

**APPENDIX D**

**RECOVERED OE ITEMS BY GRID**

## APPENDIX D - ABSTRACT

This Appendix presents a summary of OE items recovered in each sector during the field investigation at the Former Benicia Arsenal, Solano County, California. The ordnance-related items recovered in each grid are classified into one of two categories: UXO and OE Scrap. Column headings identify grid number, category (UXO or OE Scrap), description, and estimated weights of UXO and OE Scrap.

A figure is provided for each Sector at the Former Benicia Arsenal detailing items recovered during the field investigation. Grids containing UXO are shaded black. Grids containing OE Scrap are hatched. Grids containing non-OE Scrap are not shaded. The grid numbers in the tables for each sector correspond to the grid numbers in each figure.

The table listed below provides a summary of UXO and OE Scrap by Sector that was recovered during the EE/CA field investigation at the Former Benicia Arsenal.

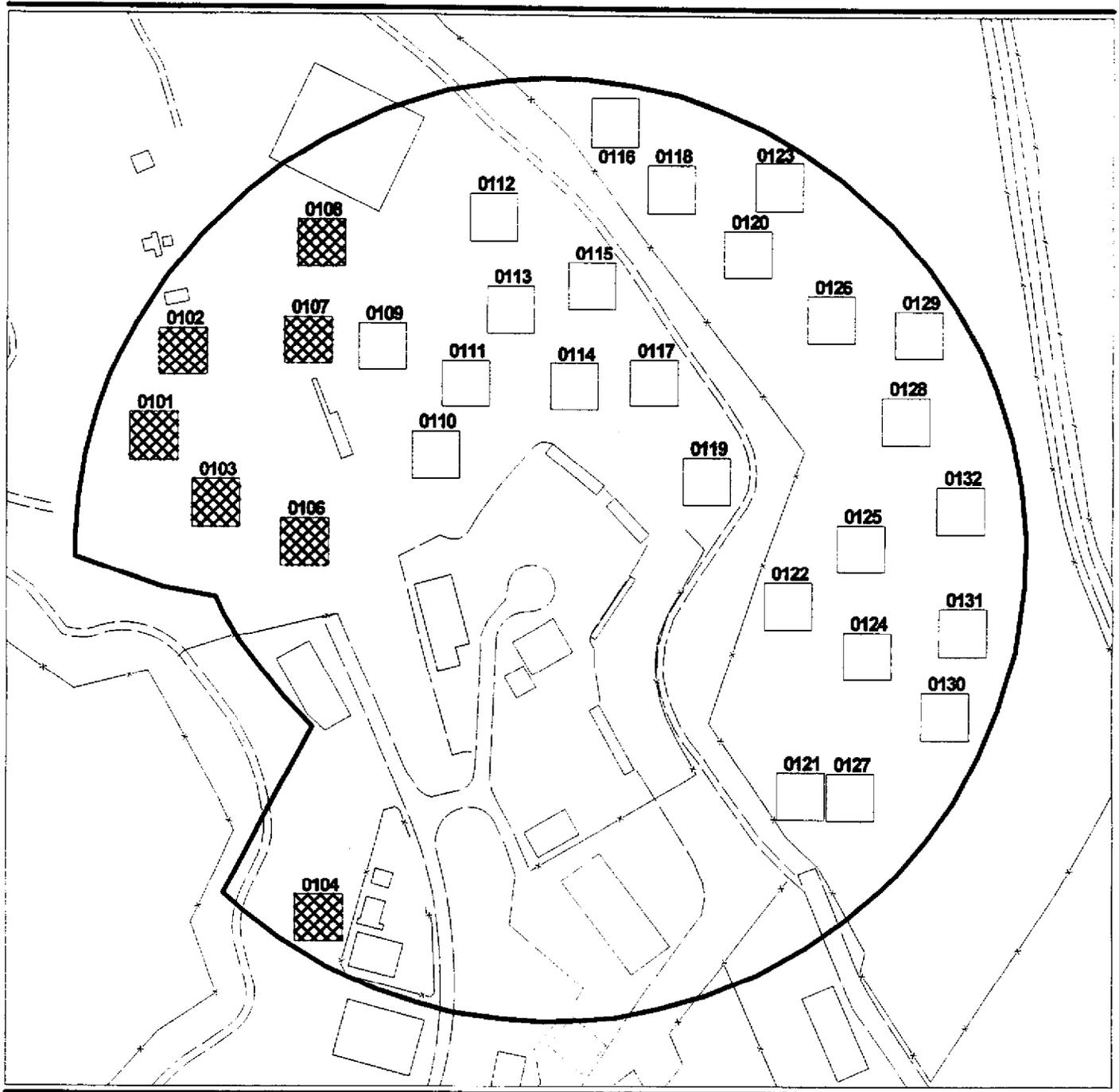
**DEPTH AND ESTIMATED WEIGHT OF UXO AND OE SCRAP**

Sector Number	Total UXO	Total OE Scrap	Range of Depth UXO and OE Scrap	Estimated Weight UXO and OE Scrap
1	0	0	--	--
2 <sup>(a)</sup>	0	0	--	--
3A	0	102	0 - 24"	352 Pounds
3B	2	273	0 - 48"	258 Pounds
3C	0	0	--	--
4	0	48	0 - 24"	73 Pounds
5	15	84	0 - 36"	50 Pounds
Grid OT01 <sup>(b)</sup>	--	--	--	--
<b>Total</b>	<b>17</b>	<b>507</b>	<b>--</b>	<b>733 Pounds</b>

Note: (a) Sampling results for Sector 2 include only those from Grid 0202.

(b) Subsurface sampling was not performed in Grid OT01.

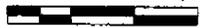
UXO = unexploded ordnance  
OE = ordnance and explosives



**EXPLANATION**

-  Grids with UXO
-  Grids with OE Scrap
-  Grids with Non-OE Scrap or Nothing
-  Grids with No Right-of-Entry
-  Sector Boundary
-  Planimetric Features  
(Roads, Fences, & Improvements)

0.02 0 0.02 0.04 Miles



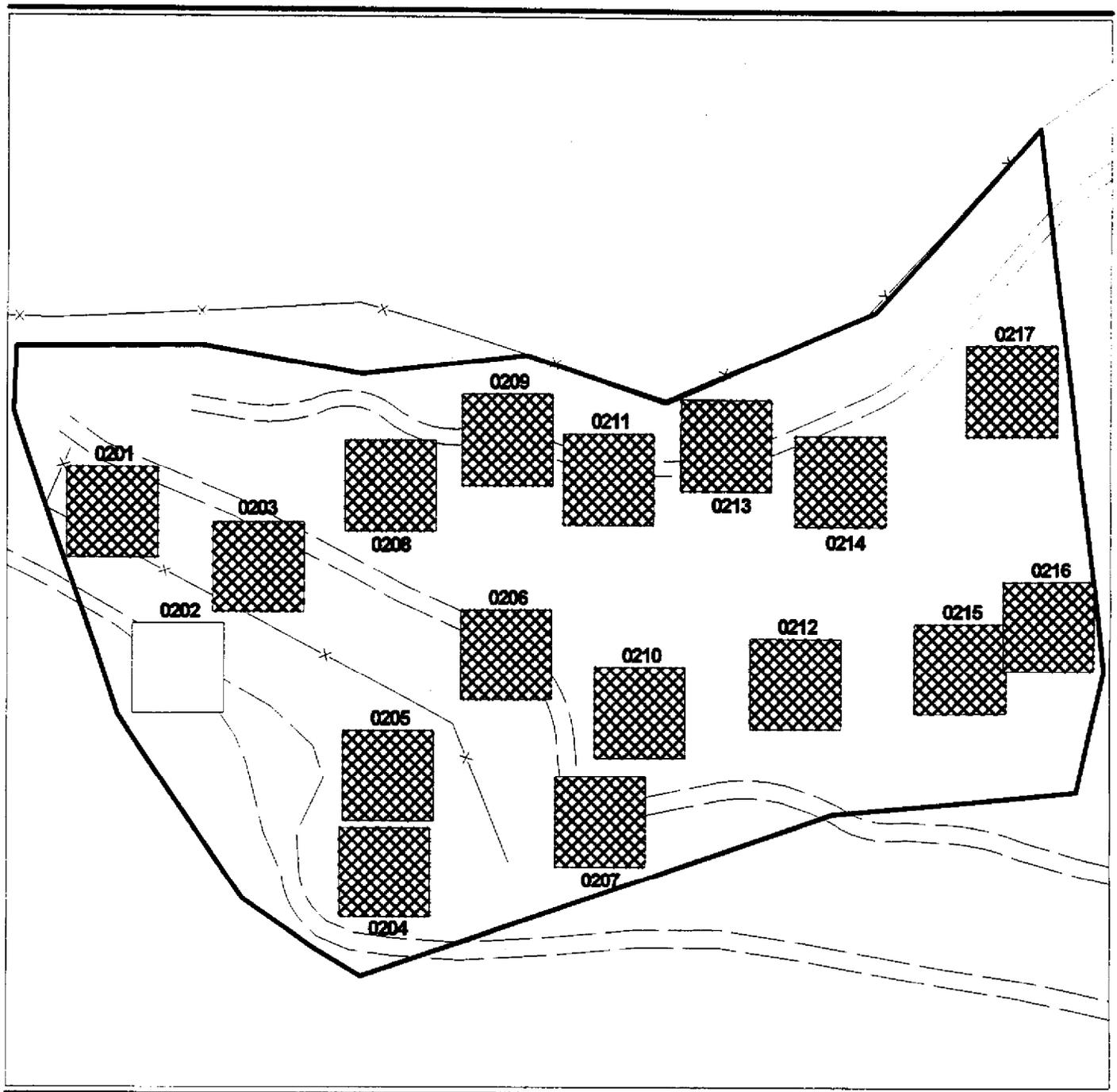
Note: Grid 0105 was deleted due to rough terrain.

