UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
NEEDLES FIELD OFFICE

# ENVIRONMENTAL ASSESSMENT

# CAMP IBIS ENGINEERING EVALUATION/COST ANALYSIS

CA-690-EA02-05

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# ENVIRONMENTAL ASSESSMENT

## INTRODUCTION

The U.S. Army Corps of Engineers (COE) proposes to conduct an Engineerin Evaluation/Cost Analysis (EE/CA) of former Camp Ibis, located in eastern Piute Valley and the western Dead Mountains, San Bernardino County, California. Camp Ibis was used for military exercises conducted from 1942 to 1944 and in May 1964. The EE/CA study would statistically characterize the nature, location and concentration of residual ordnance and explosives, if any, that may be present within the Camp as a result of former military training activities. Of the Camp's roughly 13,400 acre total, the EE/CA study would randomly sample 3,000 magnetic anomalies detected in about 100 acres. Up to 50 explosive munitions could be detonated in place, should any be found during the project. The greatest probable surface disturbance associated with these activities is estimated to be less than 0.1 acres.

## 1. CONTROL NUMBER

CA-690-EA02-05

## 2. PROPONENT

U.S. Army Corps of Engineers, Los Angeles District

## 3. PROJECT

Camp Ibis Engineering Evaluation/Cost Analysis (CACA 42611)

## 4. LOCATION

Eastern Piute Valley and western Dead Mountains. Legal Description: T. 1 N., R. 21 E., sections 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, and 21; T. 11 N R. 21 E., sections 20, 21, 22, 23, 24, 25, 26, 29, 32, and 33; T. 10 N., R. 2 E., sections 12 and 13; SBBM

5. AFFECTED ACREAGE

Disturbance in the form of traversing terrain: 100 acres. Actual ground disturbance: less than 0.1acres

6. 7.5' QUADRANGLE

Bannock; East of Homer Mountain

7. MULTIPLE-USE CLASS

Limited and Controlled Use

8. LAW ENFORCEMENT SECTOR

94

9. LAND STATUS

Public and Private Land

10. SPECIAL DESIGNATION AREA

California Desert Conservation Area; Desert Tortoise Critical Habitat; Dead Mountains Wilderness Area; Dead Mountains Area of Critical Environmenta Concern, Former Camp Ibis, Desert Training Center/California-Arizona Maneuver Area

11. AUTHORITY

43 United States Code 1701, 1733 and 1761-1771

12. LAND USE PLAN CONFORMANCE

The proposed action is subject to and in conformance with the California Desert Conservation Area Management Plan of 1980 (CDCA), as amended, in accordance with Title 43 Code of Federal Regulations 1610.5-3. The Plan's General Guidelines provide that temporary uses of the public lands i the CDCA for the purposes of protecting the health, safety, and general welfare of the public will be allowed at the discretion of the authorized officer.

## 13. PURPOSE AND NEED FOR PROPOSED ACTION

Decisions about management of those lands that were once military trainin bases but are now fully accessible by the public need to be founded on an objective measure of the risk posed by such an unintended military legacy. Congress delegated to the Corps of Engineers the responsibility to address the potential (or confirmed) existence of explosive munitions abandoned at formerly used defense sites under the auspices of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA (42 U.S.C.A. §§9601 to 9675).

The Corps of Engineers proposes to conduct an Engineering Evaluation/Cos Analysis of former Camp Ibis that would statistically characterize the type, location and amount of unexploded ordnance (UXO) that may be present within the camp. Results of the study would be used to help officials determine if there are potential hazards, identify and analyze any possible problems that may be caused by the presence of UXO, and evaluate methods to manage the risks. BLM authorization of the project located on public lands would require the issuance of a Temporary Use Permit. The project would also be conducted on one and one half sections in private ownership. Approval of the landowner would be required to undertake the study on these lands.

Camp Ibis typifies many formally used defense sites (FUDS) in that a possible upshot of military training, unexploded munitions inadvertently lef behind when the training facility had outlived its purpose, pose a challenge for managing public lands. Camp Ibis furthermore typifies many such training sites in that no one really knows whether or not dangerous and explosive military ammunition poses a credible risk in view of the current uses of the land. At the contemporary Camp Ibis for example, the Bureau o Land Management (BLM) must reckon with a public increasingly interested in historic U.S. Highway 66, the attraction former military training camps hold for many veterans (who may even have been stationed there themselves), and the possibility of visitors to Camp Ibis discovering UXO which has lain in the desert for 60 years. Ammunition fired during training exercises in 1942 and designed to explode when it hit a target sometimes failed to do so and may still be present in some areas of Camp Ibis. Disturbing them can be perilous, for a sufficient impetus by curious visitors can still make such munitions blow up even six decades later.

## 14.0 PROPOSED ACTION and NO ACTION ALTERNATIVE

### 14.1 Proposed Action

The U.S. Army Corps of Engineers proposes to conduct an Engineering Evaluation/Cost Analysis (EE/CA) of former Camp Ibis. The EE/CA would statistically characterize the nature, location and concentration of residual ordnance and explosives that may be present within the Camp as a result o former military training activities. The proposed action incorporates by reference the *Final Work Plan, Engineering Evaluation/Cost Analysis, Former Camp Ibis, San Bernardino County, California, January 2002* (to the extent not otherwise amended by the proposed action herein described), including the Site Safety and Health Program.

In the course of an EE/CA, random (or stratified random) sampling of a sma fraction of the entire site would produce a body of data to be analyzed and evaluated. Conclusions drawn from that analysis become the basis for subsequent UXO projects (if any) at the site. An EE/CA constitutes a systematic process to learn important information about UXO at a FUDS location.

During the course of random sampling a few unexploded ordnance items may be discovered. If so, Corps regulations which implement CERCLA require their destruction. That may happen at Camp Ibis. By design however, an EE/CA study yields numeric, georeferenced data intended to characterize the site and ultimately assert a defensible conclusion about the chances of a person coming upon a UXO item when their purpose in visitin the site was altogether benign and not connected to military ammunition in any way. The discovery and destruction of UXO items while conducting th field work of an EE/CA is incidental to the purpose of an EE/CA. A few explosive rounds may be demolished at Camp Ibis, but the EE/CA investigation would not materially reduce the numbers of UXO items still present (a number entirely speculative at the present). Neither would it lessen very much at all the chance people visiting the FUDS training camp might discover a UXO item, and therefore would not materially diminish the risk to the public from UXO to less than whatever it is now (a probability als strictly conjectural at the present).

