



U.S. Army Corps
of Engineers
Huntsville Center
Los Angeles District

Community Update



U.S. Army

Update 4

Engineering Evaluation/Cost Analysis For East Elliott, San Diego, California

The U.S. Army Corps of Engineers (USACE) is preparing a series of Community Updates to inform citizens of the status and findings of ordnance and explosives (OE) cleanup actions at East Elliott, located in San Diego County. East Elliott is a 3,200-acre (5-square mile) area that lies within the boundaries of the City of San Diego. The site is bordered by Marine Corps Air Station Miramar, the City of Santee, State Highway 52, and Mission Trails Regional Park (Figure 1).

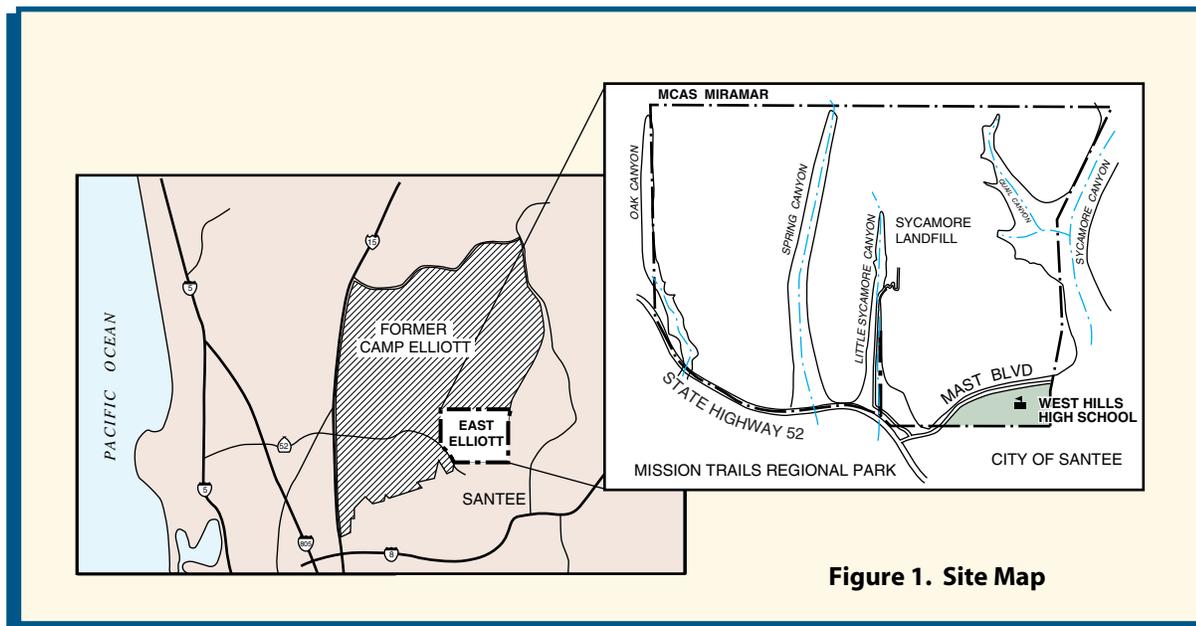


Figure 1. Site Map

Site Background

East Elliott is in the southeast corner of former U.S. Marine Corps Camp Elliott, a training facility that was active from 1917 (as Camp Kearney) to 1960 and once occupied 30,500 acres. During the 1940s and 1950s live-fire training involving tanks and artillery resulted in the presence of OE, including unexploded ordnance (UXO), within East Elliott. OE consists of abandoned, unserviceable, or excess ordnance and explosives (i.e., munitions). OE includes both intact munitions or munitions fragments. UXO is a subset of OE that includes munitions that still pose an explosive hazard.

This community update discusses the results of the Engineering Evaluation/Cost Analysis (EE/CA) for East Elliott. An EE/CA is an evaluation of remedial options for a site based on effectiveness, implementability, and cost of each remedial action. This EE/CA, prepared by USACE and submitted in August 1999 after review by the California Department of Toxic Substances Control (DTSC),

calls for removal actions for the majority of the areas within the East Elliott boundary.