**Sector 1  
Revetment Area  
EE/CA Field  
Investigation Results**

**Figure D - 1**

**Table D-1**  
**OE Items Recovered in Sector 1, Revetment Area**

There were no UXO or OE Scrap recovered in Sector 1 during the EE/CA field investigation.
---

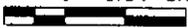


**EXPLANATION**

- Grids with UXO
- Grids with OE Scrap
- Grids with Non-OE Scrap or Nothing
- Grids with No Right-of-Entry
- Sector Boundary
- Planimetric Features  
(Roads, Fences, & Improvements)

**Sector 2  
Artillery Test Area  
EE/CA Field  
Investigation Results**

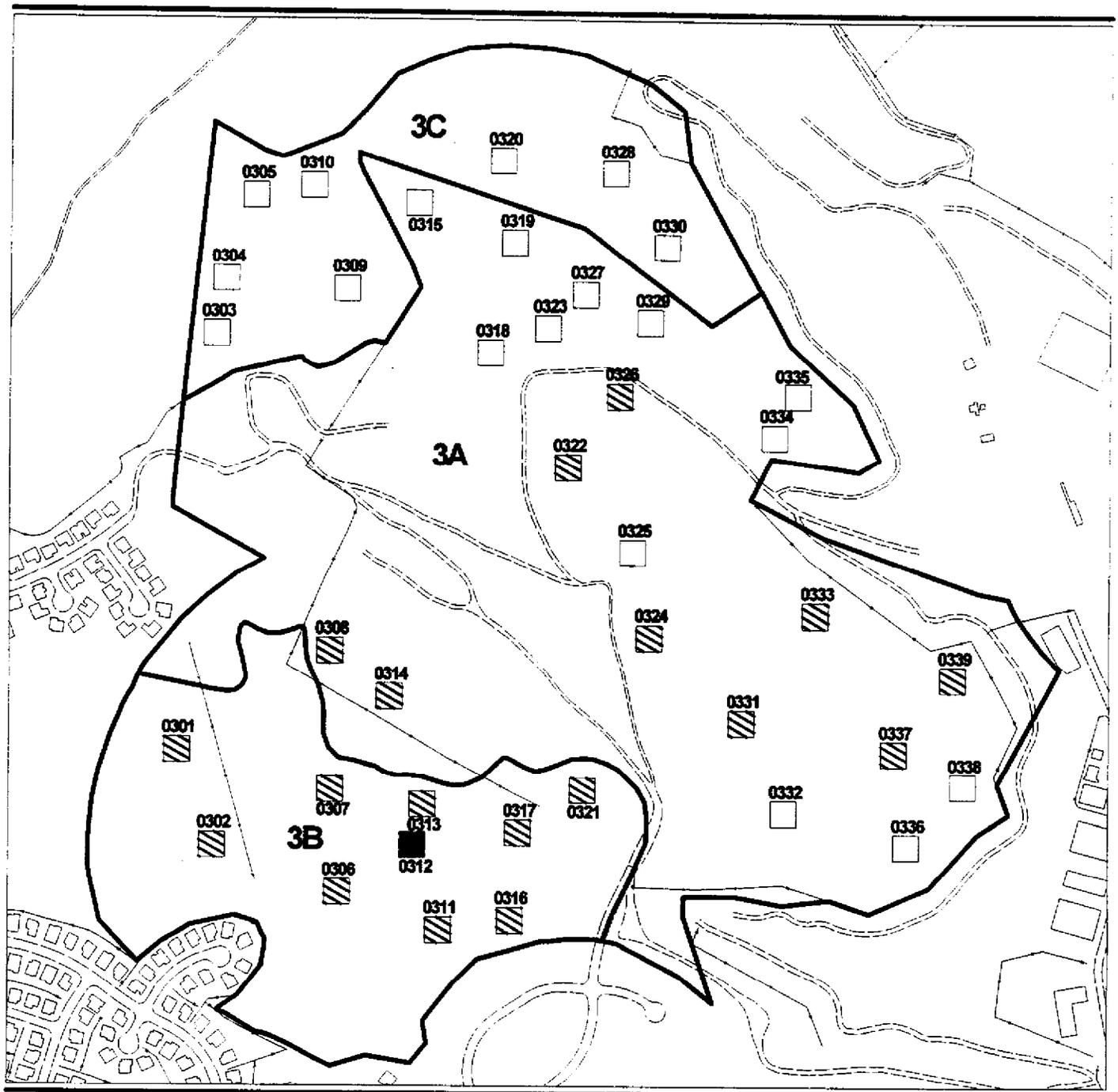
0.01 0 0.01 0.02 Miles



**Figure D - 2**

**Table D-2**  
**OE Items Recovered in Sector 2, Artillery Test Area**

	Quantity	Weight (Pounds)
There were no UXO or OE Scrap recovered in Grid 0202 during the EE/CA field investigation.		



**EXPLANATION**

-  Grids with UXO
-  Grids with OE Scrap
-  Grids with Non-OE Scrap or Nothing
-  Grids with No Right-of-Entry
-  Sector Boundary
-  Planimetric Features  
(Roads, Fences, & Improvements)

**Sector 3A, 3B, and 3C  
Tourtelot Property  
EE/CA Field  
Investigation Results**

0.04 0 0.04 0.08 Miles



**Figure D - 3**

**Table D-3  
OE Items Recovered in Sector 3A, Tourtelot Property**

0308	03080003	1	OE Scrap	OE Scrap	1	6	1.00
0308	03080006	1	OE Scrap	Frag	1	6	0.38
0308	03080007	1	OE Scrap	OE Scrap	1	3	0.38
0308	03080008	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080009	1	OE Scrap	OE Scrap	1	0	2.00
0308	03080010	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080011	1	OE Scrap	OE Scrap	1	4	0.50
0308	03080012	1	OE Scrap	OE Scrap	1	6	0.19
0308	03080013	1	OE Scrap	OE Scrap	1	4	0.38
0308	03080014	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080015	1	OE Scrap	Frag	1	20	0.75
0308	03080015	2	OE Scrap	Frag	1	20	0.75
0308	03080016	1	OE Scrap	OE Scrap	1	6	0.31
0308	03080017	1	OE Scrap	OE Scrap	1	6	0.19
0308	03080018	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080020	1	OE Scrap	OE Scrap	1	24	0.13
0308	03080020	2	OE Scrap	OE Scrap	1	24	0.13
0308	03080021	1	OE Scrap	OE Scrap	1	22	0.38
0308	03080022	1	OE Scrap	OE Scrap	1	20	0.50
0308	03080023	1	OE Scrap	OE Scrap	1	24	0.13
0314	03140001	1	OE Scrap	Frag	1	3	1.00
0314	03140002	1	OE Scrap	Frag	1	0	0.13
0314	03140006	1	OE Scrap	Frag	1	5	0.19
0314	03140008	1	OE Scrap	Frag	1	3	0.13
0314	03140009	1	OE Scrap	Frag	1	5	0.13
0314	03140011	1	OE Scrap	Fuze Adaptor	1	6	0.50
0314	03140012	1	OE Scrap	Fuze Adaptor	1	6	0.50
0314	03140027	1	OE Scrap	Frag	1	10	0.19
0314	03140031	1	OE Scrap	Frag	1	9	0.16
0314	03140031	2	OE Scrap	Frag	1	9	0.16
0314	03140032	1	OE Scrap	Frag	1	8	0.09
0314	03140032	2	OE Scrap	Frag	1	8	0.09
0314	03140035	1	OE Scrap	OE Scrap	1	10	0.50
0314	03140039	1	OE Scrap	Frag	1	8	0.13
0314	03140058	1	OE Scrap	Frag	1	4	0.13
0314	03140063	1	OE Scrap	Frag	1	8	0.50
0322	03220008	1	OE Scrap	Brass Rotating Bands	2	0	0.13
0322	03220009	1	OE Scrap	Frag	1	6	0.13
0322	03220021	1	OE Scrap	OE Scrap	1	6	0.50
0322	03220024	1	OE Scrap	155mm Base Section	1	0	30.00
0322	03220026	1	OE Scrap	Frag	1	6	2.00
0322	03220029	1	OE Scrap	Frag	1	6	0.50
0322	03220032	1	OE Scrap	Frag	1	4	0.75
0322	03220036	1	OE Scrap	Frag	1	4	1.00
0322	03220067	1	OE Scrap	Frag	1	4	1.50
0322	03220082	1	OE Scrap	155mm concrete filled projectile	1	12	100.00
0322	03220083	1	OE Scrap	155mm concrete filled projectile	1	18	100.00
0324	03240008	1	OE Scrap	Frag	1	6	0.63
0324	03240010	1	OE Scrap	Frag	1	4	0.38
0324	03240013	1	OE Scrap	Frag	1	24	0.06
0324	03240015	1	OE Scrap	OE Scrap	1	24	0.06
0324	03240016	1	OE Scrap	Frag	1	6	0.38
0324	03240019	1	OE Scrap	Frag	1	10	0.38
0326	03260013	1	OE Scrap	Frag	1	12	3.00
0326	03260014	1	OE Scrap	Frag	1	10	0.06
0326	03260015	1	OE Scrap	Frag	1	8	2.00
0326	03260017	1	OE Scrap	155mm cement filled round - rear portion only	1	18	18.00
0326	03260017	2	OE Scrap	Frag	1	18	1.00
0326	03260017	3	OE Scrap	Frag	1	18	1.00
0326	03260028	1	OE Scrap	Frag	1	24	0.75
0326	03260032	1	OE Scrap	Frag	1	12	2.00
0326	03260034	2	OE Scrap	Frag	1	24	0.06
0326	03260035	1	OE Scrap	Frag	1	3	0.38
0326	03260036	1	OE Scrap	Frag	1	24	20.00
0326	03260037	1	OE Scrap	Frag	1	4	1.00