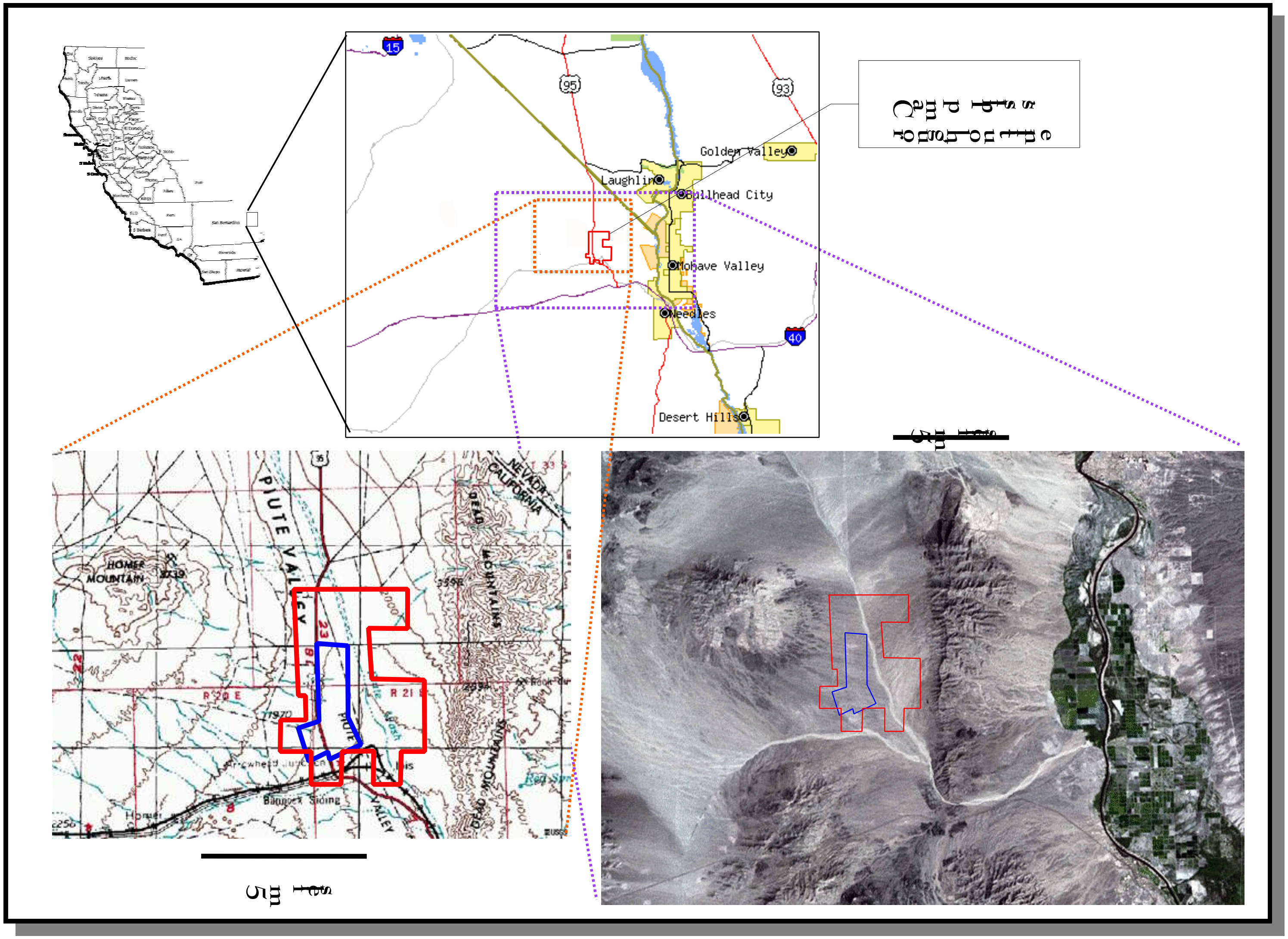


Fig. 1.  Location of Camp Ibis, astride U.S. Highway 95.  The outer boundary delineates approximately the limits of the EE/CA study, and includes the cantonment area itself (inner boundary) in the topographic map (lower left) and satellite image (lower right) insets.  The project area spans Piute Wash (draining roughly north to south), touches the western edge of the Dead Mountains on the east and the bajada of Homer Mountain to the northwest, and extends southward almost to Sacramento Wash (draining roughly west to east).  The EE/CA study would sample about 100 acres of the entire 13,400 outlined.  Needles, California appears in the lower right corner on the west side of the Colorado River.

## Inferences About UXO at Camp Ibis By Statistical Sampling

When completed, the EE/CA study would summarize quantitative information about UXO at this FUDS location by expressing the probability o a visitor to Camp Ibis unintentionally coming upon an ordnance item in terms of arithmetic average density, i.e. the number of UXO per acre. Historically, different parts of Camp Ibis were used differently and therefore average densities may also differ between areas, as likely as not very much lower in the cantonment and the general vicinity of the highway (because soldiers lived in that part of Camp Ibis) than in target ranges well to the eas of Piute Wash. A few may remain there. Ordnance specialists with experience at many former training facilities expect the average density of UXO for all portions of Camp Ibis, including target ranges, would prove less than one item every ten acres at the maximum, i.e. $\bar{x} \leq 0.1$/acre.

At other military training camps, UXO occurs randomly[1] where big guns once were trained. Camp Ibis should be no different, with individual UXO projectiles few and far between. The process of EE/CA studies at FUDS locations has been designed to collect data about where UXO occurs, how many exist in the area to be sampled, and would rely on the number of anomalies (i.e. sample size, N) to be investigated. In effect, the more metal objects of unknown character dug up and identified from smaller sample areas selected at random, and therefore representative of the entire Camp Ibis, the higher the confidence in characterizing all of Camp Ibis based on statistical sampling. This EE/CA study would randomly sample a fraction o all magnetic anomalies detected in about 100 acres out of roughly 13,400 total (Fig. 1). The calculation of 95% confidence intervals around those average densities represents the level of statistical characterization about UXO deemed sufficient to describe accurately the risk to a visitor from unexploded munitions at Camp Ibis. By digging and identifying approximately 30 separate anomalies per acre ($N \approx 3{,}000$; 30/acre × 100 acres) the EE/CA process would yield enough data to express a UXO densit and an acceptably small margin of error, represented numerically as $\bar{x} \pm$ 95% confidence interval.

[1]Objects thought to exhibit a random spatial distribution, such as explosive projectiles scattered in desert terrain, do not keep to any spatial pattern. Instead, the odds of finding one are always the same despite the quirks of local features or terrain by which we mentally distinguish one place from another. Two ways of describing randomness of spatial location help convey the idea: 1) any two spots picked arbitrarily from anywhere across the desert landscape have exactly equal probability of a UXO item being there, and 2) the existence of an item at any arbitrary spot in no way influences the probability of existence of a projectile at any and all other spots that could be selected arbitrarily. Statistically, a random distribution is best described by a Poisson function which calculates the probability (of a UXO item at a particular spot, in this case) from the average number of occurrences per unit of area (UXO/acre, in this case) and sample size (the total number of anomalies investigated, in this case). The EE/CA study treats them as randomly distributed, and would yield data about the number of UXO per acre at Camp Ibis, on average, and variance associated with that average. Both average and variance are currently unknown, hence the reason for an EE/CA study of unexploded ordnance at Camp Ibis.

No one can say before hand with any certainty what degree of UXO contamination now exists at Camp Ibis. All 3,000 separate anomalies to be investigated may reveal little more than innocuous metallic debris, or even partially magnetic rocks. However, the contingency of finding some UXO among these 3,000 anomalies must be addressed to anticipate how their necessary excavation and demolition would cause surface disturbance. In the judgement of experienced UXO specialists, circumstances at Camp Ibis indicate the field crews would find at most 50 explosive projectiles, the anticipatory worst-case guess of numbers to be discovered and one of extraordinarily low odds of turning out to be correct. In other words, at the highest credible degree of UXO contamination about 2,950 excavations would disclose objects which would be merely reburied. Fifty UXO encountered in 100 acres of land would correspond to a maximum average density equal to 0.5 with a 95% confidence interval around that average equal to 0.0037, written as $\bar{x}$ = 0.5/acre ± 0.0048. In actuality, such projectiles appear to be quite scarce at Camp Ibis, and realistic expectations for the total number of UXO items likely to be found during the EE/CA study range from zero to 3 or 4. The target ranges would be expected to have the highest UXO density, perhaps $\bar{x}$ = 0.01/acre ± 0.001. The abundance of UXO within the cantonment proper and near the highway would likely be much lower, $\bar{x} \leq$ 0.001/acre ± 0.0005.

Planned Schedule

Field activities would begin immediately following the USFWS's issuance of a Biological Opinion and the BLM's subsequent issuance of a Decision Record approving the EE/CA. The current plans foresee completion of the three aspects of the study and full demobilization from Camp Ibis three to four months after commencement of the project.

Duties and Conduct of On-Site EE/CA Personnel

EE/CA personnel would consist of groups having specialized functions. One group (geophysical data acquisition) would use a specialized apparatus to detect buried metal objects. A second group (anomaly relocation) would relocate and mark a proportion of those underground anomalies. A third group (ordnance specialists) would excavate those marked anomalies to identify them, and should they prove to be explosive ordnance destroy them in accordance with accepted COE safety procedures and techniques for disposal of UXO.

Authorized desert tortoise biologists would accompany the first group of specialists. The primary role of authorized desert tortoise biologists would lie in guiding long sampling transects across open ground and away from desert tortoise burrows, in surveying proposed locations for small sampling grids for evidence of desert tortoises and repositioning grids as needed to avoid desert tortoise burrows, and in safeguarding any desert tortoises which might be in the vicinity of a UXO item being prepared for demolition. All handling of desert tortoises necessary to move them from harm's way caused by preparations for UXO demolition would occur according to protocal methods (Desert Tortoise Council, 1999).

All personnel with a field role in the EE/CA study would drive to the site eac working day from temporary quarters in Laughlin, Nevada. No equipment c personnel would remain on site at the end of the work day. A rally site would serve as daily headquarters for all field activities. This muster point would be along the dirt road which leads east from U.S. Highway 95 past the Camp Ibis monument. A temporary desert tortoise fence, with a gate, would be raised around the perimeter of this area every day during desert tortoise active season. From that central point vehicles may reach Piute Wash along an existing dirt road. Piute Wash would be the primary route f moving within the geographic limits of the project area. Five other dirt roac would allow passage to facilitate daily logistics. These would be marked inconspicuously at the beginning of field work. In no circumstance would motorized vehicles be allowed to drive overland. All 4-wheel drive vehicles would carry a sheet of 5-mil plastic to be used as an emergency catch basi in the event of leaking oil sumps.

Small motorized buggies (sometimes known as 'gators') may be an option for daily movement within the project area. These small vehicles would als keep to the same five dirt roads and the wash. Gators would be outfitted with smooth rubber tires rather than knobbies.

Attributes of UXO and EE/CA Techniques Properties

Munitions used in training at Camp Ibis had substantial amounts of iron in their design. An internal cavity held a charge of high explosive (commonly TNT, or other explosive compounds occasionally). A mechanical fuze threaded into the front or rear of the projectile was designed to set off the high explosive when the projectile struck. Roughly 10% of those projectiles hit but did not explode for various reasons. The projectiles being both poin and having considerable momentum could penetrate the ground and disappear below the surface if their trajectory brought them in a high arc, a from artillery batteries. Direct fire rounds which turned out to be duds ofte glanced along the surface, rather than penetrating it and disappearing from sight. Once buried, these items could still be there at Camp Ibis. The metallurgical properties of the steel case makes detecting buried munitions comparatively simple matter of applied physics; the EE/CA study depends c this ability to sense unseen UXO.