The EE/CA Framework and Process

The East Elliott EE/CA was prepared under the Defense Environmental Restoration Program - Formerly Used Defense Sites (FUDS). A FUDS is a facility or site that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination.

Montgomery Watson Americas, Inc., was contracted by USACE in Huntsville, Alabama, to prepare the EE/CA. USACE's Huntsville Center (CEHNC) has been designated as Center of Expertise and Design Center for OE-related activities, and is responsible for the design and successful implementation of OE remedial activities required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), including those associated with FUDS.

In accordance with the Removal Action Planning for Ordnance and Explosive Waste Sites Procedural Document, issued by CEHNC in 1995, an EE/CA must be completed for all non-time-critical removal actions (i.e., those requiring a response no sooner than 6 months after a determination has been made that a response is necessary). The EE/CA process described in the CEHNC Removal Action Planning guidance is in substantial compliance with the National Oil and Hazardous Substances Pollution Contingency Plan issued by the U.S. Environmental Protection Agency in 1993.

The purpose of the EE/CA is to characterize the site; assess potential risks associated with the site; identify removal action alternatives; evaluate the alternatives based on the criteria of effectiveness, implementability, and cost; and propose the selected alternative. The EE/CA process is particularly applicable to sites with potential OE contamination because there are proven technologies for the control or removal of OE. Removal action alternatives typically include institutional controls, physical removal of the OE-related hazard, or detonation in place. Detonation in place can be selected if it can be shown that the residual debris resulting from the detonation will not constitute a risk to public health or the environment.



Sycamore Landfill

East Elliott Today

East Elliott currently consists of 165 parcels, owned by more than 85 private individuals; the cities of San Diego and Santee, California; several land development firms; two school districts; and a public utility company. Mast Boulevard and West Hills High School are located in the southeast corner of the site. The Sycamore Landfill occupies approximately 170 acres in the center of East Elliott.

Although most of the open space at East Elliott is privately-owned, unrestricted access along its southern boundary and its proximity to Mission Trails Regional Park makes it attractive for a variety of recreational uses including hiking, mountain biking, jogging, motor biking, horseback riding, and off-road vehicle use. Rock climbers also use several clusters of large boulders located near the southeast corner of the site. Several dirt roads and trails are located along the ridges and canyons (Oak Canyon, Spring Canyon, and Little Sycamore Canyon).



Rock Climbing Area in the Southeast Corner of East Elliott

The City of San Diego Planning Department has evaluated the biological resources of East Elliott in the context of its draft regional plans for open space and habitat protection. Of particular concern is the Multiple Species Conservation Program, which seeks to preserve endangered habitats such as the coastal sage habitat that exists within East Elliott. This habitat serves as home to the California gnatcatcher, a federal threatened species and California species of special concern. According to the Multiple Species Conservation Plan, East Elliott is included within a "core resource area," which is defined as an area with a "high concentration of sensitive biological resources which, if lost, could not be replaced or mitigated elsewhere." Over 65 percent of the habitat within East Elliott is considered to be of "very high" value. In addition to the California gnatcatcher sensitive species identified in the vicinity of East Elliott include willowy monardella, San Diego ambrosia, and least Bell's vireo.



California gnatcatcher

Three probable future land use scenarios have been identified for East Elliott: 1) dedicated open space (i.e., undeveloped) with habitat preserves and continued recreational use; 2) landfill construction; and 3) residential construction, consisting of a mix of single family residential, institutional, and open space land uses. The Sycamore Landfill plans to eventually expand to 500 acres. The City of San Diego has also proposed the area between Oak and Spring canyons as the location of a new 700-acre landfill for which construction would begin in 2005. In addition, the continued population growth and development of the San Diego area may result in increased pressure to develop privately owned parcels.

OE Encounters at East Elliott

In recent years, considerable attention has been focused on OE investigations within the Tierrasanta and Mission Trail areas of former Camp Elliott located south and southwest of East Elliott. The pivotal event that drove these investigations and subsequent ordnance cleanups in Tierrasanta and Mission Trail was the 1983 accident that killed two boys when a 37-millimeter high-explosive projectile exploded when they found it in the open space adjacent to their Tierrasanta homes. Considerable public attention was brought to bear on OE hazards associated with former Camp Elliott following this accident. These events also provided the impetus for continued evaluation and active remediation of OE hazards in the area from 1984 to the present.