**Table D-3  
OE Items Recovered in Sector 3A, Tourtelot Property**

Item ID	Item Description	Quantity	Material	Material	Quantity	Quantity (Frag)	Estimated Weight (kg)
0326	03260040	1	OE Scrap	OE Scrap	1	2	0.25
0326	03260041	1	OE Scrap	Frag	1	0	0.13
0326	03260049	1	OE Scrap	Frag	1	10	1.00
0326	03260052	1	OE Scrap	Frag	1	11	0.75
0326	03260055	1	OE Scrap	Frag	1	6	1.00
0326	03260056	1	OE Scrap	Frag	1	0	0.38
0326	03260061	1	OE Scrap	Frag	1	0	1.00
0326	03260064	1	OE Scrap	Frag	1	3	0.17
0326	03260064	2	OE Scrap	Frag	1	3	0.17
0326	03260064	3	OE Scrap	Frag	1	3	0.17
0326	03260065	1	OE Scrap	Frag	1	3	1.00
0326	03260070	1	OE Scrap	Frag	1	6	2.00
0326	03260075	1	OE Scrap	Frag	1	8	0.13
0326	03260077	1	OE Scrap	Frag	1	6	4.00
0326	03260100	1	OE Scrap	Frag	1	8	1.00
0326	03260105	1	OE Scrap	Frag	1	24	0.13
0326	03260112	1	OE Scrap	Frag	1	6	0.75
0326	03260115	1	OE Scrap	Frag	1	14	0.38
0326	03260121	1	OE Scrap	OE Scrap	1	6	0.38
0326	03260123	1	OE Scrap	OE Scrap	1	12	1.00
0326	03260123	2	OE Scrap	OE Scrap	1	12	1.00
0326	03260124	1	OE Scrap	Frag	1	6	0.38
0326	03260124	2	OE Scrap	Base Section of 155mm	1	6	20.00
0326	03260142	1	OE Scrap	Frag	1	12	1.00
0326	03260142	2	OE Scrap	Frag	1	12	1.00
0326	03260151	1	OE Scrap	Frag	1	6	0.38
0326	03260152	1	OE Scrap	Frag	1	4	0.25
0326	03260157	1	OE Scrap	Frag	1	12	3.00
0326	03260157	2	OE Scrap	Frag	1	12	3.00
0331	03310005	1	OE Scrap	Frag	1	4	0.13
0333	03330002	1	OE Scrap	Frag	1	6	2.00
0337	03370004	1	OE Scrap	OE Scrap	1	4	0.50
0337	03370005	1	OE Scrap	OE Scrap	1	6	0.50
0337	03370007	1	OE Scrap	OE Scrap	1	4	0.50
0337	03370008	1	OE Scrap	OE Scrap	1	20	0.50
0339	03390002	1	OE Scrap	Frag	1	6	0.19

Total UXO recovered in Sector 3A:

0

Total OE Scrap recovered in Sector 3A:

102

Table D-4  
 OE Items Recovered in Sector 3B, Tourtelot Property

Code	Item ID	Quantity	Material	Description	Weight (lbs)	Estimated Value
0301	03010001	1	OE Scrap	Frag	1	0.25
0301	03010008	1	OE Scrap	Frag	1	0.13
0301	03010009	1	OE Scrap	Frag	1	0.25
0301	03010013	1	OE Scrap	Frag	1	0.13
0301	03010014	1	OE Scrap	Frag	1	0.31
0301	03010015	1	OE Scrap	Frag	1	0.13
0301	03010023	1	OE Scrap	Frag	1	0.38
0301	03010028	1	OE Scrap	Frag	1	0.19
0301	03010031	1	OE Scrap	Frag	1	0.31
0301	03010035	1	OE Scrap	Frag	1	0.50
0301	03010036	1	OE Scrap	Frag	1	0.31
0301	03010037	1	OE Scrap	Frag	1	0.38
0301	03010039	1	OE Scrap	OE Scrap	1	0.13
0302	03020001	1	OE Scrap	Frag	1	0.50
0302	03020003	1	OE Scrap	Frag	1	0.63
0302	03020004	1	OE Scrap	Frag	1	0.19
0302	03020005	1	OE Scrap	Frag	1	0.63
0302	03020009	1	OE Scrap	Frag	1	0.13
0302	03020011	1	OE Scrap	Fuze Adaptor	1	0.50
0302	03020013	1	OE Scrap	Frag	1	0.31
0302	03020014	1	OE Scrap	Frag	1	0.06
0302	03020015	1	OE Scrap	Frag	1	1.00
0302	03020016	1	OE Scrap	Frag	1	1.00
0302	03020021	1	OE Scrap	OE Scrap	1	0.50
0306	03060003	1	OE Scrap	Frag	1	0.13
0306	03060010	1	OE Scrap	Frag	1	0.38
0306	03060022	1	OE Scrap	Frag	1	0.25
0306	03060023	1	OE Scrap	Frag	1	1.00
0306	03060024	1	OE Scrap	Frag	1	0.25
0306	03060026	1	OE Scrap	Frag	1	0.19
0306	03060026	2	OE Scrap	Frag	1	0.19
0306	03060029	1	OE Scrap	Frag	1	0.19
0306	03060039	1	OE Scrap	Frag	1	0.06
0306	03060040	1	OE Scrap	Frag	1	0.75
0306	03060042	1	OE Scrap	Frag	1	1.40
0306	03060043	1	OE Scrap	Frag	1	0.25
0306	03060044	1	OE Scrap	Frag	1	0.19
0306	03060045	1	OE Scrap	Frag	1	0.19
0306	03060046	1	OE Scrap	Frag	1	0.19
0306	03060046	2	OE Scrap	Frag	1	0.19
0306	03060047	1	OE Scrap	Frag	1	0.13
0306	03060049	1	OE Scrap	Frag	1	0.19
0306	03060051	1	OE Scrap	Frag	1	0.75
0306	03060052	1	OE Scrap	Frag	1	0.38
0306	03060052	2	OE Scrap	Frag	1	0.13
0306	03060053	1	OE Scrap	Frag	1	0.25
0306	03060054	1	OE Scrap	Frag	1	0.13
0306	03060054	2	OE Scrap	Frag	1	0.19
0307	03070001	1	OE Scrap	Frag	1	0.38
0307	03070002	1	OE Scrap	Frag	1	0.13
0307	03070003	1	OE Scrap	Frag	1	0.13
0307	03070004	1	OE Scrap	Frag	1	0.25
0307	03070005	1	OE Scrap	Frag	1	0.06
0307	03070006	1	OE Scrap	Frag	1	0.19
0307	03070012	1	OE Scrap	Frag	1	0.25
0307	03070013	1	OE Scrap	Frag	1	0.50
0307	03070013	2	OE Scrap	Frag	1	0.50
0307	03070017	1	OE Scrap	Frag	1	0.06
0307	03070018	1	OE Scrap	Frag	1	0.13
0307	03070019	1	OE Scrap	Frag	1	0.25
0307	03070020	1	OE Scrap	Frag	1	0.50
0307	03070022	1	OE Scrap	Frag	1	1.00
0307	03070023	1	OE Scrap	Frag	1	0.13
0307	03070024	1	OE Scrap	Frag	1	0.19
0307	03070025	1	OE Scrap	Frag	1	0.13

**Table D-4**  
**OE Items Recovered in Sector 3B, Tourtelot Property**

DN#	Item#	Qty	Category	Description	Weight	Volume (Liters)	Estimated Value
0307	03070026	1	OE Scrap	Frag	1	6	0.25
0307	03070026	2	OE Scrap	Frag	1	6	0.25
0307	03070029	1	OE Scrap	Frag	1	2	0.25
0311	03110001	1	OE Scrap	Frag	1	4	0.13
0311	03110001	2	OE Scrap	Frag	1	4	0.13
0311	03110002	1	OE Scrap	Frag	1	48	0.19
0311	03110003	1	OE Scrap	Frag	1	3	0.50
0311	03110004	1	OE Scrap	Frag	1	4	0.06
0311	03110005	1	OE Scrap	Frag	1	12	1.00
0311	03110009	1	OE Scrap	Frag	1	6	0.09
0311	03110009	2	OE Scrap	Frag	1	6	0.09
0311	03110009	3	OE Scrap	Frag	1	6	0.09
0311	03110009	4	OE Scrap	Frag	1	6	0.09
0311	03110010	1	OE Scrap	Frag	1	6	0.38
0311	03110012	1	OE Scrap	Frag	1	2	0.13
0311	03110013	1	OE Scrap	Frag	1	0	0.25
0311	03110013	2	OE Scrap	Frag	1	0	0.56
0311	03110015	1	OE Scrap	Frag	1	6	1.00
0311	03110016	1	OE Scrap	Frag	1	6	0.13
0311	03110017	1	OE Scrap	Frag	1	6	0.06
0311	03110018	1	OE Scrap	Frag	1	6	0.13
0311	03110019	1	OE Scrap	Frag	1	3	0.50
0311	03110021	1	OE Scrap	Frag	1	0	0.13
0311	03110022	1	OE Scrap	Frag	1	4	0.31
0311	03110023	1	OE Scrap	Frag	1	4	0.06
0311	03110026	1	OE Scrap	Frag	1	4	0.38
0312	03120002	1	OE Scrap	OE Scrap	1	8	1.00
0312	03120010	1	OE Scrap	Frag	1	12	2.00
0312	03120016	1	OE Scrap	Frag	1	30	10.00
0312	03120017	1	OE Scrap	Frag	1	11	0.38
0312	03120017	2	OE Scrap	Frag	1	11	0.38
0312	03120018	1	OE Scrap	Frag	1	8	0.38
0312	03120019	1	OE Scrap	Frag	2	8	--
0312	03120021	1	OE Scrap	Frag	6	18	5.00
0312	03120022	1	OE Scrap	Frag	1	24	8.00
0312	03120023	1	OE Scrap	Grenade, Hand, Practice, M-21	1	8	2.00
0312	03120026	1	OE Scrap	Frag	1	2	0.50
0312	03120026	2	OE Scrap	Frag	1	2	0.50
0312	03120026	3	OE Scrap	Frag	2	2	1.00
0312	03120029	1	OE Scrap	Frag	1	18	3.00
0312	03120032	1	OE Scrap	Frag	1	4	4.00
0312	03120033	1	OE Scrap	Frag	1	24	2.00
0312	03120034	1	OE Scrap	OE Scrap	1	4	1.00
0312	03120039	1	OE Scrap	Frag	1	5	0.25
0312	03120039	2	OE Scrap	Frag	1	5	0.25
0312	03120045	1	OE Scrap	Frag	1	6	0.13
0312	03120046	1	OE Scrap	Frag	1	6	5.00
0312	03120047	1	OE Scrap	Frag	1	12	1.00
0312	03120050	1	OE Scrap	Frag	1	24	2.00
0312	03120051	1	OE Scrap	Frag	1	9	0.25
0312	03120054	1	OE Scrap	Frag	1	3	10.00
0312	03120054	2	OE Scrap	37mm	1	3	2.00
0312	03120056	1	OE Scrap	Frag	1	20	1.00
0312	03120056	2	OE Scrap	M52 Series Fuze	2	12	--
0312	03120057	1	UXO	37mm projectile, fuzed	1	24	--
0312	03120057	2	OE Scrap	Frag	15	18	5.00
0312	03120057	3	OE Scrap	M52 Series Fuze	1	12	--
0312	03120057	4	OE Scrap	PTTF Fuze	1	12	--
0312	03120057	5	OE Scrap	Booster Adapter	1	12	--
0312	03120059	1	OE Scrap	Frag	1	0	4.00
0312	03120059	2	OE Scrap	Frag	1	0	4.00
0312	03120064	1	UXO	75mm shrapnel projectile, unfuzed	1	6	0.50
0312	03120064	2	OE Scrap	M-21 Grenade Shell	1	6	0.50
0312	03120064	3	OE Scrap	Frag	1	6	0.50