Large pieces of buried scrap metal, possibly the fragments of projectile cases, would also be sensible for the same reason. The detecting instruments cannot always discriminate between UXO and large scrap item so until manually dug up buried anomalies remain unidentified.  Those whose magnetic signature attract notice when geophysical data are reviewed in the 2nd phase, approximately 3,000 anomalies in total, would b investigated even when the odds are high that each magnetic contact coul turn out to be merely a rusting scrap.

In the event buried anomalies prove to be UXO, or if UXO items are found lying visible on the surface, they would be destroyed.  Demolition procedur which cause the minimal achievable effects to the surrounding area, and which are fully consistent with all personal safety requirements, would be employed as appropriate to the circumstances of each separate UXO item. Small commercial explosives (each well perforator contains a high explosiv charge of about 18 grams shaped to melt a hole through steel) would be used to set off the item's fuze (explosive in its own right, containing perhap as much as an ounce of TNT) and whatever TNT filler the round may contain.  With conventional modifications the same demolition techniques can also be used to destroy UXO items from which the fuze broke away without detonating the charge, leaving a steel case with high explosive fille only.  The explosive force which results depends nearly entirely on the quantity of TNT in the projectile and as would be expected larger caliber items contained more explosive.  Standard issue munitions at WWII trainin centers usually included a wide selection (Table 1).

Experience at other FUDS locations has shown that nearly all munitions fire in training were either 37mm, 75 or 76mm, and 90mm.  Evidently virtually all stocks of larger munitions (105 and 155 mm) were needed overseas far more than their worth in training circumstances.   The preponderance of th rounds used in training exercises, often as much as 90%, contained no hig explosive charge or fuze (the stockpiles of high explosive also being allocat for combat).  Instead, a capsule holding an incendiary mixture replaced the fuze and burned as a simple tracer while the round was in flight.  Sand use in place of high explosive filler gave these practice rounds the proper mass and flight characteristics.

**Table 1.** Physical properties of UXO which may have appeared on quartermasters' manifests at Camp Ibis.  In actuality, the great majority of projectiles at FUDS training facilities such as Camp Ibis contained sand rather than high explosive.

| intended purpose | caliber, or other descriptor | quantity of TNT (or equivalent high explosive) filler | likelihood as anomalies remaining at Camp Ibis |
|---|---|---|---|
| high explosive effects | 37 mm | 0.085 lbs. | very high |
| | 75 mm | 1.49 lbs. | very high |
| | 76 mm | 1.49 lbs. | very high |
| | 90 mm | 2.04 lbs. | high |
| | 105 mm | 4.8 lbs. | very low |
| | 155 mm | 15.13 lbs. | extremely low |
| | 2.36" rocket | 0.5 lb. | moderately low |
| fragmentation effects | 60 mm mortar | 0.34 lb. | very low |
| | 81 mm mortar | 1.22 lbs. | very low |
| | hand grenade | 2 oz. | low |
| create smoke, either to obscure or mark impact points | 81 mm mortar | 4 lbs. of white phosphorus | very low |
| | colored smoke hand grenade | 0.72 lbs. of smoke mixture | very low |
| | rifle grenade | 8.5 oz. of white phosphorus | very low |

Dispersed or Trash Pit UXO

Two kinds of activities during the period of active military training have proven to be good indicators where UXO is likely to occur. Naturally enoug it appears where guns were trained. UXO also shows up where expended matériel were gathered into disposal pits, contents of which were sometim burned, and then buried. Military records indicate burial pits and aerial photographs show scraped or oddly flattened surfaces at 40 locations with the EE/CA limits.

The EE/CA study aims for confidence levels which require statistical sampling of data from approximately 100 acres of Camp Ibis lands. The entire Camp is about 13,400 acres, so this sampling procedure would occu on 0.7% of the total acreage. The EE/CA study would emphasize statistical data from target ranges and the cantonment of Camp Ibis (Table 2).

Table 2. Anticipated way of parceling out geophysical data acquisition efforts during the EE/CA study proposed for Camp Ibis.

| to be implemented at | technique of geophysical data acquisition | acreage |
|---|---|---|

| | | |
|---|---|---|
| firing ranges and within the cantonment | very thin and elongate meandering transects, starting from a predetermined location and heading more or less in the direction of a predetermined end. | 92 |
| isolated suspected burial pits | predetermined locations ("placed grids", squares 100 feet on a side) searched in their entirety | 8 |

As the field work progresses, small shifts of acreage possibly may be deemed advisable to learn more about one area or the other – either converting some acreage from thin transects to placed grids or vice versa.

EE/CA PROCESS IN THREE PHASES

Field components of the EE/CA study fit into one of three separate but linke activities: 1) geophysical data acquisition, 2) anomaly review and selection followed by re-location in the field, and 3) anomaly excavation and possible explosive demolition of UXO. The initial geophysics phase would be the longest of the three, and would overlap the other two. Close coordination and synchrony of each facet, in combination with the absolute minimum of unforeseen delays and complications, would allow completion of all field work in 50 to 60 days. Field work would likely begin when tortoises are sti active above ground, and end after they become torpid during the winter.

1) geophysical data gathering.............................three months
2) anomaly review and relocation....................... two months (within the 1st 3 months)
3) anomaly excavation, demolition of any UXO......three months (within the 1st 3months)

Two separate teams of specialists working simultaneously would accomplish the first phase of the EE/CA study. An authorized desert tortois biologist and a qualified archaeologist would accompany each geophysics team. As soon as field data are winnowed of spurious noise, geophysicists would begin analysis of field data to produce a list of anomalies which seer conspicuous by their signals as suspected ordnance items. These objects would be located a second time by a separate team of specialists (phase 2) Finally, a third team would dig with hand tools to reveal and identify those select anomalies. If UXO come to light, these same specialists would hand all demolition procedures (phase 3).

Allowances for the unexpected need to be considered however, as this proposed EE/CA study would be the first of its kind anywhere in the Mojave Desert. Should delays come to pass, the inception of field work could be postponed. Once under way, the intricately complex topography of Camp Ibis, the need to avoid desert tortoises above ground and in their burrows, avoidance of cultural deposits, and the long distances of foot travel during each day's work may slow the pace by more than half that anticipated optimistically; perhaps as much as 125 days instead of 50 to 60 as planned

During each and every aspect of EE/CA field activities, all personnel would observe and adhere to aforementioned restrictions of vehicular access (five dirt roads and Piute Wash) and operation (10 miles/hr and vigilance for desert tortoises).

Phase 1: Geophysical Anomaly Detection

Detection instrument

An industry mainstay procedure, interrogation for underground metallic objects by pulsed time-domain electromagnetic (TEM) induction, would be employed to detect UXO at Camp Ibis. The apparatus forms a light cart bui from a tubular framework of fiberglass rectangles, wire coils hidden inside them, a handle, fitted with rubber tires half a meter in diameter and 4 centimeters wide, and often has a mount for a roving GPS receiver attached afterward. The cart used for calibration trials in the field at Camp Ibis in January 2001 has a mass of approximately 31 kg (Fig. 2).

Fig. 2. Apparatus for sensing buried UXO. Its design positions the lower rectangle half a meter above the ground. The entire mass is about 31 kg as arranged for Camp Ibis.

Each of the two orange rectangles, dimensions of 1 meter wide by half a meter deep, houses closed-loop coils of copper wire. That in the upper rectangle and one of two coils in the lower rectangle work as a receiving antenna. A second coil in the lower rectangle functions separately as a transmitting coil. Think of the complete instrument as a metal detector consisting of both a rolling source of an intermittent magnetic field (rather like an electromagnet, but without a ferrite core and therefore it has no residual magnetism) and two sensors tuned precisely to listen passively for induced echoes to that magnetic field, and capable of recording exact coordinates to give geospatial locations for every object it detects. The overall geometry of the rectangles, the distance between them and the height above the ground fixed by the wheels is integral to the way the instrument senses buried objects. The quadripod clamped to the upper rectangle positions the mobile GPS antenna. Determining locations of anomalies with survey grade accuracy (± 15 cm precision) requires differential correction between the roving GPS antenna and a base antenna fixed at a precisely surveyed location.