At East Elliott, site workers involved in landfill construction and biological assessments found UXO at several locations in the 1980s and 1990s. There are also anecdotal reports of detonations during brush fires in the area. Investigations at East Elliott were conducted by explosive ordnance disposal teams in 1984 and 1994. OE found during these investigations primarily consisted of loose fragments of 37-millimeter and 75-millimeter shells; no UXO was found.



OE, 75-mm Shell



OE Found at East Elliott

East Elliott Archive Search Report

In 1995, under a contract with USACE, Montgomery Watson Americas, Inc. prepared an Archives Search that addressed the past uses of ordnance at various portions of East Elliott. The archives search assembled historical records and available field data, assessed potential ordnance presence, and recommended OE follow-up actions. Based on all the information gathered during the archives search,

the following known or suspected firing points and ranges that may have resulted in ordnance contamination at East Elliott were identified:

- Possible tank firing area in the southeast corner of East Elliott
- Jacques Farm, located approximately 6.4 miles southwest of East Elliott
- Main Camp Elliott firing point, located approximately 6.3 miles west of East Elliott
- Anti-tank range, located approximately 2 miles west of East Elliott

1996 Ordnance and Explosives Investigation

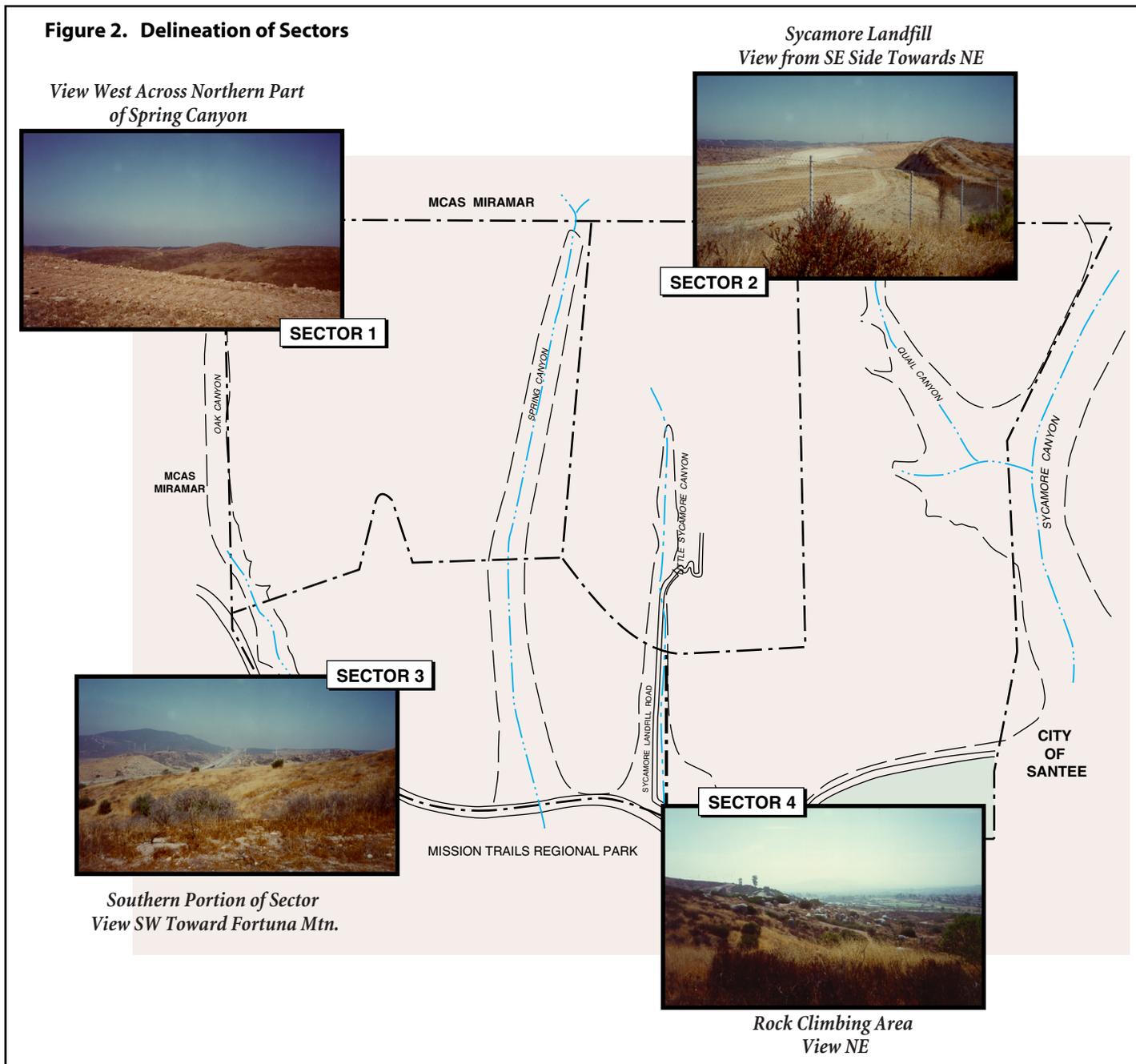
To evaluate the nature and extent of ordnance contamination at East Elliott, an OE investigation in the East Elliott area was conducted in 1996 by CMS Environmental, Inc., under contract to USACE. The investigation approach consisted of dividing East Elliott into four sectors for the purposes of evaluating risk and developing recommendations for each area. The sectors are shown on Figure 2 and described below:

- **Sector 1:** Approximately 750 acres in the northwest quadrant of East Elliott in the area of the proposed city landfill between Oak and Spring canyons.
- **Sector 2:** Approximately 650 acres in the northern central portion of East Elliott in the area that will eventually be occupied by the existing landfill in Little Sycamore Canyon.
- **Sector 3:** Approximately 750 acres in the southwest quadrant of East Elliott, south of the proposed city landfill and north of State Highway 52.
- **Sector 4:** Approximately 1,050 acres in the eastern portion of East Elliott, including the area most frequently used for recreational activities.

A statistical computer program, SiteStats/GridStats, was used to aid in the characterization of OE in each sector. A total of 89 survey grids, each measuring 100 by 200 feet, were established within the four sectors. Brush was thinned and OE was cleared from the surface within the entire area of each survey grid. Each survey grid was then swept using a magnetometer and all anomalies were mapped and flagged. When all subsurface anomalies were mapped within a survey grid, the computer program was used to randomly select which subsections within the larger survey grids would have subsurface anomalies excavated and identified. As these anomalies were excavated, GridStats determined how many and which anomalies within the grid should be sampled. SiteStats was then used to predict the ordnance density for each sector.

Ordnance and explosives was detected and removed from survey grids in all four sectors of East Elliott; however, only four UXO items were found during the sampling. The largest concentration of OE was in Sector 4 and the western portion of Sector 2. All but one of the intact shells discovered during the investigation were found pointing westward, indicating that the projectiles were likely fired from points at the southeast corner of East Elliott, within an area used for tank maneuvers. All UXO was destroyed at the site.

Figure 2. Delineation of Sectors



Ordnance and Explosives Risk Assessment

Using data from the 1996 OE investigation, Montgomery Watson Americas, Inc. conducted a deterministic risk assessment for East Elliott using the Ordnance and Explosives Cost-Effectiveness Risk Tool developed by USACE in 1996. The Ordnance and Explosives Cost-Effectiveness Risk Tool provides a means of determining the estimated number of exposures to UXO at a site given different levels of removal action or no action for various land uses. An OE Exposure is defined as a person coming into contact with or being in immediate proximity to UXO. It does not imply that the UXO item detonates. Land uses evaluated include both current and future recreational use, current and future landfills, and future residential construction. Based on the risk assessment and the 1996 sampling data, baseline UXO risks are present in Sectors 1, 2, and 4. No exposures were predicted for Sector 3 because no UXO was found in this area; however, due to limitations to OE sampling and the risk assessment tool, it should not be assumed that there is no risk in Sector 3.