**Table D-4**  
**OE Items Recovered in Sector 3B, Tourtelot Property**

GR#	Agency	QTY	Material	Description	QTY	Length (inches)	Estimated Weight
0312	03120064	4	OE Scrap	Frag	1	24	0.50
0312	03120070	1	OE Scrap	75mm (No nose, empty casing)	1	3	2.00
0312	03120072	1	OE Scrap	105mm (plaster load)	1	26	20.00
0312	03120074	1	OE Scrap	Frag	1	4	0.21
0312	03120074	2	OE Scrap	Frag	1	4	0.21
0312	03120074	3	OE Scrap	Frag	1	4	0.21
0312	03120075	1	OE Scrap	Frag	1	30	2.00
0312	03120075	2	OE Scrap	Frag	1	30	2.00
0312	03120078	1	OE Scrap	Frag	1	12	10.00
0312	03120078	2	OE Scrap	Frag	1	12	10.00
0312	03120081	1	OE Scrap	Frag	1	10	0.67
0312	03120081	2	OE Scrap	Frag	1	10	0.67
0312	03120081	3	OE Scrap	Frag	1	10	0.67
0312	03120083	1	OE Scrap	Frag	1	14	6.00
0312	03120084	1	OE Scrap	Frag	1	8	1.00
0312	03120084	2	OE Scrap	Frag	1	8	1.00
0312	03120084	3	OE Scrap	Frag	1	8	1.00
0312	03120088	1	OE Scrap	Frag	1	18	5.00
0312	03120089	1	OE Scrap	75mm (no nose, empty case)	3	20	15.00
0312	03120092	1	OE Scrap	Frag	1	12	1.00
0312	03120095	1	OE Scrap	Frag	1	10	1.00
0312	03120096	1	OE Scrap	Frag	1	10	1.00
0312	03120097	1	OE Scrap	Frag	1	24	2.00
0312	03120100	1	OE Scrap	Frag	1	10	0.75
0312	03120101	1	OE Scrap	Frag	1	12	12.00
0312	03120103	1	OE Scrap	Frag	1	10	0.38
0312	03120109	1	OE Scrap	Frag	1	12	1.00
0312	03120111	1	OE Scrap	Frag	1	2	1.25
0312	03120111	2	OE Scrap	Frag	1	2	1.25
0312	03120111	3	OE Scrap	Frag	1	2	1.25
0312	03120111	4	OE Scrap	Frag	1	2	1.25
0312	03120113	1	OE Scrap	Frag	1	4	1.00
0312	03120113	2	OE Scrap	Frag	1	4	1.00
0312	03120114	1	OE Scrap	Frag	1	20	1.00
0312	03120116	1	OE Scrap	Tail Boom	1	4	0.33
0312	03120116	2	OE Scrap	37mm Base	1	4	0.33
0312	03120116	3	OE Scrap	Frag	1	4	0.33
0312	03120122	1	OE Scrap	Frag	1	8	20.00
0312	03120124	1	OE Scrap	M48 Series Fuze	1	12	1.00
0312	03120125	1	OE Scrap	Frag	1	0	0.38
0312	03120126	1	OE Scrap	Frag	1	3	1.00
0312	03120127	1	OE Scrap	Frag	1	18	0.50
0312	03120127	2	OE Scrap	Frag	1	18	0.50
0312	03120127	3	OE Scrap	Frag	1	18	0.50
0312	03120133	1	OE Scrap	Powder Train Time Fuze	1	6	1.00
0313	03130001	1	OE Scrap	Frag	1	0	0.19
0313	03130007	1	OE Scrap	Frag	1	3	0.38
0313	03130008	1	OE Scrap	Frag	1	36	0.13
0313	03130008	2	OE Scrap	Frag	1	36	0.25
0313	03130010	1	OE Scrap	Frag	1	6	0.13
0313	03130012	1	OE Scrap	Frag	1	6	0.38
0313	03130016	1	OE Scrap	Frag	1	4	0.75
0313	03130019	1	OE Scrap	Frag	1	0	0.13
0313	03130021	1	OE Scrap	Frag	1	6	0.13
0313	03130022	1	OE Scrap	Frag	1	6	0.13
0313	03130022	2	OE Scrap	Frag	1	6	0.13
0313	03130022	3	OE Scrap	Frag	1	6	0.25
0313	03130023	1	OE Scrap	Frag	1	6	0.25
0313	03130023	2	OE Scrap	Frag	1	6	0.19
0313	03130031	1	OE Scrap	Frag	1	1	0.19
0313	03130038	1	OE Scrap	Tail Boom	1	4	0.38
0313	03130039	1	OE Scrap	Frag	1	3	0.25
0313	03130042	1	OE Scrap	Tail Boom - Piece 1 of 3	1	6	0.19
0313	03130042	2	OE Scrap	Tail Boom - Piece 2 of 3	1	6	0.06

**Table D-4**  
**OE Items Recovered in Sector 3B, Tourtelot Property**

GR#	Arms#	QTY	Category	Description	QTY	Days (Est.)	Estimate (\$)
0313	03130042	3	OE Scrap	Tail Boom - Piece 3 of 3	1	6	0.13
0313	03130047	1	OE Scrap	Frag	1	2	0.38
0313	03130049	1	OE Scrap	Frag	1	6	0.38
0313	03130049	2	OE Scrap	Frag	1	6	0.13
0313	03130055	1	OE Scrap	Frag	1	4	0.19
0313	03130055	2	OE Scrap	Frag	1	4	0.25
0313	03130059	1	OE Scrap	Frag	1	12	0.19
0316	03160004	1	OE Scrap	Frag	1	6	0.06
0317	03170001	1	OE Scrap	Frag	1	10	0.19
0317	03170001	2	OE Scrap	Frag	1	10	0.19
0317	03170002	1	OE Scrap	Frag	1	6	0.50
0317	03170003	1	OE Scrap	Frag	1	20	0.06
0317	03170004	1	OE Scrap	Frag	1	6	0.33
0317	03170004	2	OE Scrap	Frag	1	6	0.33
0317	03170004	3	OE Scrap	Frag	1	6	0.33
0317	03170005	1	OE Scrap	Frag	1	6	0.16
0317	03170005	2	OE Scrap	Frag	1	6	0.16
0317	03170006	1	OE Scrap	Frag	1	8	0.09
0317	03170006	2	OE Scrap	Frag	1	8	0.09
0317	03170007	1	OE Scrap	Frag	1	8	0.20
0317	03170007	2	OE Scrap	Frag	1	8	0.20
0317	03170007	3	OE Scrap	Frag	1	8	0.20
0317	03170007	4	OE Scrap	Frag	1	8	0.20
0317	03170007	5	OE Scrap	Frag	1	8	0.20
0317	03170008	1	OE Scrap	Frag	1	6	0.38
0317	03170009	1	OE Scrap	Frag	1	6	0.06
0317	03170011	1	OE Scrap	Frag	1	6	0.06
0317	03170012	1	OE Scrap	Frag	1	4	0.13
0317	03170014	1	OE Scrap	Frag	1	8	0.13
0317	03170015	1	OE Scrap	Frag	1	18	0.25
0317	03170015	2	OE Scrap	Frag	1	18	0.25
0317	03170016	1	OE Scrap	Frag	1	12	0.67
0317	03170016	2	OE Scrap	Frag	1	12	0.67
0317	03170016	3	OE Scrap	Frag	1	12	0.67
0317	03170017	1	OE Scrap	Frag	1	24	0.19
0321	03210008	1	OE Scrap	OE Scrap	1	4	0.50
0321	03210009	1	OE Scrap	OE Scrap	1	4	0.50
0321	03210014	1	OE Scrap	OE Scrap	1	12	0.25
0321	03210015	1	OE Scrap	OE Scrap	1	8	0.50
0321	03210016	1	OE Scrap	OE Scrap	1	24	0.06
0321	03210020	1	OE Scrap	OE Scrap	1	16	0.38
0321	03210022	1	OE Scrap	OE Scrap	1	8	0.50
0321	03210024	1	OE Scrap	OE Scrap	1	10	0.75
0321	03210039	1	OE Scrap	Frag	1	6	0.33
0321	03210039	2	OE Scrap	Frag	1	6	0.33
0321	03210039	3	OE Scrap	Frag	1	6	0.33
0321	03210040	1	OE Scrap	Frag	1	6	0.25
0321	03210040	2	OE Scrap	Frag	1	6	0.25
0321	03210040	3	OE Scrap	Frag	1	6	0.25
0321	03210041	1	OE Scrap	Frag	1	6	1.00
0321	03210045	1	OE Scrap	Frag	1	2	0.25
0321	03210045	2	OE Scrap	Frag	1	2	0.25
0321	03210045	3	OE Scrap	Frag	1	2	0.25
0321	03210051	1	OE Scrap	OE Scrap	1	18	0.13
0321	03210060	1	OE Scrap	Frag	1	6	0.38
0321	03210070	1	OE Scrap	Frag	1	4	0.25
0321	03210071	1	OE Scrap	Frag	1	8	0.13
0321	03210072	1	OE Scrap	Frag	1	6	0.38