The instrument behaves in two ways during each operational cycle: actively transmitting at first, then passively listening for responses. In active mode, electrical current through the transmitter coils induces a primary, localized magnetic field within the rectangles which permeates the ground to a maximum depth of about 4 meters. The intensity of the primary field measured at the ground surface, 1 gauss (Bosnar, 2001), has to be somewhat stronger than earth's natural background, approximately 0.3 gauss as a rule of thumb. The instrument's sensitivity derives, in part, from the brief and pulsed nature of the primary magnetic field, a total duration less than 4 milliseconds. Attenuation rate of the primary field occurs inversely to the cubic distance (d) from the antennae, $\propto d^{-3}$. That primary field induces short-lived eddy currents in the surface of nearby metallic objects. A secondary magnetic field accompanies each of those eddy currents, and as the induced eddy decays its magnetic field exhibits distinctive properties. In passive mode, the instrument listens with the receiving coils for those properties of secondary magnetic fields emanating from buried anomalies. Objects below ground, especially those made of iron, react vigorously to this TEM technique. The rate at which those secondary fields change with time forms an important element of the data and allows some discrimination between flat or plate-like objects (likely to be scrap metal) and elongate object (more likely to be projectiles) (Pasion, *et al.*, 2001). Moreover, the spacing of the two rectangles gives the instrument some capability to estimate the depth of an anomaly.

Composition of the object, its permeability to the primary magnetic field, mass, shape, and orientation all influence the rate of decay in the secondary field. Depending on its depth beneath the surface, any buried object which can sustain for a brief time its own induced magnetic field will be detected and recorded as an anomaly with a distinctive "magnetic signature" and precise geospatial location. Both strength and spatial extent of the magnetic signature comprise informative aspects of each datum, with some anomalies seeming to be 'larger' than others as determined in proportion to the unseen object's mass and physical size and inversely with its depth. While these data from all across Camp Ibis would likely indicate quite a range of mass, geophysicists skilled at interpreting such geophysical data gathered at other FUDS locations can discern individual objects of the appropriate size range (larger than 40 mm in diameter) to be deemed possible separate UXO items.

from the greater fraction of signatures indicative of individual smaller and non-hazardous pieces of metal. So, too, the instrument would record a strikingly large signature from massed clusters of projectiles, buried vehicular parts (such as driveshafts, differential housings, motors, etc.), flattened 5-gallon cans, and such.

It cycles back and forth between active and passive modes at 75 Hz. A full second of operation consists of slightly more than 250 milliseconds of magnetic field output; it listens for slightly less than 750 milliseconds. A motorcycle-size 12 volt battery supplies power to energize its active transmitting components. In use the instrument's primary magnetic field strength measured at a depth where desert tortoises commonly burrow, 30 to 50 cm below the surface, would range between about 400 and 200 milligauss, respectively. As a comparison, high voltage power transmission lines which cross desert tortoise habitat in several regions of the Mojave typically operate at 220 to 230 kilovolts and create a static magnetic field between 15 and 20 milligauss in strength at the ground surface beneath th wires (Kim, 2001) and penetrating to desert tortoise depth at virtually the same strength because of the higher voltage.

Meandering Path Transects

In the designated ranges where explosive munitions would have been fired at Camp Ibis, both tank and artillery crews aimed in the general direction of the Dead Mountains. Targets may have been anything visible anywhere in the ranges so long as the projectiles went towards the mountains. Abundant tank tracks still visible to the east of the wash probably reflect training in the fundamentals of tank maneuvers and they occurred all over the lower slopes of the Dead Mountains: drive, sight target, aim, fire, then drive some more. Now consider any two arbitrary spots in this general are The statistical expectation of finding any UXO item at one is virtually identical to that of finding a UXO at the other, because of the same causal reason for the projectiles' original dispersion across the desert landscape. Hence, the cart may be pushed anywhere without introducing statistical bi into geospatial data about each anomaly.

Although depicted as straight lines across the landscape, in reality every single transect would meander through the open spaces between perennia plants (Fig. 3). The geophysics teams manning each cart would include an authorized desert tortoise biologist and a qualified archaeologist. That authorized desert tortoise biologist would work ahead of the cart to identify desert tortoise burrows before the cart gets closer than 40 feet, steer away from them, scout the optimal route from one open space to the next, and determine how geophysical data acquisition may be accomplished without coming too near any single burrow. By telling the operator where to head next, the authorized desert tortoise biologist would guide that meandering course.

Fig. 3. Representative view looking eastward toward the Dead Mountains of the natural spacing of large perennials at Camp Ibis. Open ground between plants would facilitate meandering transects across this landscape. White bursage (*Ambrosia dumosa*), creosote bush (*Larrea tridentata*), and white rhatany (*Krameria grayi*) are the most numerous species in this view.

The technique would thereby avoid the opening to desert tortoise burrows by enough distance to achieve two beneficial effects. First, by its intensity[2] the percussive effects from explosion of a projectile would neither cause th burrow to collapse nor subject any desert tortoise in it to an injurious jolt. Secondly, the distance would minimize the duration of ground movement which any desert tortoise might experience. Explosion of a UXO causes ver transient and crisp initial ground movement: almost an instantaneous twitc felt through the ground, then nothing more. The single impulse which propagates away from the demolition site would be over so quickly that it i probably insensible to desert tortoises preparing for (October through mid-

2 proportional to both acceleration and velocity of soil particles in response to the force of an explosion; following appendix.

November) or already in winter torpor (after mid-November). Nor is it anticipated that they would be aroused from that seasonal metabolic state, unlike the documented arousal by the long, repeated rumble of thunder of monsoon thunderstorms which can awaken desert tortoises from summer estivation.

Thus, the meandering path includes an effective zone of influence to safeguard desert tortoises from all anticipated potential effects of UXO demolition. A concession of 40 feet between burrow and data gathering path would suffice for the movement of ground and material ejected by a 9 mm projectile (Table 1).

Avoidance of Desert Tortoise During Anomaly Detection

The authorized desert tortoise biologist accompanying each cart would not burrow entrances in a circular area of 40 foot radius and determine the general drift of the tunnel by looking into the opening, possibly illuminate it interior with a hand mirror, then exercise professional judgement how best to direct the cart away. The meandering path which results would skirt bo the opening of burrows (lower buffer zone in the illustration) and the tunne below ground (upper buffer zone) and stay primarily in open ground between large perennials (Fig. 4). Should either geophysics team happen upon a desert tortoise above ground, they need merely steer the cart away from the animal in any convenient direction without compromising the unbiased property of the data gathering technique.

The geophysics cart detects anomalies in a swath three feet wide. Some individual transects would meander over a comparatively short distance, ½ mile or so. Others would cover as much as three miles. The EE/CA study requires anomaly data from 3-foot wide meandering path transects which i total sum to approximately 92 acres. The geophysics phase necessitates pushing data carts across approximately 253 linear miles of Camp Ibis landscape.

Burial Locations

The EE/CA study would apply a somewhat different method over approximately 8 acres where physical evidence or camp records indicate something was buried. Rather than elongate and wavy transects, these sampling areas would be predetermined shapes (square or rectangular sample grids) placed deliberately where the surface appears to have been disturbed in the course of Camp Ibis's use as a training facility. At each location (small squares, large format maps enclosed, Figs. 6.1 and 6.2) a pl of land nominally 100 feet on a side would be delineated. Geophysical data would be gathered by pushing the cart to and fro over the entire sample grid. All 10,000 $ft^2$ of each grid would be included.

The authorized desert tortoise biologists would survey each proposed grid site entirely, including a buffer zone of 40 feet wide around the entire perimeter. Any desert tortoise burrow within the grid and buffer zone wou be mapped. Avoidance of that burrow might take one of three alternatives. Preferentially, if a thorough survey of adjacent land which fulfills the EE/CA objective of data about anomalies at possible burial sites reveals no desert tortoise burrows then the sampling grid would simply be relocated. Secondly, the proposed square grid could be deformed to any polygonal outline that still bounds a 10,000 $ft^2$ area surrounded by a buffer 40 feet wide. Provided no burrows lie within this polygon this alternative would st permit adequate surface area for geophysical data collection. As a last resort, a plot smaller than 100 by 100 feet would be delineated for geophysical data collection. The reduced size would still incorporate the 40 foot standoff from any desert tortoise burrows outside the actual perimeter nonetheless.

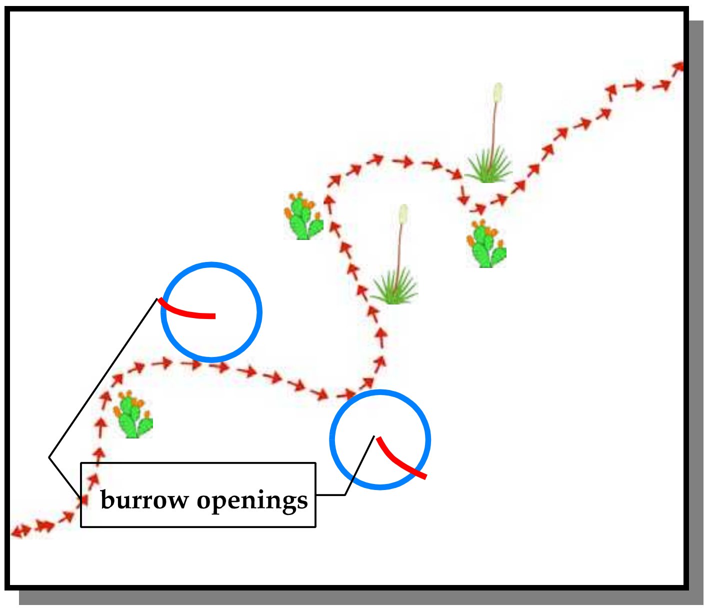


Fig. 4. Stand off zones (blue circles) around desert tortoise burrows (red lines) would be 40 feet in radius. Resultant meandering path (arrows) misses desert vegetation and precludes discovery of UXO items smaller than 90 mm in a location close enough to imperil tortoises below ground.