Removal action alternatives were therefore evaluated for each of the four sectors in East Elliott to achieve an acceptable level of risk to human health and the environment from potential exposure to UXO based on current and future land uses. The risk assessment also provided an estimate of the expected annual exposures to UXO and associated risk reduction for each of the removal actions considered.

Removal Action Alternatives Evaluated in the EE/CA

Removal action alternatives can generally be grouped into the following categories: no action, institutional controls, treatment technologies, containment technologies, and removal technologies. Removal action alternatives for East Elliott were screened by considering CERCLA guidance objectives, presumptive remedies at other UXO sites, site-specific characteristics, the conceptual model of potential exposure risk, and current and future land use and ownership. The removal action alternatives evaluated for East Elliott include the following:

- **Alternative 1:** No Action
- **Alternative 2:** Institutional Controls, including warning signs, display boards, and awareness training designed to modify the behavior of people who encounter UXO
- **Alternative 3:** Surface Clearance, including inspection of the ground surface and removal and/or destruction of any OE and UXO encountered
- **Alternative 4:** Surface and Subsurface Clearance to a Depth of 1 Foot, including investigation of magnetic anomalies and removal and/or destruction of any OE and UXO encountered up to 1 foot below the ground surface
- **Alternative 5:** Construction Support, including surface and subsurface clearance of OE to support grading and construction up to a depth of 3 feet below the ground surface

The remedial alternatives were then evaluated on the basis of three criteria to determine their applicability. These criteria are:

- **Effectiveness** - The ability of the proposed removal action to achieve the removal action objectives, to comply with applicable or relevant and appropriate requirements, and to reduce the exposure risk to the public. The most important criterion for East Elliott is the long-term effectiveness of the proposed removal action to protect the public and to reduce the risk of an encounter with UXO.
- **Implementability** - The technical and administrative feasibility of a removal action, the availability of necessary equipment and services, and the potential for community acceptance of the removal action alternative.
- **Cost** - The 30-year present worth analysis of estimated direct and indirect capital costs, and recurring or post-removal site control costs including long-term monitoring, reporting, and maintenance activities.

Removal Action Selection

Sector 1. Based on the above analysis, Surface Clearance (Alternative 3) is the recommended removal action alternative for the approximately 750 acres of Sector 1. Surface Clearance significantly reduces risk to recreational users, who are most likely to be exposed, at an estimated cost over 30 years of \$5,757,000 (Table 1). Construction Support (Alternative 5) for the proposed landfill in Sector 1 was also considered. However, the proposed City of San Diego landfill is still in the pre-planning stages; therefore, the risk reduction for recreational users would not occur for 20 to 50 years.

Sector 2. Surface Clearance (Alternative 3) is the recommended removal action alternative for Sector 2. Because the landfill, including the current expansion, occupies approximately 170 acres, clearance operations will only be performed with the remaining 480 acres of Sector 2. Surface Clearance will result in a significant reduction of risk for recreational users and construction workers at a cost over 30 years of \$3,546,000 (Table 1). Periodic monitoring activities required for this alternative will include investigation and disposal, if warranted, of any subsurface OE encountered during landfill construction.



Clearance Operations

USACE conducted OE removal operations for construction support during the 1998 expansion of the Sycamore Landfill. Construction support activities included surface and subsurface removal of OE encountered up to a depth of 3 feet. These activities were conducted over a 53-acre area on the north side of the existing landfill. During construction support, 24 UXO items and 64 pounds of harmless OE scrap were discovered. No UXO was found deeper than 2 feet, and most of the OE items were found on the ground surface. Following identification, the UXO were destroyed on-site. The resulting inert OE and OE scrap were then recycled. Based on the number of UXO encountered during 1998 removal action, the removal action contractor recommended that OE construction support be provided during all expansion activities of the Sycamore Landfill.