Total UXO recovered in Sector 3B:

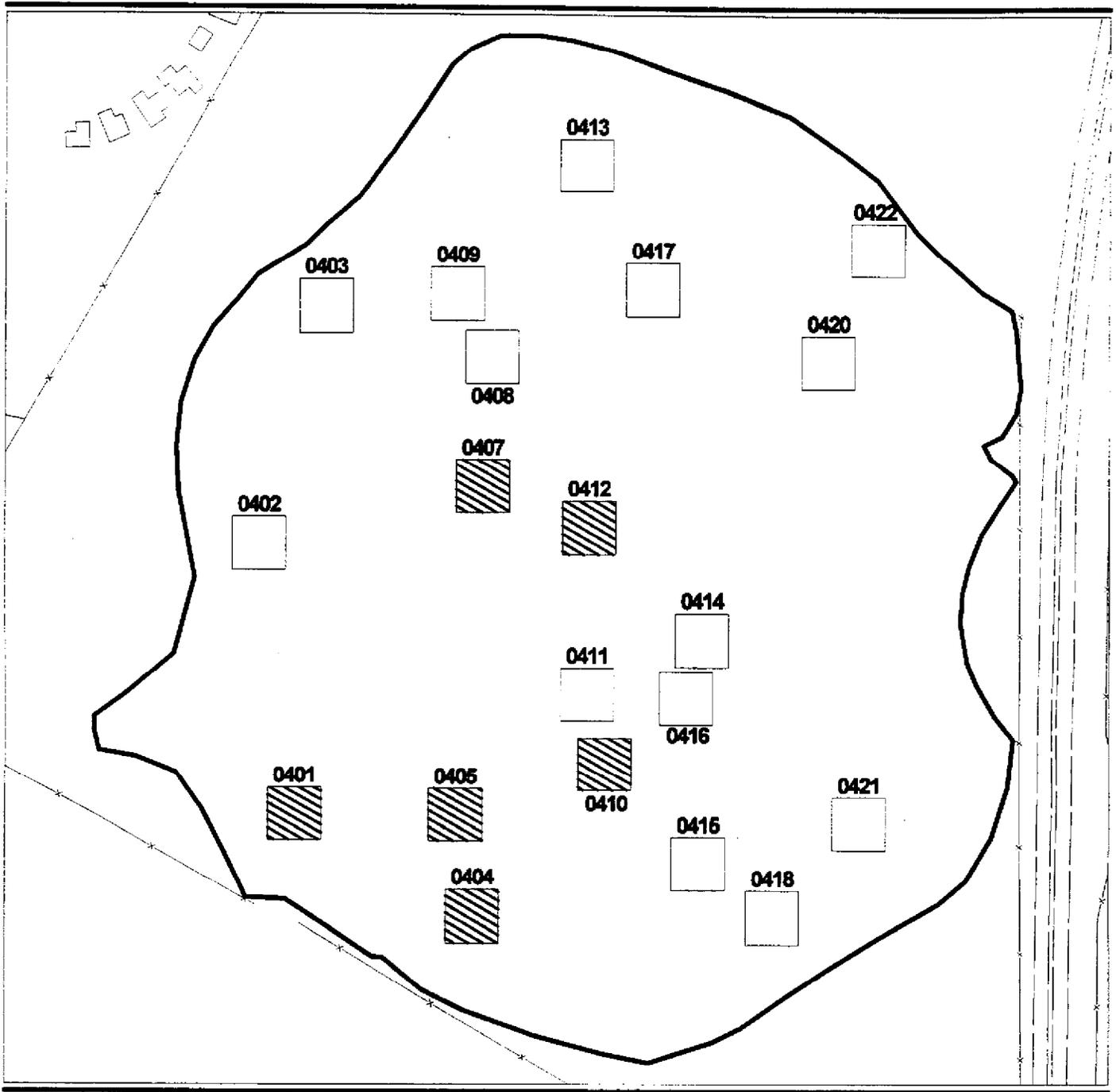
2

Total OE Scrap recovered in Sector 3B:

273

Table D-5  
OE Items Recovered in Sector 3C, City Property Adjacent to Tourtelot Property

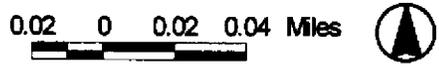
									Quantity	Description						Estimated Weight (Pounds)
There were no UXO or OE Scrap recovered in Sector 3C during the EE/CA field investigation.																



**EXPLANATION**

-  Grids with UXO
-  Grids with OE Scrap
-  Grids with Non-OE Scrap or Nothing
-  Grids with No Right-of-Entry
-  Sector Boundary
-  Planimetric Features (Roads, Fences, & Improvements)

**Sector 4  
Demolition Site on  
Exxon Property  
EE/CA Field  
Investigation Results**



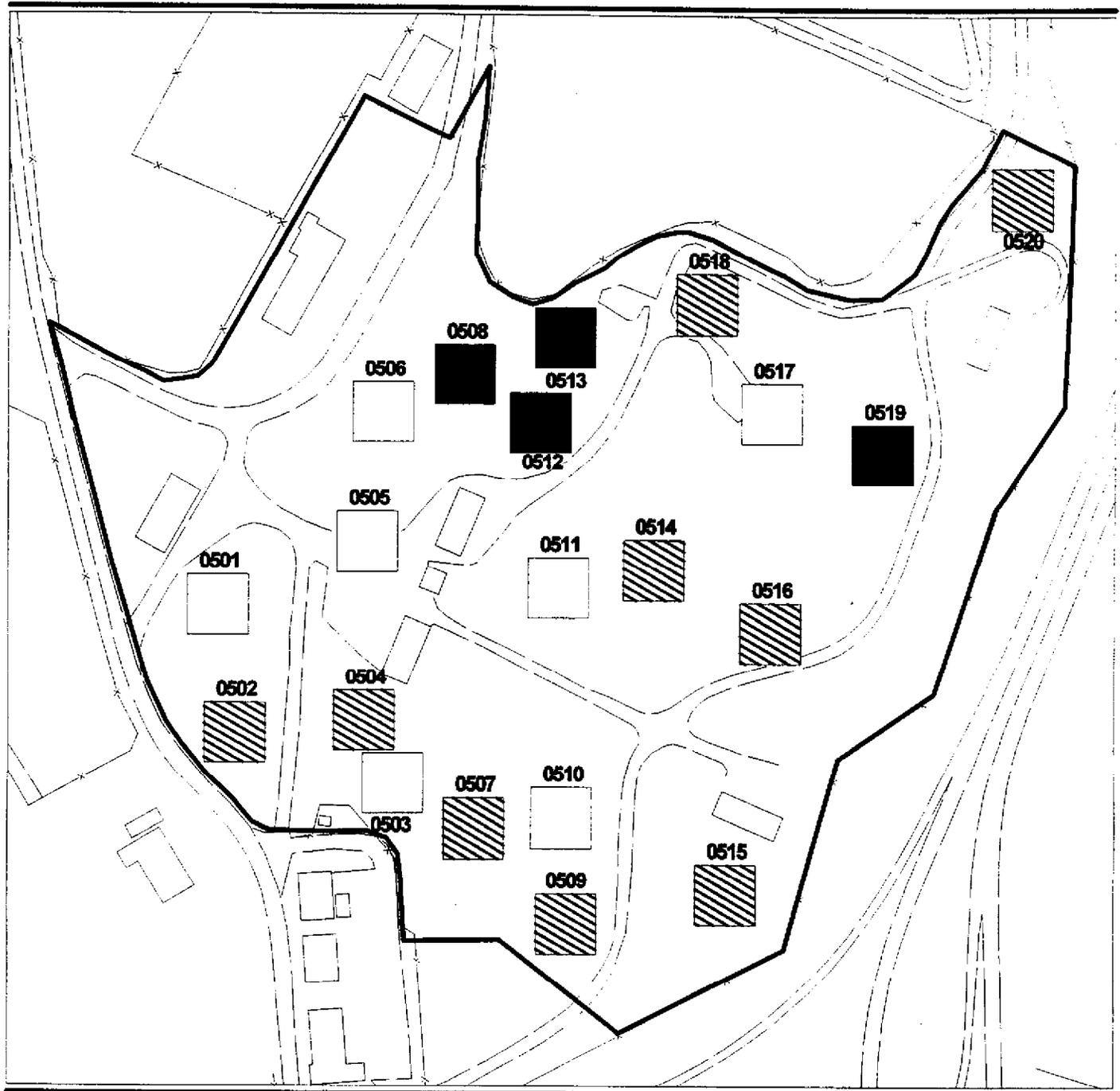
Note: Grids 0406 and 0419 were deleted due to rough terrain.