Avoidance of Cultural Resources

The archaeologist accompanying the cart would identify all cultural resources occurring within 15 meters of either side of the transect by mean of separate GPS instruments synchronized with the cart GPS unit. Archaeologists would return to identified cultural resource locations during the 1st phase and thoroughly record each site employing California Department of Parks and Recreation forms DPR523 (A-L). No anomalies located on or within 40 feet of the recorded cultural resources would be designated for subsequent investigation in the project's 3rd phase.

Soil Samples for Chemical Analysis

A modicum of data about WWII-era chemical constituents of soil derived from explosive ordnance would also be collected. These soil assays would be conducted at five locations near the western edge of the proposed proje area to establish background concentrations of chemical species in these soils. In addition, soils would be sampled at representative locations where digging yields ordnance related scrap. These samples would demonstrate any residual chemical effects of explosions which occurred in the past. About 45 such 'historical comparison' samples would taken. Where investigation reveals UXO, as many as five representative soil samples wou be collected in the immediate vicinity of the projectile before destroying it, then afterwards as many as three would be drawn from the soils of the crater its demolition creates. Colorimetric qualitative tests done in the field and quantitative assays by a soils laboratory for concentrations in soils of TNT, RDX, metals associated with explosive projectiles and fuzes, total phosphorus, and nitrates would yield cursory information about soil chemistry. Elemental lead, such as shaped bullets fired at small-arms ranges, would be removed by hand and excluded from analyses.

Both the authorized biologist and archaeologist would examine in advance the proposed location of all soil samples. Each would suggest alternative locations if appropriate.

Samples would be drawn by hand auger (3 inches in diameter, up to 6 inches deep, each complete aliquot approximately half a liter in volume). Prior to extracting each of the five background samples, the authorized desert tortoise biologist either would verify the proposed spot free of desert tortoise burrows or propose an acceptable alternative in the immediate vicinity. Soils not packaged for shipment to a laboratory and those used in the colorimetric tests would be placed back in the hole from which they we taken and compacted. All holes and trenches would immediately be back filled or sloped in such a manner as to allow any animals who should wander into the hole to be able to escape.

At minimum, fifty soil samples would be drawn from the ground, each 9.6 $in^2$ in surface area. These fifty samples include five background soil sampling locations and 45 samples associated with historic explosive impa locations. If no UXO were found, no further soil sampling would be necessary. At the most, discovery of 50 UXO would necessitate a maximur of 250 auger holes around the projectiles (pre-detonation chemical analyses and 150 auger holes in the rubble soil of the crater (post-detonation analyses). All samples potentially to be drawn total 450: the actual numbe would likely be much nearer 50 than 450.

Phase 2: Review of Geophysical Data, Anomaly Selection and Relocation

All data recorded at the carts' moving locations would be analyzed offsite b trained geophysicists. Using judgement from other UXO localities, and fron results of experimental tests conducted in January 2001 over seeded grour at Camp Ibis, this analysis would discriminate as best possible between the signatures of potential UXO and those of all other buried metallic objects th might turn up in a military camp. Those that experienced geophysicists think may be solitary ordnance items (or up to as many as three projectiles which happen to be very close together) would be nominated for explorator digging in order that the source may be identified.

Statistical validity of the EE/CA study also requires identification of a predetermined number of anomalies and therefore digging that number of holes. This is really a matter of sample size, the power of the statistical tes appropriate to assumptions about dispersion of UXO, and the procedural objective of eventually stating the average density of UXO at Camp Ibis. Th expectations for the EE/CA study require approximately 30 holes per geophysical acre to achieve a statistically significant result. That sampling density when applied to meandering transects means anomalies selected fo further investigation would be about 485 feet apart, on average. In the individual fixed grids, on average 7 anomalies would be investigated withir that area.

Beginning approximately 3 weeks following the start of geophysical data acquisition, a second coterie would begin relocating these designated anomalies. All travel would be identical to that previously described. Starting at the location indicated by geospatial coordinates hand held magnetometers would be used to re-discover the object and determine its alignment if that can be discerned. Anomalies would be marked temporaril with plastic pin flags.

Procedural Limitations to Emphasize UXO Singeltons and Avoid Aggregations

Those magnetic contacts judged by skilled geophysicists as conspicuously different from those typical of solitary anomalies but consistent with the flu intensity and spatial extent of objects grouped together – magnetic contact reasonably interpretable as the aggregate mass of more than three projectiles piled together for instance – would be highlighted in the geophysical data. They stand out as much too large to indicate anything except a single object far bigger than a lone projectile or massed separate objects. An aggregation of this sort would be most likely in suspected buri areas, if anywhere. In the conduct of the EE/CA study those specific anomalies whose geomagnetic data are consistent with the combined mas of more than three UXO would be excluded from intrusive investigation (phase 3); they would remain uncharacterized and undisturbed. Therefore, the proposed EE/CA action would not stray across the line into a localized UXO removal action wherein unexpected clumps of munitions which had been sequestered together would have to be destroyed and cause greater impact than anticipated to the desert's surface. The location of each large anomaly would be retained among the geophysical data.

The three paragraphs which follow lay out the rationale for excluding potential clusters of UXO from the third phase of the proposed EE/CA study at Camp Ibis. Inability to know the source of magnetic contacts without digging them up is at the root.

Surface disturbances have been identified in several isolated places within the proposed project area. A few have been confirmed by the customary rubbish of military encampments now visible on the surface as burial sites associated with Camp Ibis. Most have no proven link to it (although that is good bet). While the emphasis of an EE/CA study automatically makes one think of unexploded munitions (and in this context of disposal sites where ammunition might, perhaps, have been burned and the scrap covered up), all sorts of contents in rubbish pits could look 'suggestive' in geophysical data, e.g. an armful of steel reinforcement bars used in general constructio a scattered heap of used nails, discarded engine parts, and such. A chanc aggregation of projectiles in target areas is exceedingly unlikely because no two would have followed identical trajectories, failed to explode, and come to rest together underground without having been consciously covered up, i.e. a burial site with observable surface disturbance.

Procedural complications would ensue were excavation of anomalies in burial pits are and could reveal projectiles piled together. Geophysical data would be far more apt to reveal anomalies that suggest large aggregates of metal in trash pits than along transects which wander across undisturbed desert. Consequently, anomalies detected in putative burial areas would receive particular scrutiny during the review of geophysical data (phase 2). On one hand, ordnance disposed of this way in the 1940s, i.e. likely never t have been fired (and therefore unfuzed, or with attached but unarmed fuzes and inaccessible and not manifest because it's buried, does not pose an imminent hazard to the public. On the other hand, once revealed by investigation then it becomes precisely such a hazard and must either be effectively secured somehow or demolished. In effect, such a discovery of many rounds would compel their demolition, perhaps *en masse* if warranted by concerns for safety.

Future decisions about a prudent course of action regarding any evidently large contacts, which go beyond the intent for this proposed EE/CA study and possibly to be implemented at an indeterminate later date, explicitly would also entail a separate evaluation of potential environmental consequences and consultation with the USFWS would be reinitiated. Prio to any form of potential UXO removal action involving suspected ordnance caches the Corps needs to assess safety hazards, convey the results to all agencies concerned, coordinate thoroughly with BLM on how best to proceed pending the outcome of appropriate deliberations, and would be dependent on approval by BLM. Any demolition of cached UXO would be accomplished under separate authorization.

Phase 3: Digging to Reveal and Identify Each Anomaly, and Demolition of Solitary UXO

Within a few days after phase 2 begins, UXO specialists would begin to excavate each marked anomaly. Should a desert tortoise be walking nearb when the investigation team arrives, the digging crew has several options; 1) move on to the next anomaly to be investigated then return, 2)wait the desert tortoise out until it has walked away, or 3) summon the authorized desert tortoise biologist and have the animal picked up and moved, in accordance with USFWS protocol, to a safe place on the far side of an intervening ridge.

