Volatile Organic Compounds	4	2	2	2	10
Semi-Volatile Organic Compounds	14	2	7	2	25
PCDDs/PCDFs	0	0	0	0	0
OC Pesticides/PCBs	18	3	7	4	32
Explosives	0	0	0	4	4
Orghanophosphate Pesticides	0	0	0	0	0
Chlorinated Herbicides	0	0	0	0	0
TPH	18	3	7	4	32
TRPH	18	3	7	4	32
RCRA Metals	18	3	7	4	32
Beryllium	18	3	7	4	32
Hexavalent Chromium	0	0	0	0	0
Nitrate/Nitrite	1	1	0	1	3
Ammonia Nitrogen	1	1	0	1	3
Total Organic Carbon	4	2	2	2	10
Biological Oxygen Demand	1	1	0	1	3
Chemical Oxygen Demand	1	1	0	1	3
pH	6	1	3	0	10
Mustard Gas	0	0	0	0	0
Thiodigylcol	0	0	0	0	0
Redox Potential	1	1	1	0	3
Grain Size	0	0	0	0	0
Bulk Density	0	0	0	0	0

September 12, 1996

SCOPE OF WORK

Subject: Remedial Investigation/ Feasibility Study
Groups C-3 Sites
Camp Navajo
Bellemont, Arizona

A-E: Tetra Tech, Inc.
180 Howard Street, Suite 250
San Francisco, CA 94105

A-E Contact: Bradley Hall — Phone (415) 974-1221
Fax: (415) 974-5914

Contract Number: Indefinite Delivery Contract DACA05-93-D-0019

Delivery Order: Number 24, Modification Number 5

Authorization: Working Authorization Directive No. 863, issued 18 June 1994

Technical Manager: Maynardo Aala
U.S. Army Corps of Engineers, Sacramento District
Attn: CESPK-ED-EB (DERP Section)
1325 J Street, 12th Floor
Sacramento, CA 95814-2922
Telephone: (916) 557-7771
Facsimile: (916) 557-7865

1. General: Camp Navajo (NADA) occupies 28,347 acres of land in North Central Arizona. Beginning with activation in 1942, Camp Navajo has functioned primarily as a munitions supply depot, providing storage and limited maintenance of assigned commodities.

A preliminary assessment and site inspection of 5 Group C-3 sites have been completed. This effort will build on that PA/SI and complete characterization of each site, develop compliance actions and conduct feasibility studies for remediation of site contamination. The sites include the Former Sanitary Landfill (NAAD 40); Current Construction Debris Landfill (NAAD 42); Former 5 Construction Debris Landfills (NAAD 43); Quarry Tank Area (NAAD 45); and Construction Debris Waste Pile (NAAD 46), (all landfill sites).

2. DESCRIPTION OF WORK AND SERVICE:

A: Contract Requirements: The Revised Supplement Scope of Work for Group C-3Sites RI/FS dated 16 February 1995 and revised 30 November 1995, Task 2.A.1.2- Field Activities, included Soil and ground water sampling at, and sample analyses for, Former Sanitary Landfill; Current Construction Debris Landfill; and Former Construction Debris Landfill Sites. The contract requirement in this scope of work is to reduce the quantities of the above tasks - 167 feet of Soil Borings and 7 hydropunches and the associated sampling; and 8 surface water samples, and the required analyses for the Former Sanitary Landfill Site; 3 surface water samples and the required analyses for the Current Construction Debris Landfill Site; and 3 hydropunches for the Former Construction Debris Landfill Site, from the above part of Task 2.A.1.2 of said Supplemental scope of Work. Reduction is either due to drilling refusal or shallow depth of ground water.

Period of service: Period of Service shall remain the same.

Maynardo Aala
Technical Section
DERP Section

Distribution:
A-E- Tetra Tech
Camp Navajo, NADA/EM: Cpt John Morrow, Jr.
A-E Negotiation Section
DERP Section