**Figure D - 4**

**Table D-6  
OE Items Recovered in Sector 4, Demolition Site on Exxon Property**

Item ID	Item Description	Quantity	Material	Condition	Count	Volume	Estimated Weight (Pounds)
0401	04010001	1	OE Scrap	Frag	1	10	0.75
0401	04010001	2	OE Scrap	Frag	1	10	0.75
0401	04010001	3	OE Scrap	Frag	1	10	0.75
0401	04010001	4	OE Scrap	Frag	1	10	0.75
0401	04010002	1	OE Scrap	Frag	1	2	0.50
0401	04010003	1	OE Scrap	Frag	1	6	1.00
0401	04010003	2	OE Scrap	Frag	1	6	1.00
0401	04010004	1	OE Scrap	Frag	1	6	1.50
0401	04010005	1	OE Scrap	Frag	1	4	1.00
0401	04010006	1	OE Scrap	Frag	1	6	1.00
0401	04010008	1	OE Scrap	Frag	1	3	0.19
0401	04010010	1	OE Scrap	Frag	1	0	0.50
0401	04010012	1	OE Scrap	Frag	1	4	0.50
0401	04010013	1	OE Scrap	Frag	1	3	1.00
0401	04010014	1	OE Scrap	Frag	1	3	1.00
0401	04010017	1	OE Scrap	Frag	1	6	0.50
0401	04010018	1	OE Scrap	Frag	1	0	1.00
0401	04010019	1	OE Scrap	Frag	1	4	0.19
0404	04040026	1	OE Scrap	Frag	1	5	0.13
0405	04050010	1	OE Scrap	Frag	1	4	0.50
0405	04050011	1	OE Scrap	Frag	1	4	2.00
0405	04050015	1	OE Scrap	Frag	1	4	2.00
0405	04050016	1	OE Scrap	Frag	1	2	0.75
0405	04050021	1	OE Scrap	Frag	2	3	2.00
0405	04050021	2	OE Scrap	Frag	1	3	1.00
0405	04050023	1	OE Scrap	Frag	1	3	0.67
0405	04050023	2	OE Scrap	Frag	1	3	0.67
0405	04050023	3	OE Scrap	Frag	1	3	0.67
0405	04050024	1	OE Scrap	Frag	1	4	1.50
0405	04050024	2	OE Scrap	Frag	1	4	1.50
0405	04050027	1	OE Scrap	Frag	1	4	1.00
0405	04050034	1	OE Scrap	Frag	1	4	0.50
0405	04050047	1	OE Scrap	Frag	2	4	0.19
0405	04050051	1	OE Scrap	Frag	1	4	2.00
0407	04070002	1	OE Scrap	Frag	1	3	0.31
0407	04070004	1	OE Scrap	Frag	1	4	0.38
0410	04100004	1	OE Scrap	Frag	1	6	2.50
0410	04100005	1	OE Scrap	Frag	1	0	1.00
0410	04100007	1	OE Scrap	Rotating Band	1	4	--
0410	04100008	1	OE Scrap	Frag	1	1	0.25
0410	04100009	1	OE Scrap	Frag	1	2	0.38
0412	04120015	1	OE Scrap	155mm Frag	1	24	8.00
0412	04120019	1	OE Scrap	155mm Frag	1	18	8.00
0412	04120020	1	OE Scrap	155mm Base	1	24	15.00
0412	04120021	1	OE Scrap	155mm Frag	1	18	4.00
0412	04120033	1	OE Scrap	155mm Frag	1	2	2.00

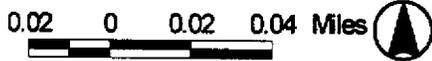
**Total UXO recovered in Sector 4: 0**  
**Total OE Scrap recovered in Sector 4: 48**



**EXPLANATION**

- Grids with UXO
- Grids with OE Scrap
- Grids with Non-OE Scrap or Nothing
- Grids with No Right-of-Entry
- Sector Boundary
- Planimetric Features  
(Roads, Fences, & Improvements)

**Sector 5  
Camel Barn Area  
EE/CA Field  
Investigation Results**



**Figure D - 5**

**Table D-7**  
**OE Items Recovered in Sector 5, Camel Barn Area**

Grid	Accession	Item	Description	Quantity	Depth (Inches)	Estimated Weight (Pounds)
0502	05020001	1	OE Scrap 75mm Mec Time Fuze	1	8	0.75
0504	05040007	1	OE Scrap Frag	1	4	1.00
0504	05040014	1	OE Scrap Frag	1	10	0.13
0507	05070005	1	OE Scrap Tail Boom	1	2	0.75
0508	05080009	1	OE Scrap Frag	1	10	0.38
0508	05080011	1	UXO 75mm shrapnel projectile, fuzed	1	16	--
0508	05080011	2	UXO 3"/50 APHE, unfuzed	1	16	--
0508	05080012	1	OE Scrap Stokes Mortar	1	20	4.00
0508	05080029	1	OE Scrap 4.2 Mortar Base Plate with Tail Boom	1	6	1.00
0508	05080035	1	OE Scrap Frag	1	6	0.25
0509	05090051	1	OE Scrap Stokes Fuze, Empty	1	4	1.00
0509	05090054	1	OE Scrap Tail Boom	1	0	1.00
0509	05090065	1	OE Scrap Frag from Stokes Fuze	1	7	1.00
0512	05120001	1	OE Scrap Frag	1	3	0.38
0512	05120002	1	OE Scrap Frag	1	0	0.75
0512	05120003	1	OE Scrap Frag	1	6	0.25
0512	05120007	1	OE Scrap Frag	1	6	1.50
0512	05120009	1	OE Scrap Frag	1	6	0.50
0512	05120015	1	OE Scrap Power Train Time Fuze, M/T	1	6	0.75
0512	05120017	1	OE Scrap Tail Boom	1	8	0.50
0512	05120021	1	OE Scrap Tail Boom	1	4	0.50
0512	05120025	1	OE Scrap Frag	1	0	0.50
0512	05120028	1	UXO Grenade	1	4	1.00
0512	05120030	1	OE Scrap Stokes Fuze, M/T	1	4	0.75
0512	05120032	1	OE Scrap Stokes Mortar Fuze, partial	1	4	0.75
0513	05130001	1	UXO 3"/50 APHE, unfuzed	1	32	--
0513	05130001	2	UXO Grenade	1	32	--
0513	05130002	1	UXO 3"/50 APHE, unfuzed	1	30	--
0513	05130002	2	UXO Grenade	1	30	--
0513	05130002	3	UXO Stokes mortar fuze	1	30	--
0513	05130003	1	UXO 3"/50 APHE, unfuzed	2	30	--
0513	05130003	2	UXO Grenade	2	30	--
0513	05130009	1	OE Scrap Frag	1	8	0.06
0513	05130010	1	UXO Grenade	1	4	--
0513	05130011	1	OE Scrap Frag	1	6	0.25
0513	05130014	1	OE Scrap Frag	1	6	0.50
0513	05130021	1	OE Scrap Frag	1	12	0.50
0513	05130021	2	OE Scrap Frag	1	12	0.50
0513	05130022	1	UXO Base Fuze	1	4	--
0514	05140001	1	OE Scrap Frag	1	3	--
0514	05140003	1	OE Scrap 75mm Projectile Base Plate	1	3	1.00
0514	05140004	1	OE Scrap Frag	1	6	1.00
0514	05140005	1	OE Scrap Frag: Fuze Adapter	1	5	0.25
0514	05140006	1	OE Scrap Base Plate	1	6	--
0514	05140010	1	OE Scrap Frag	1	6	0.50
0514	05140011	1	OE Scrap Tail Boom	1	6	0.75
0514	05140012	1	OE Scrap Frag	1	4	0.25
0514	05140014	1	OE Scrap Tail Boom	1	7	0.75
0514	05140015	1	OE Scrap Frag	1	3	0.25
0514	05140016	1	OE Scrap Frag	1	6	0.13
0514	05140017	1	OE Scrap Tail Boom	1	4	0.50
0514	05140018	1	OE Scrap Frag	1	3	0.75
0514	05140019	1	OE Scrap Frag	1	4	0.13
0514	05140021	1	OE Scrap Tail Boom	1	4	0.50
0514	05140022	1	OE Scrap Tail Boom	1	4	0.75
0514	05140023	1	OE Scrap Frag	1	3	0.50
0515	05150042	1	OE Scrap Stokes Fuze - Expended	3	20	2.00
0516	05160002	1	OE Scrap Frag	1	2	0.13
0516	05160003	1	OE Scrap Frag	1	5	0.38
0516	05160004	1	OE Scrap Grenade, M/T	1	1	1.00
0516	05160005	1	OE Scrap Frag: Base of a Stokes Fuze	1	0	0.38
0516	05160006	1	OE Scrap Frag	1	6	0.19
0516	05160007	1	OE Scrap Frag	1	2	0.19
0516	05160008	1	OE Scrap Frag	1	4	0.38
0516	05160009	1	OE Scrap Grenade, M/T	1	3	1.00
0516	05160011	1	OE Scrap Frag	1	0	1.00