Under ideal situations, desert tortoise burrows can be quite long and meandering. It is possible, but unlikely given the preparations to skirt all burrow entrances, for intrusive investigation to start above a burrow that escaped notice. Despite the odds of starting to dig toward an unseen burrow, should the excavation break through into a tunnel or other underground vacuity, digging would cease until the authorized desert tortoise biologist can examine the space. If the tunnel is determined to be that of a desert tortoise, that particular anomaly would be abandoned in favor of an alternate. The tunnel would be cleared and a makeshift patch fo the hole would be made from plywood and the patch covered over with dir

Intrusive investigation would not disturb any more desert soil than necessa to reveal the object detected previously, since benign objects would merely be covered back up and left in place once they have been identified. Photographs would be taken of several representative locations to show th existing surface covering anomalies before any digging begins. Here again experience at other FUDS locations would indicate that 85% of all 3,000 holes dug for this purpose (approximately 2,550 total) would be smaller in surface area and size than four shovelfuls (approximately 50 $in^2$), largely because most anomalies would prove to be ferrous construction materials, miscellaneous parts broken off vehicles, metallic flotsam of daily life in military training camp, or sizeable pieces of fragments from shells which exploded properly, and all commonly just barely below the surface. Indeed many of these can be revealed sufficiently merely be nudging aside the dirt with the edge of a boot. Those anomalies demonstrated to be non-hazardous would be recorded, the dirt tamped back into the hole, representative photographs taken to show the restored surface afterward, and the object left to rust away.

A buried object of which at first glimpse reveals something projectile-like mandates greater caution as digging continues. If a projectile, the hole mu be large enough to expose fully both ends and still allow people to work wi unencumbered hands around it. Excavations of such items at Camp Ibis could necessitate holes as large as two and a half feet long, one foot wide, and eighteen inches deep (2½ square feet, about 0.3 $m^2$ in surface area). A few representative photographs would be taken to show the nature of such explorations. The decision about disposition of each such discovery require being able to see all of it. Those demonstrated to be inert practice rounds would be physically removed from the hole, demilitarized and hauled away from Camp Ibis. Demolition *in situ* of any UXO would enlarge surface area disturbed from about 0.3 $m^2$ to about 1.75 $m^2$ by creating a circular crater about 1½ meters in diameter and as deep as the projectile itself had penetrated. A final brace of representative photographs that show clearly the net effect of surface disturbance would be taken of the crater itself and after it has been backfilled and compacted. The ensemble of photographs would represent the effects resulting from investigation of and preparation for demolition of the full gamut of UXO that may be encountered at Camp Ibis, and would include images of any trenches dug to protect burrows at a distance from the shock effects of projectiles larger than 90 mm (although such bigger munitions are not anticipated at Camp Ibis).

Any UXO items discovered during the EE/CA study at Camp Ibis, including any visible on the surface, would have to be destroyed (§§8-9a, Corps of Engineers, 2001). Demolition procedures which cause the minimal achievable effects to the surrounding area, and which are fully consistent with all personal safety requirements, would be employed as appropriate to the circumstances of each separate UXO item. Depending on time of day when technicians finish digging to lay bare a UXO item, it may be too late in the work day to deliver commercial explosives to the location so its demolition would have to be put off until the next day. In that event, a piec of plywood would be placed over the hole and its edges covered with rock and dirt to prevent a desert tortoise from falling into the excavated site. Alternatively, temporary desert tortoise fencing could be raised around the hole. A guard would stand watch at any UXO item thus left exposed from one work day to the next in those parts of Camp Ibis readily accessible by citizens.

Avoidance of Desert Tortoise During Demolition

During desert tortoise active season, it is possible that a desert tortoise(s) could wander into the vicinity of demolition preparations and be in peril. There always comes a final moment during preparations of all explosive items regardless of size and TNT content when personal safety considerations preclude anyone other than authorized UXO specialists being at the demolition site for any reason. Immediately prior to demolition, authorized desert tortoise biologists would conduct a final survey of the site and buffer zone, provided a UXO escort accompanies them. The extent of this protective scan depends on local topography and the protective means assembled around the item. In most circumstances, a final survey over an area 150 to 200 feet in radius would find any desert tortoises above ground This scan would be done from a few different vantage points around the item and looking toward it. Any desert tortoises seen would be picked up and moved to safety one hundred to two hundred yards distant, or to the fa side of sheltering ridges that are at least 100 feet away if topography allow so long as animals would be far enough away that they cannot walk back into danger at the UXO location in a few minutes. Carrying animals to a nearby refuge would also minimize the chance of shrapnel or rocks, thrown by the explosion, striking a desert tortoise farther away.

Once demolition of the UXO has been accomplished the authorized desert tortoise biologist would check on any burrows in the general area to verify their integrity, and monitor the area for about half an hour to observe any unusual behavior by desert tortoises who emerge. Untoward behavior, suc as animals coming above ground unseasonably immediately after a detonation, is not to be expected in light of the 40 foot safety radius from burrows. The authorized desert tortoise biologists would exercise professional judgement in assisting any desert tortoise displaying unusual behavior.

The meandering transects and the scrutiny given to sample grids prior to geophysical data gathering would inherently result in enough distance between desert tortoise burrows and the types of projectiles, 90 mm or of smaller caliber, expected to be present at Camp Ibis that explosion of those UXO items would not damage burrows. The project description has a contingency which would require different methods to minimize risk to desert tortoises in the event of the unlikely discovery of UXO items with mo high explosive filler than the 2.04 pounds of a 90 mm round (Table 1). These contingency methods would be implemented as soon as UXO specialists identify the item. Under the explicit escort of a UXO safety office the authorized desert tortoise biologist would search thoroughly for desert tortoise burrows in a radius 60 feet or 100 feet from the item, for a 105 or 155 mm projectile, respectively. If no burrow exists within that limit, preparation for demolition of the item would continue. Any burrow within that radius would be mapped cursorily and the entrance marked in temporary fashion.

Then, one of two steps would be implemented under the direction of the authorized desert tortoise biologist. First (and preferable) would be excavation of a small ditch in a direct line between the UXO item and the burrow within the area of potential effect. The trench would act as a shock absorber by interposing an air space between the UXO item and the burrow because the gap blocks propagation of explosive forces through the soil between an item. The trench would be made with the same hand tools; between one and three feet long, a foot wide, and slightly deeper than the item itself, by a few inches. It would be as close as 10 feet from the UXO. Shock waves crossing such a gap in the soils lose virtually every bit of their energy, hence much less force reaches a burrow still farther away. This technique is widely used in commercial blasting to prevent damage to structures from explosives which have to be used nearby (Crull, 2001). All material dug to make this protective feature would be piled on a ground cloth, then put back and compacted after the demolition has been accomplished.

Second (and less desirable), the authorized desert tortoise biologist would examine the burrow using an endoscope. If empty, the entrance would be blocked temporarily. If occupied and the tunnel leads away from the item then the animal could be sequestered inside by blocking the entrance temporarily (a matter of an hour or two at the most). Alternatively, the authorized desert tortoise biologist would temporarily remove the desert tortoise(s) from its burrow and carry it a safe distance away, in accordance to protocol methods. In the circumstances of each preparation for blowing up a projectile larger than 90 mm, the authorized desert tortoise biologist would weigh the potential effects of small-scale surface disturbance (up to ft$^2$ of additional surface area disturbance) against excavation of a burrow and forcible temporary relocation of the occupant.

Surface Area Disturbance Attributable to EE/CA Activities

Extraction of soil aliquots for chemical analyses would require disturbance native soil surfaces. Holes made by augers would total somewhere betwee 50 and 450, depending on the number of UXO encountered. If 450, then th combined total impact of soil sampling would alter approximately 2.8 m$^2$ (3.35 yd$^2$) of desert surface.

Statistical objectives for the EE/CA study would necessitate investigation of as many as 3,000 anomalies at random locations throughout the project area. Investigation of each anomaly would require moving dirt aside to reveal the buried object. Estimating conservatively, roughly 85% of the anomalies would require three or four shovelfuls from an area about 5 by 1 inches. Each one of these investigations would thus disturb about 0.03 m$^2$ (50 in$^2$). The total disturbance caused by these smaller investigations woul measure about 85 m$^2$ (102 yd$^2$). The remainder of anomalies investigated would each necessitate a hole as large as about 2½ square feet. Approximately 450 investigations would each need a hole this size; in total these would thus disturb about 105 m$^2$ (125 yd$^2$). Any ordnance items encountered during the study would be destroyed explosively. In soils of th nature found at Camp Ibis demolition of projectiles 90 mm or smaller in diameter commonly produces a crater not wider than approximately 1½ m (4.1 feet) in diameter. Ordnance experts anticipate finding fifty projectiles o all caliber (counting 75, 76, 90, 105, and 155 mm shells) in the most pessimistic expectation of UXO contamination at Camp Ibis. Out of fifty total, 48 of those projectiles would be 90 mm in diameter or smaller. Explosive demolition of these UXO items would cause total surface disturbance equal to 85 m$^2$ (102 yd$^2$).
Larger projectiles, 105 mm and 155mm, could still lie at Camp Ibis, but the occurrence is extremely unlikely. If present nonetheless, their demolition would disturb additional surface area. The two bigger rounds would eject soil from wider craters, 2½ and 4 meters in diameter, respectively. For the sake of completeness, consider the foreseeable maximum of two 155 mm projectiles. The craters would each affect a surface area of about 12½ m$^2$ (15 yd$^2$). Any shock absorbing trenches excavated during the preparation could total as much as 2½ m$^2$ (3 yd$^2$). Combined, preparations for bigger projectiles would disturb about 15 m$^2$ (18 yd$^2$) in total. Two such projectile

would mean disturbance to 30 $m^2$ (36 $yd^2$) of desert surface.