Sector 3. Institutional Controls (Alternative 2), which include the use of warning signs and display boards to modify the behavior of people who encounter OE, is the recommended removal action alternative for the approximately 750 acres of Sector 3. Because the potential for UXO exposures appears very unlikely, clearance activities were eliminated from further consideration for this area. However, because OE-related scrap was encountered in Sector 3, there is a possibility that UXO is present. In addition, people may access other areas of East Elliott from Sector 3. Institutional Controls will cost-effectively reduce the risk of a hazardous encounter (considering the inherently low risk present in Sector 3) and focus on informing those who may choose to enter the area of the potential hazard. The total cost for these Institutional Controls over 30 years is \$377,000 (Table 1).

Sector 4. Surface and Subsurface Clearance (Alternative 4) is the recommended removal action alternative for the approximately 1,050 acres of Sector 4. This alternative will result in the greatest reduction of risk for recreational users, including local residents. Sector 4 has a higher risk level than the other sectors at East Elliott because this area is more accessible and attractive to recreational users. Surface Clearance alone would result in the greatest reduction of risk at a lower cost than other removal alternatives. However, because risk associated with OE in Sector 4 is approximately five times that for other sectors, a more stringent removal action (Surface and Subsurface Clearance) is warranted even though this alternative is significantly more costly.

USACE conducted surface clearance of OE in 1998 and 1999 as a Time-Critical Removal Action in Sector 4 in response to the risk assessment results, which were originally presented in the draft version of the EE/CA dated January 1998. During the 1996 OE investigation, Sector 4 was found to contain the largest concentration of UXO and OE scrap. Based on this concentration of OE, the proximity to local residents, and the large number of recreational users in this area, it was determined that a time-critical removal action was warranted due to the immediate threat of public exposure to OE with the risk of serious injury or death.

The Time-Critical Removal Action was conducted in Sector 4 between July 1998 and February 1999 by Human Factors Associates, Inc. under contract to USACE. Surface OE removal operations were conducted over 900 acres of roads, trails, and open space. Surface clearance was not conducted in areas of heavy brush, which covers approximately 150 acres of Sector 4.



Clearance Operations

Twenty-four UXO items and approximately 1,250 pounds of harmless OE scrap were discovered during the Time-Critical Removal Action. The UXO items consisted primarily of 37-millimeter and 75-millimeter rounds. The majority of the UXO were found along the ridge between Sycamore Canyon and Little Sycamore Canyon. Based on information discovered during the archive search, this area appears to have been the primary target area for tank maneuvers in the southeast corner of East Elliott.

During the Time-Critical Removal Action, numerous subsurface anomalies were identified. However, because the removal action was limited to surface OE removal, these anomalies were not excavated. Based on this information and the amount of OE found in the southern portion of Sector 4, Human Factors Associates, Inc. recommended that subsurface clearance be conducted in the southern and northwest areas of Sector 4. This recommendation is consistent with recommendations made by CMS Environmental after the 1996 site investigation.

The remaining removal action in Sector 4 will therefore clear the surface areas that were not addressed by the Time-Critical Removal Action. Because no OE, including scrap, was discovered north and east of Quail Canyon, a reduction in the scope of the proposed overall removal action is recommended to eliminate additional clearance of OE in this area of Sector 4. Therefore, the remaining removal action includes surface and subsurface removal of OE in areas of heavy brush not included in the Time-Critical Removal Action, and subsurface removal of OE within roads, trails, and open areas south and west of Quail Canyon. The total cost for this alternative over 30 years is approximately \$15,413,000 (Table 1). This estimate includes the costs for performing the Time-Critical Removal Action.

Managing Residual Risk at East Elliott

Because the removal actions will not completely eliminate the possibility of encountering UXO and will take up to five years to fully implement, it is also recommended that residual risk management measures be implemented in all sectors of East Elliott. These residual risk management measures will be similar to the Institutional Controls alternative, but will include additional public awareness activities and long-term monitoring. Residual risk management measures will therefore include the following activities:

- use of signs and display boards to describe the potential hazards and provide information on what to do if OE is encountered;
- continuation of public meetings to describe the removal actions taken at the site and what risks may remain;
- implementation of public education programs aimed at members of the public who are most likely to use the site, such as landfill employees and high school students;
- notification of property owners and local residents with regular fact sheets, newsletters, brochures, and internet sites;
- compliance with California Real Estate disclosure laws by establishment of deed notification for each parcel at East Elliott; and
- notification about potential subsurface hazards through the building permit system.