**Table D-7  
OE Items Recovered in Sector 5, Camel Barn Area**

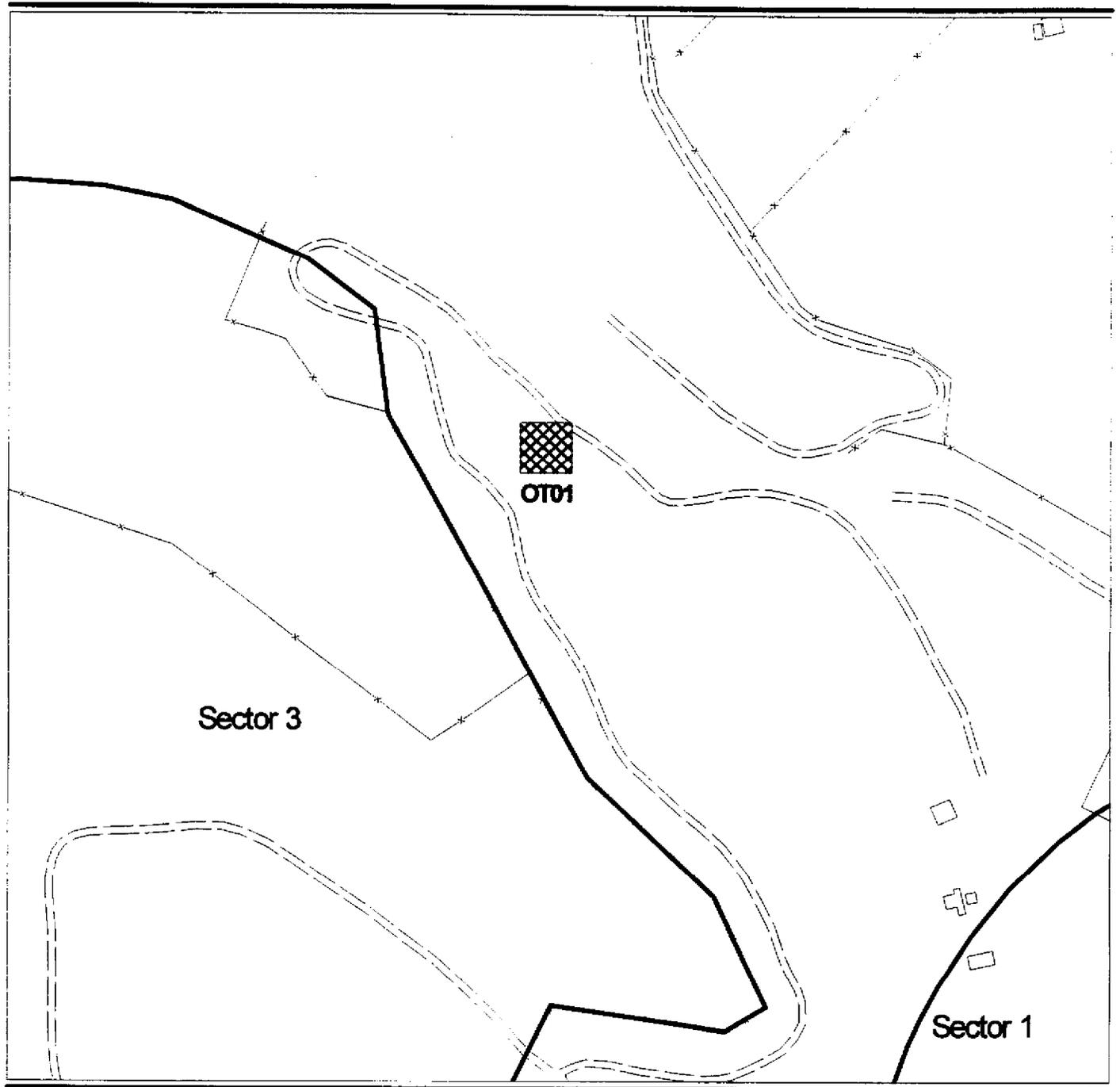
GRID	Item ID	Quantity	Category	Description	Quantity	Depth (inches)	Estimated Weight (pounds)
0516	05160013	1	OE Scrap	Frag from Stokes Fuze	1	0	0.50
0516	05160016	1	OE Scrap	Frag	1	3	0.25
0516	05160017	1	OE Scrap	Frag	1	4	0.25
0516	05160018	1	OE Scrap	Frag	1	0	0.13
0518	05180013	1	OE Scrap	Fuze, M/T	1	36	0.67
0518	05180013	2	OE Scrap	Booster Cap, M/T	2	36	1.32
0518	05180013	3	OE Scrap	75mm Pusher Plate	1	36	0.67
0518	05180013	4	OE Scrap	Frag	1	36	0.67
0518	05180013	5	OE Scrap	Grenade, M/T	1	36	0.67
0518	05180029	1	OE Scrap	Frag	1	8	0.19
0519	05190006	1	OE Scrap	Frag	1	3	1.00
0519	05190008	1	OE Scrap	Frag	1	3	1.00
0519	05190013	1	OE Scrap	Frag	1	4	0.38
0519	05190015	1	OE Scrap	Frag	1	3	0.38
0519	05190016	1	OE Scrap	Frag	1	3	0.13
0519	05190018	1	OE Scrap	Frag	1	6	0.25
0519	05190019	1	OE Scrap	Base Plate with Tail Boom	1	6	2.00
0519	05190022	1	OE Scrap	Tail Boom	1	0	0.38
0519	05190024	1	OE Scrap	Frag: 37mm	1	6	0.50
0519	05190027	1	OE Scrap	Frag	1	1	0.38
0519	05190035	1	UXO	Grenade	1	0	1.00
0519	05190036	1	OE Scrap	Frag	1	4	0.13
0519	05190042	1	OE Scrap	Frag	1	1	0.06
0520	05200013	1	OE Scrap	Frag	1	4	1.00
0520	05200014	1	OE Scrap	Frag	1	2	0.19
0520	05200015	1	OE Scrap	Frag	1	4	0.25
0520	05200032	1	OE Scrap	Frag	1	6	0.13
0520	05200034	1	OE Scrap	Frag	1	2	0.19

Total UXO recovered in Sector 5:

15

Total OE Scrap recovered in Sector 5:

84



**EXPLANATION**

-  Grids with UXO
-  Grids with OE Scrap
-  Grids with Non-OE Scrap or Nothing
-  Grids with No Right-of-Entry
-  Sector Boundary
-  Planimetric Features (Roads, Fences, & Improvements)

**Grid OT01  
Overturned Truck Area  
EE/CA Field  
Investigation Results**

0.02 0 0.02 0.04 Miles



**Figure D - 6**

Table D-8  
OE Items Recovered in Grid OT01, Overturned Truck Area

Item	Quantity	Depth (Inches)	Estimated Weight (Pounds)
OE Sampling was not performed in Grid OT01 because right-of-entry could not be granted.			

**APPENDIX E**  
**INSTITUTIONAL ANALYSIS REPORT**

## TABLE OF CONTENTS

	Page
1.0 INTRODUCTION .....	1-1
1.1 PURPOSE AND OBJECTIVES .....	1-1
1.2 DEFENSE ENVIRONMENTAL RESTORATION PROGRAM .....	1-1
1.3 INSTITUTIONAL CONTROLS.....	1-2
1.4 METHODOLOGY .....	1-3
1.5 BACKGROUND .....	1-4
1.6 GOVERNMENT AGENCIES .....	1-6
1.7 OTHER STAKEHOLDERS.....	1-6
2.0 LAND USE .....	2-1
3.0 EXISTING INSTITUTIONAL CONTROLS .....	3-1
4.0 CONCLUSIONS.....	4-1
5.0 BIBLIOGRAPHY .....	4-1

Appendix A     Summaries of Interviews and Institutional Data Summary Form

## LIST OF FIGURES

1-1	Regional Map.....	1-7
2-1	Future Land Use Former Benicia Arsenal.....	2-2

## LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
GSA	General Services Administration
I	Interstate
LAFCO	Local County Agency Formation Commission
NCP	National Contingency Plan
OE	ordnance and explosives
PG & E	Pacific Gas and Electric
SARA	Superfund Amendments and Reauthorization Act
SOI	Sphere of Influence
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance

## 1.0 INTRODUCTION

---

This institutional analysis identifies and analyzes the institutional framework necessary to support the development of institutional controls as alternative plans of action for the Former Benicia Arsenal in Benicia, California.

### 1.1 PURPOSE AND OBJECTIVES

The purpose of this analysis is to gather background information and document which public and private entities have jurisdiction over ordnance and explosives (OE)-contaminated lands at the Former Benicia Arsenal, and to assess their capability and willingness to assert institutional controls that would protect the public from explosive hazards. More specifically, this report:

- Identifies entities that have jurisdiction over the land within the site boundaries
- Defines each entity's authority, responsibility, capabilities, resources, and willingness to participate in institutional controls over the property for the protection of the public from explosive hazards
- Identifies potential institutional control strategies available to implement access control and/or public behavior modifications for the property
- Defines and analyzes intergovernmental relationships, joint responsibilities, land use control functions, technical capability, funding sources, and recommendations.

### 1.2 DEFENSE ENVIRONMENTAL RESTORATION PROGRAM

In 1986, Congress enacted the Superfund Amendments and Reauthorization Act (SARA). SARA amended certain aspects of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), some of which directly related to OE contamination. Chapter 160 of SARA established the Defense Environmental Restoration Program (DERP). One of the goals specified for the DERP is "correction of environmental damage" (such as detection and disposal of unexploded ordnance [UXO]) that creates an imminent and substantial endangerment to the public health or welfare or to the environment. The DERP requires that appropriate action consistent with CERCLA be undertaken whenever such "imminent and substantial endangerment" is found at a facility or site that is under the jurisdiction of the Secretary of Defense and is owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination.