All totaled and expressed in round numbers as the estimation of the greates probable disturbance, at the most assorted actions would disturb less than 350 $m^2$ of desert surface [in four separate ways: 1) soil samples, 0.45 $m^2$; 2 excavation of anomalies, 85 $m^2$ for smaller investigations and 105 $m^2$ for bigger ones; 3) demolition of 48 UXO 90 mm in diameter or smaller, 85 $m^2$; 4) demolition of 2 UXO 155mm in diameter and shock absorbing trenches, 30 $m^2$ . Added together, surface area disturbance totals 305 $m^2$, that is to say, less than 350 $m^2$. Converted to English measurements, this equals approximately 365 square yards, or less than 0.1 acres (about 3300 $ft^2$). If no UXO of any type were discovered during the EE/CA study, as some ordnance experts anticipate, soil samples and intrusive investigation would disturb about 191 $m^2$ (about 230 $yd^2$, 0.05 acres) of surface area. The final result would probably fall between the two estimates, and indicates that digging to reveal anomalies would have a greater net effect than the foreseeable effects of blowing up old ordnance.

All holes would be filled and compacted with the loose dirt immediately available. All holes that can not be completely back filled would be sloped i such a manner as to allow wildlife to escape. Undisturbed nearby ground would not be broken up to provide fill for holes.
Reclamation for the Proposed Action:

The excavations would be backfilled and compacted with the soil taken fro them in the first place. Where a UXO item left a conical pit and spread dirt over too broad an area, it may not bet reasonable to try to retrieve it all. In that event, such loose materials as can be raked together would be put bac and compacted, but efforts to obliterate all such marks would result in surface damage of a larger area than the pit itself. All pits would be sloped in such a manner as to allow wildlife to escape.

Compaction of backfill would not likely achieve the same solidity as undisturbed soils. A desert tortoise coming upon these spots later might b tempted to burrow in them where the digging is easier. The animal would quickly reach the limits of the hole dug to investigate anomalies and then encounter soils of native texture and compaction.

Disturbed surfaces foster opportunities for exotic vegetation such as schismus, bromus, and cheat grass to spread into uncolonized areas. Thes species currently inhabit Camp Ibis, but are comparatively scarce.

The likely pattern of intrusive investigation would create widely separated spots where soils would be more receptive to these grasses. Additionally,

none would be larger than about two and half square feet in area (0.3 squa
meters). If UXO items are discovered, the surface disturbance left behind
from their demolition would not likely exceed about thirteen square feet (1.2
square meters).

The EE/CA study may lead to a small encroachment by these species into th
desert landscape at Camp Ibis but is not anticipated to spread beyond the
small above mentioned area, or occur in any greater abundance than what
found in other nearby previously disturbed areas.

Experimental and calibration tests of the geophysical handcart were conducted in late January 2001 at a location close to the monument. An authorized desert tortoise biologist from BLM examined the proposed area and found no evidence of desert tortoises or burrows. The location typifies the soils and plant growth form seen elsewhere at Camp Ibis. The small ca
can easily be steered away from larger bushes and straddles those with a low, mounded growth form such as the bursage which predominates at th
spot (Fig. 5A), barely brushing the upper branches. The cart leaves temporary, visible tire tracks where alluvial soils do not have a desert pavement. Those tracks pictured here (Fig. 5B) varied in width from 2 to 4 cm depending on stiffer or softer ground. The cart left no tracks wider thar
4 cm in sandy soils and where the surface was rocky it made no visible trac
at all. Where the carts leave visible tire tracks at points of entry into the wilderness area, the tracks would be swept to remove the potential for the tracks to entice vehicular entry.

Fig. 5A (above) and 5B (right). Calibration tests of apparatus in January 2001 demonstrated the ease with which the hand-pushed cart may be steered through the open ground at Camp Ibis. White bursage, creosote, and white rhatany predominate, but there is still ample space to accomodate the cart. Dead Mountains are in the background.

Tire tracks are no deeper than footprints in the soils on these bajadas. Two sets of tracks overlap here. The tape marks one set, about 1¼ meters between the wheels. Note white bursage in the background.

UXO specialists with experience from other FUDS training sites anticipate that the great majority of the holes dug at Camp Ibis would require no more than a couple turns with a shovel. A roughly rectangular excavation 2½ fee long by a foot wide by 1½ feet deep would be big enough to investigate all likely UXO. Safety concerns may warrant the use of sand bags around UXO preparations, especially any found closer to the highway than the distance steel fragments may carry. Sand would be taken from Piute Wash or the sandy bottom of unnamed feeder washes leading to it. Any spot proposed as a source for sand would be surveyed first by an authorized archaeologist and biologist. The upper-most four inches of loose sand would be scooped into sacks with shovels only from those places determined to be devoid of cultural resources, vegetation (living, or dead but still rooted), and desert tortoises. Burlap sacks would be filled with sand, stacked in an igloo-like manner around the projectile, and above it on a thin plywood roof. Burlap used this way does not burn readily, hence reducing the chance of fire in th vicinity. Shreds larger than 1 inch in diameter would be picked up and removed after a demolition. This would minimize the prospect of desert tortoises finding and eating this coarse fabric. If a protective trench betwee a UXO and a burrow becomes necessary, that safeguard would still be only about three feet in length by one wide and one and half deep. Explosion of UXO item would form a conical crater perhaps four feet in diameter and as deep as the item buried itself, on average, a foot and half feet deep.

Pipeline Traversing Project Area

Topographic maps from U.S. Geologicalcal Survey (1:24,000 scale) record a pipeline traversing the EE/CA project area. Its alignment roughly parallels Piute Wash, about half a mile west of it and along the eastern edge of the military cantonment itself, and trending from southeast to northwest. Its actual existence cannot be verified from records kept by any agency or private company whose business revolves around fluids sent through pipelines (e. g., petroleum or distillates, natural gas, water, slurry, helium, etc.). Moreover, the alignment indicating the putative pipeline simply ends several miles north of the Camp Ibis, but at no obvious destination. The pipe may, or may not, be there in fact.

Geophysical data will instantly confirm or refute its existence, as a very intense magnetic signature from a uniform linear anomaly. In fact, a buried pipeline would return a magnetic signature so overwhelmingly strong as to wash out completely the signature of solitary, nearby anomalies and make them impossible to discern. Thus, no anomalies would be investigated close to the putative pipeline.

Its alignment came so close to the cantonment that soldiers assumably would not have aimed artillery there, their very backyard. Hence, the likelihood of finding an unexploded munition anywhere near the pipeline is vanishingly small. Should a UXO be discovered near enough to raise concerns for the structural integrity of the pipe from the percussion, techniques uniformly accepted as industry standards for avoiding damage to nearby infrastructure features would be implemented. Chiefly, these would involve digging one, or perhaps two, trenches between the projectile and the pipe. The distance between them and the size of the UXO item would dictate the depth of the trenches; none deeper than two feet should ever be required during this EE/CA study.

## SITE SAFETY

A Site Safety and Health Plan supports the proposed undertaking. The plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted at fieldwork sites. Sections cover field responsibilities and work procedures, physical and chemical risks, emergency procedures, and levels of protection. Site-specific information such as a project description and sit history, a contingency plan, training, site access control, a list of emergency contacts and their locations, and necessary health and safety equipment ar also addressed.

### Site Control

Site access control would be implemented by the UXO Safety Officer based on site-specific characteristics including:

1. Potential explosive hazards;
2. Terrain;
3. Expected weather conditions;
4. Planned site activities; and
5. Work zone proximity to the public.

Site access control would include the following:

1. Worker/visitor registration;
2. Escort of visitors;
3. Personal Protective Equipment;
4. Flagging of site/work zone boundaries; and
5. Establishment of Minimum Standoff Distances (MSD).

MSD's and Site Closing Data

Based on a review of archival data, the 155mm projectile has been identified as the largest and most energetic artillery round utilized during training activities at the former Camp Ibis. As such, this round was given the preliminary designation as the most probable munition (MPM) for each of the three sectors (A, B, and C) within the site. The MPM is used to calculate a working exclusion zone within which only UXO-qualified personnel essential to the operation may enter and all others, including the public, must remain beyond. The MSD is dynamic and moves based on the specific anomaly location. For a 155mm projectile the MSD is 2,577 feet unless COE approved engineering controls are implemented. Typically two independent intrusive investigation teams would work onsite, thus two MSD exclusion zones would be active at any given time.