In addition, East Elliott will be included in a long-term monitoring program designed to assess the continued effectiveness of the removal action alternative. The monitoring will include a visual inspection of the site, a review of any additional OE found after the alternative is implemented, an assessment of the continued land use patterns, maintenance of the residual risk management measures, and community feedback. Reviews will be performed every five years after completion of the removal action. During the removal action, a baseline for monitoring erosion will be established to see if subsurface OE not included in the removal action may become exposed. The baseline will include a general map of drainages, landslides, and other areas of erosion, along with a series of photographs taken from designated locations for comparison through time. In addition, areas of East Elliott will be inspected for exposed ordnance as needed following major storm events or wild fires. Monitoring activities will be documented in a report issued every five years.

Table 1. Summary of Costs for Recommended Alternatives

Sector	Description of Recommended Action	Initial Cost	Net Present Worth Cost Over 30 Years	Priority ^a
1	Surface Clearance	\$1,606,000	\$5,757,000	3
2	Surface Clearance ^b	\$1,055,000	\$3,546,000	2
3	Institutional Controls	\$212,000	\$377,000	4
4	Surface and Subsurface Clearance ^c	\$6,844,000	\$15,413,000	1
	All Residual Risk Management Measures	\$719,000	\$1,396,000	5
Total Costs: \$10,436,000			\$26,489,000	

^a Based on relative risks for each sector.

^b Does not include clearance operations already completed within the existing landfill.

^c Costs include those for the recently completed time-critical removal action.

To implement these recommendations, memoranda of agreement will be developed between USACE and individual parties participating in the overall risk management plan. These memoranda will outline the specific authorities and responsibilities of each agency participating in the action. The total cost of residual risk management measures over 30 years is approximately \$1,396,000 (Table 1).

Total Costs of All Removal Actions

The total costs of each of the recommended alternatives for East Elliott are listed in Table 1. The total cost of all recommended alternatives, including the Time Critical Removal Action is approximately \$26,489,000. Based on the reduction in annual exposures to UXO for each proposed alternative, it is recommended that the removal actions for each sector be implemented in the order listed in Table 1.

If You Encounter Ordnance at East Elliott ...

UXO items capable of causing injury or death have been discovered in many areas of East Elliott. UXO removal actions conducted by USACE have reduced, but may not have completely eliminated, the presence of UXO at East Elliott. If you encounter munitions or buried metal objects at East Elliott, do not attempt to touch, disturb, or move the item. Call the San Diego Emergency Services at 911.



37mm and 75mm Shells Found at East Elliott



GLOSSARY

DTSC - California State Department of Toxic Substances Control (DTSC) - The DTSC is the lead regulatory agency concerned with OE contamination at East Elliott.

EE/CA- Engineering Evaluation/Cost Analysis - An evaluation of remedial options for a site based on effectiveness, implementability, and cost of the remedial action.

Institutional Controls - Physical, educational, and, legal actions designed to either reduce contact with a hazardous substance, or modify behavior of people who do encounter a hazardous substance, (e.g., UXO).

Ordnance and Explosives (OE) - OE describes anything related to munitions designed to cause damage to personnel or material through explosive force, incendiary action, or toxic effects. OE may include intact munitions, or munitions fragments.

Removal Action - The cleanup or removal of released hazardous substances (e.g., UXO) from the environment. This may include institutional controls, treatment, containment, and removal.

Unexploded Ordnance (UXO) - Ordnance and explosives that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded by either malfunction, design, or other cause.

Information Repositories

To gain a more thorough understanding of the history of East Elliott and the activities associated with the proposed OE removal activities, the public is encouraged to review relevant documents maintained in the information repositories for East Elliott at the following locations:

San Diego City Library, Tierrasanta Branch
4978 La Cuenta Drive
San Diego, CA 92101
(619) 573-1384

San Diego County Library, Santee Branch
9225 Carlton Hills Blvd.
Santee, CA 92071
(619) 448-1863

For More Information

For more information on USACE's removal actions at East Elliott, please contact:

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