Engineering controls may potentially include such structures as the prefabricated aluminum Open-Front Barricade (OFB), sand bag enclosures, and water-filled container structures. These engineering controls could be used during the intrusive (digging) portion of the work and would reduce the MSD by a predetermined distance. Approval for using engineering controls is granted on a case-by-case basis and by the Chief of OE Safety at the Corps of Engineer's Engineering and Support Center at Huntsville, Alabama.

The OFB is constructed of aircraft-grade aluminum, can be reduced to pieces of frame and containment plates, is easily transported and can be assembled by hand. This OFB will reduce the MSD to 300 ft on the enclosed sides (270 degrees). However on the open side, the MSD remains at the original distance (2,577 feet for 155mm projectile MPM) and would face away from the area being protected. To reduce the MSD any further would require justification and detailed engineering calculations and design.

Prior to determining the need for more elaborate safety barrier designs and approval around Camp Ibis' active transportation routes (U.S. Highway 95 and Burlington Northern Santa Fe Railway), the non-intrusive geophysical survey and anomaly selection process would be completed. Geophysical findings and target selections, tempered with biological and archeological restrictions, would dictate whether intrusive investigation of individual anomalies would be pursued. Further review of historical documents and findings may be used to support a request for modification of the MPM and subsequent reduction in the MSD for some areas within the site, where either live artillery training was not likely or evidence of smaller arms training can be justified. In addition, some anomalies could be deferred from intrusive investigation or engineering controls could be approved, engineered, and mobilized in order to alleviate the impacts to traffic routes.

Air pressure (acoustics/sound) is also a factor considered when designating exclusion zones. The 155mm projectile has a 141 feet radius outside of which potential damage or rupture of human eardrums is unlikely. This distance is referred to as the K-50 overpressure distance and is calculated based on an overpressure tolerance of 0.09 PSI. The K-50 overpressure distance for the 155mm projectile is notably less than the MSD of 2,577 feet and is less than the reduced MSD resulting from implementation of engineering controls.

The EE/CA investigation will be performed over approximately 100 acres in the form of small grids and transects distributed throughout the 13,398 acres of the former Camp Ibis. Securing the MSD exclusion zone (i.e. closing the work areas to the public) is required during the intrusive investigation phase of the EE/CA only and is not necessary during the geophysical survey. During intrusive operations, field teams would delineate the approximate work area each day and mark the exclusion zone with highly-visible flagging. The flat terrain and flagging would then aid the MSD guards/monitors to use line-of-sight monitoring to identify an impending potential breach by unauthorized personnel (the public). The work is expected to typically be performed Monday through Thursday and 6:30AM through 5:30PM.

Where U.S. Highway 95 falls within a MSD, traffic control would be coordinated with the California Department of Transportation, California Highway Patrol and San Bernardino County Sheriff’s Department. The Burlington Northern Santa Fe Railway would be briefed on the project and notified of the project’s schedule. However, intrusive investigations and intentional detonations would be timed to take place when trains are positioned beyond applied MSDs.

Desert Tortoise Protection Measures

The following measures are incorporated as project mitigation measures. The purpose of these measures is to minimize anticipated impacts on the desert tortoise and its habitat. An authorized desert tortoise biologist, as used below, is defined as a wildlife biologist who has been authorized to handle desert tortoises. An authorized desert tortoise biologist must be approved by the USFWS, the California Department of Fish and Game, and the BLM.

1) All personnel who work on-site would participate in a desert tortoise education program prior to initiation of field activities. All personnel would receive formal, approved training prior to working on-site. The program would cover the following topics:
-distribution of the desert tortoise,
-general behavior and ecology of the desert tortoise,
-sensitivity to human activities,
-legal protection and penalties for violations, and
-project protective mitigation measures.

2) To assure observation and avoidance of any desert tortoise in roadways, the proponent would travel no more than 10 mph on all dirt roads and washes. During desert tortoise active season, overnight parking and storage of equipment would be within the desert tortoise fenced area. During desert tortoise hibernation season overnight parking would be in previously disturbed areas. Vehicular traffic is permitted only on five existing dirt roads and along Piute Wash.

3) Desert tortoises would be handled only by the authorized desert tortoi biologist and only when necessary. The authorized desert tortoise biologist would follow the "Guidelines for Handling Desert Tortoises During Construction Projects", Desert Tortoise Council, 1994 (revised July 1999).

4) The areas of disturbance would be confined to the smallest practical location, considering topography, placement of facilities, location of burrows, and public health and safety. Areas would be marked to minimize surface disturbance. Special habitat features, such as burrows, identified by the authorized desert tortoise biologist would b avoided to the extent possible.

5) During the operations, any pits or trenches temporarily created, would at the end of the work day, be sloped in such a manner as to allow

wildlife to escape. All operations would cease and workers would lea
the site before nightfall. Any trenches would be inspected for desert tortoises before work begins the following day. Any desert tortoises found in the project area would be relocated in accordance to the protocol measures.

6) Dust suppressant use is not anticipated. In the event that dust suppression becomes necessary water would be used, but only durin periods of desert tortoise dormancy.

7) The authorized desert tortoise biologist would be on-site at all times. T authorized desert tortoise biologist would guide each data acquisition team through the natural open spaces of Mojave Desert vegetation.

8) Temporary desert tortoise fencing would surround the primary rally po during desert tortoise active season.

9) Precautions would be taken to ensure that no desert tortoises would b harmed. Each burrow and pallet that could not avoid being destroyec would be examined individually using a fiber optic cable to determine is active. If a desert tortoise is located in one of these burrows, the desert tortoise would be excavated by an authorized desert tortoise biologist and relocated in a nearby burrow of similar depth, length anc direction, according to the Desert Tortoise Council protocol (1999). Th desert tortoise would be temporarily marked and monitored on a week basis to determine its status. Monitoring would continue until the en of the project.

10) All other desert tortoise burrows/pallets within the proposed project areas would be marked in such a manner so as the equipment and ha operators would be able to identify and avoid such burrows. Flaggin these locations would be performed prior to initiation of the proposed project.

11) Any investigation that unexpectedly breaches a desert tortoise burrow would be halted and a makeshift patch for the burrow would be installed.

12) During the operation an authorized desert tortoise biologist would remove any desert tortoises that are threatened. It would be moved to nearby location in accordance with the 1994 Desert Tortoise Council protocol (1999). For each removal, the proponent would submit a pos project report identifying all activities affecting the desert tortoise to th USFWS Ventura Office and to the BLM Needles Field Office.

13) The authorized desert tortoise biologist would ensure at least a 40-foo separation between any aspect of a desert tortoise burrow and magne anomalies to be investigated. While desert tortoises are still active ab ground, the authorized desert tortoise biologist would search the entir area surrounding a UXO item about to be destroyed for animals on the surface. If one is found, it would be moved to safety according to protocol. Remnants of engineering control structures (e.g., gunny sac used as sand bags and water-filled containers) used during UXO demolition would be picked up from the surrounding area following its demolition. The authorized desert tortoise biologist would monitor the vicinity for about half an hour after an explosion to aid desert tortoises exhibiting atypical behavior.

14) The authorized desert tortoise biologist would maintain a record of all desert tortoises handled. This information would include for each des tortoise:

1. The location(s) (narrative and maps) and dates of observations
2. General condition and health, including injuries and state of healing and whether animals voided their bladders;
3. Location moved to and from;
4. Diagnostic markings (identification numbers or marked latera scutes); and;
5. Photographs of each handled desert tortoise.

15) Upon locating a dead or injured desert tortoise (that occurred due to project activities), the BLM would notify the USFWS within 3 days of t finding. Written notification would be made within 5 days of the findi The information provided would include the date and time of the findi or incident (if known), location of the carcass or injured animal, a photograph, cause of death, if known, and any other pertinent information. The injured animal would be transported to the nearest qualified veterinarian for treatment. If the animal recovers, the USFWS Ventura Office would be contacted for final disposition of the animal.

16) If a death should occur, the BLM would place the remains of intact desert tortoise carcasses with educational or research institutions holding the appropriate State and Federal permits. If the remains are poor condition, the information noted above would be obtained and th carcass left in place. If left in place and sufficient pieces are available, the BLM would mark the carcass to ensure that it is not reported agai

17) Workers would inspect for desert tortoises resting in the shade under vehicle prior to moving it. If a desert tortoise is present, the worker(s) would carefully move the vehicle only when necessary and when the desert tortoise would not be injured by moving the vehicle. If this is n possible, the worker(s) would wait for the desert tortoise to move out

from under the vehicle before moving the vehicle or the authorized desert tortoise biologist would carefully move the desert tortoise using the previously mentioned protocol methods.

18) No dogs or firearms would be permitted on any of the project sites.

19) All trash and food items would be promptly contained within closed, raven-proof containers. These would be regularly removed from the project sites to reduce the attractiveness of the areas to ravens and ot desert tortoise predators.

20) Biologists would be certified as authorized for the project by the USFV and BLM prior to initiating EE/CA field activities.

## 14.2 No Action Alternative:

The Proposed Action would not be undertaken as proposed. Existing management and use of the site would continue subject to applicable statu regulations, policy and land use plans.