The National Contingency Plan (NCP) was established by the Clean Water Act of 1972 and has been revised and broadened several times since then. Its purpose is to provide the organizational structure and procedures for remedial actions to be taken in response to the presence of hazardous substances, pollutants, and contaminants at a site. Section 105 of the 1980 CERCLA states that the NCP

1 shall apply to all response actions taken as a result of CERCLA requirements.  
2 The March 1990 National Oil and Hazardous Substances Pollution Contingency  
3 Plan given in 40 Code of Federal Regulations (CFR) Part 300 is the latest version  
4 of the NCP. Paragraph 300.120 states that "Department of Defense (DOD) will  
5 be the removal response authority with respect to incidents involving DOD military  
6 weapons and munitions under the jurisdiction, custody, and control of DOD."  
7

8 The NCP model requires that any government response be considered openly in  
9 coordination with all stakeholders. Further, federal decision making requires  
10 development of alternative response strategies to assure that the most effective  
11 (and least objectionable) plans are implemented. Alternative plans should be  
12 based upon a variety of technologies or implementation strategies that are  
13 sufficiently different in effect to allow for technical discrimination in the  
14 assessment of plans, and to allow for real choice on the part of the stakeholders.  
15 A strategy that engages the presence of ordnance is a removal action.  
16

17 Removals are the traditional response. In general, a plan of action involves  
18 developing and coordinating plans for worker and public safety during the action,  
19 site mobilization, operations, and site close out that may include continuing  
20 maintenance requirements. When a federal response action is complete, there is  
21 a natural tendency for stakeholders to assume that the site is clean. This  
22 happens no matter how clearly it is stated that no removal action is complete.  
23 Removal produces a condition where there is less ordnance. If human behavior  
24 is the same before and after the removal, we can claim that the risk is  
25 substantially reduced. However, if, as a result of the removal, human access is  
26 facilitated and/or behavior is less cautious, we have an unknown situation that  
27 may pose greater risk. Institutional controls are alternative response plans that  
28 use government or other authorities in addition to the response authority under  
29 the DERP.  
30

### 31 1.3 INSTITUTIONAL CONTROLS

32 Institutional controls are non-engineering methods that federal, state, and local  
33 governments, or private parties can utilize to prevent or limit access to or use of  
34 property.  
35

36 Institutional controls rely on strategies based on behavior modification and site  
37 access control. Institutional controls use the existing powers and authorities of  
38 government agencies to protect the public from OE risks. Limiting access to or  
39 use of a property may be required to prevent activities from interfering with,  
40 reducing, or impairing the effectiveness or protectiveness of cleanup measures,  
41 or to protect human health and safety and the environment.  
42

43 Potential institutional controls for the Former Benicia Arsenal include:  
44

- 45 • General plans
- 46 • Special-use permits
- 47 • On-site access restrictions and enforcements
- 48
- 49
- 50

- Real estate disclosure statements
- Public education and awareness of the potential presence of ordinance
- Zoning, subdivision, and public facilities ordinances.

These strategies require local cooperation, responsible land use control, or police powers for enforcement. These approaches require a close, voluntary relationship among the various levels of government, stakeholders, and landowners.

In general, access control limits the use of the contaminated property. This can be accomplished by restricting access or by dedicating the property to compatible use. The target strategy is to remove the human element from the chain of events leading to an accident. Restricting access can be accomplished by enforcement of trespass regulations. Enforcement may include the posting of signs prohibiting access, the construction of a barrier, such as a fence, or security guards. Another form of access control is to find an appropriate use of the property that is compatible with ordinance contamination. Compatible uses may limit human activity in order to protect the public. Examples of compatible use include wildlife preserves, parking lots, and golf courses, where the general public participates in an activity that is not likely to result in ground disturbance. Compatible land uses can be developed through general plans and zoning ordinances.

Behavior modification requires on the personal responsibility of the site users. The concept of behavior modification extends to agencies that have jurisdiction over the site. Institutional controls that influence behavior include notifications that ordinance is present, such as an environmental defect restriction, training and education concerning ordinance-contaminated sites, restricting access, and establishment of administrative requirements for the protection of property owners and the public.

#### 1.4 METHODOLOGY

Basic data used for this institutional analysis was collected from various sources, including site visits; government records research; interviews with individuals representing the city of Benicia, the Exxon refinery, Benicia Industries, Granite Management, and distribution and analysis of an Institutional Data Survey Form to the City of Benicia.

The data survey form requested information on the type of organization, its jurisdiction, responsibilities for public safety, intergovernmental relationships, function and aims, and financial basis. Summaries of interviews as well as the completed Institutional Data Survey Forms are provided as Appendix A.

Data collected during the interview and survey processes included jurisdictional boundaries, authorities, responsibilities for land use and public safety, capabilities, resources, and the agencies' willingness to participate in institutional controls. Institutional controls already in place were identified. Current and future

1 capabilities for institutional controls, current and future responsibilities for land  
2 use, and public safety and capabilities in terms of authorities and resources were  
3 also investigated. The methods focused upon identification of institutional  
4 controls that would be protective, based upon legally constituted authority that  
5 would fit the community to which the controls were applied. The analysis focused  
6 upon behavior modification and access control strategies capable of reducing or  
7 eliminating OE risk.  
8

## 9 1.5 BACKGROUND

10 The Former Benicia Arsenal began as the Benicia Barracks in 1849. Prior to this  
11 the property was used for grazing and crops. In 1851, the first ordnance supply  
12 depot in the West, the California Ordnance Depot, was established on land  
13 adjoining the Barracks to the east. Between 1849 and 1958, the United States  
14 acquired a total of 2,728 acres for the Benicia Arsenal.  
15

16 During the Civil War, the Former Benicia Arsenal supplied arms to arsenals along  
17 the Atlantic coast. Testing of experimental gun powders developed on the West  
18 Coast was conducted at the Former Benicia Arsenal from 1882 to 1890. In 1898,  
19 supplies of ordnance were shipped from Benicia to the Philippines during the  
20 Spanish-American War (Jacobs Engineering, 1998).  
21

22 By the early 1900s, the Benicia Arsenal was manufacturing targets for seacoast,  
23 field, and mobile artillery firing practice. In addition, the arsenal assembled  
24 powder charges and rapid-fire ammunition, and filled armor-piercing projectiles  
25 with high explosives. During World War I, the arsenal furnished ordnance  
26 supplies to all troops west of the Rocky Mountains and serviced weaponry  
27 destined for Europe. In 1924, the Benicia Barracks and Benicia Arsenal were  
28 combined into one entity, which was referred to as the Benicia Arsenal  
29 Reservation (Jacobs Engineering, 1998).  
30

31 In 1912, a fire devastated Storehouse 29, igniting 15 million rounds of small arms  
32 ammunition, 34,000 rifles, and other supplies. In 1922, another notable fire  
33 occurred when a spark ignited powder on the ground at the Benicia Barracks,  
34 destroying a powder magazine and some nearby living quarters (Jacobs  
35 Engineering, 1998).  
36

37 World War II was a time of great expansion at the Benicia Arsenal. Two-thirds of  
38 the arsenal's land was acquired at this time, and construction of more than 200  
39 structures took place. A deepwater concrete wharf, capable of docking up to four  
40 ships simultaneously, was built. Other improvements included 109 concrete  
41 igloos for ammunition storage, warehouses, and extension of rail spurs into the  
42 ammunition and industrial areas.  
43

44 Following the war, the Benicia Arsenal served as a reclamation center, receiving  
45 unused arms, ammunition, equipment, and other supplies. Much of the material  
46 returned required servicing in preparation for sale as salvage, or to be placed in  
47 storage. Repairs were made to thousands of handguns, machine guns, and  
48 artillery pieces. In addition, hundreds of tons of damaged or obsolete ammunition  
49 were destroyed by the Former Benicia Arsenal (Jacobs Engineering, 1998).  
50

1 More expansion took place prior to and following the Korean Conflict. New  
2 structures included warehouses and transitory storage shelters. During this time,  
3 the nearby Stockton Ordnance Depot was decommissioned, and its operations  
4 were transferred to the Benicia Arsenal. Supplies and materials from Stockton,  
5 coupled with incoming shipments destined for Korea and existing supplies  
6 returned from World War II, flooded Benicia. Open fields had to be used to  
7 contain the abundance of supplies as there were not enough structures to store  
8 everything. At the end of the Korean Conflict, 21 ships loaded with unserviceable,  
9 obsolete, and surplus supplies headed to the Benicia Arsenal (Jacobs  
10 Engineering, 1998).

11  
12 As part of the Cold War build-up, the Benicia Arsenal began reconditioning NIKE  
13 guided missiles in 1954. Two NIKE test sites were situated in the northwest  
14 portion of the arsenal. In addition, NIKE launch racks were situated throughout  
15 the arsenal's hills.

16  
17 Leases for 575.45 acres were terminated between 1945 and 1960. By 1958,  
18 operations at the arsenal slowed, and the Small Arms Shop was shut down. The  
19 following year, most World War II surplus supplies were sold or transferred. In  
20 1961, DOD announced that it planned to decommission the Benicia Arsenal and  
21 transfer its operations to Tooele Ordnance Depot in Utah. By 1962, Tooele had  
22 already assumed most of the mission elements that were being conducted at  
23 Benicia. That same year, the arsenal was declared excess by the Department of  
24 Defense and was reported to the General Services Administration (GSA), which  
25 immediately reported 360.78 acres of public domain/license/easement/lease  
26 property as excess. Final closure of the Benicia Arsenal occurred in 1964  
27 (Jacobs Engineering, 1998).

28  
29 From 1964 to 1965, 1.33 acres of public domain property was reassigned to the  
30 Benicia Arsenal Cemetery, and the city of Benicia received the remaining  
31 1,790.48 acres through GSA quitclaim deeds. Between 1966 and 1969, an oil  
32 refinery, now operated by Exxon, was constructed on 400 acres, destroying many  
33 of the former arsenal's storage igloos. The remainder of the former arsenal  
34 remained vacant. Beginning in 1975, Benicia Industries redeveloped most of the  
35 remaining warehouse space in the central portion of the former arsenal and  
36 leased the space to various light industrial businesses.

37  
38 During the early 1990s, Pacific Bay Homes began development north and west of  
39 the Revetment area. A portion of the undeveloped area near the former Howitzer  
40 Tunnels was used as a borrow site for soils.

41  
42 In February of 1997, Pacific Bay Homes began residential construction in the  
43 same area. Live conventional ordnance was found during excavation activities.  
44 Construction was halted, and the U.S. Army Corps of Engineers (USACE) was  
45 tasked to perform additional research to determine potential occurrence of OE  
46 within the Tourtelot section of the Former Benicia Arsenal and any other possible  
47 sites on the former arsenal with the potential for buried ordnance.

48  
49 Based on research and review of historical records, approximately 400 acres are  
50 suspected of having OE/UXO contamination. The 400-acre study area is mostly  
51 in the undeveloped portion of the Former Benicia Arsenal.

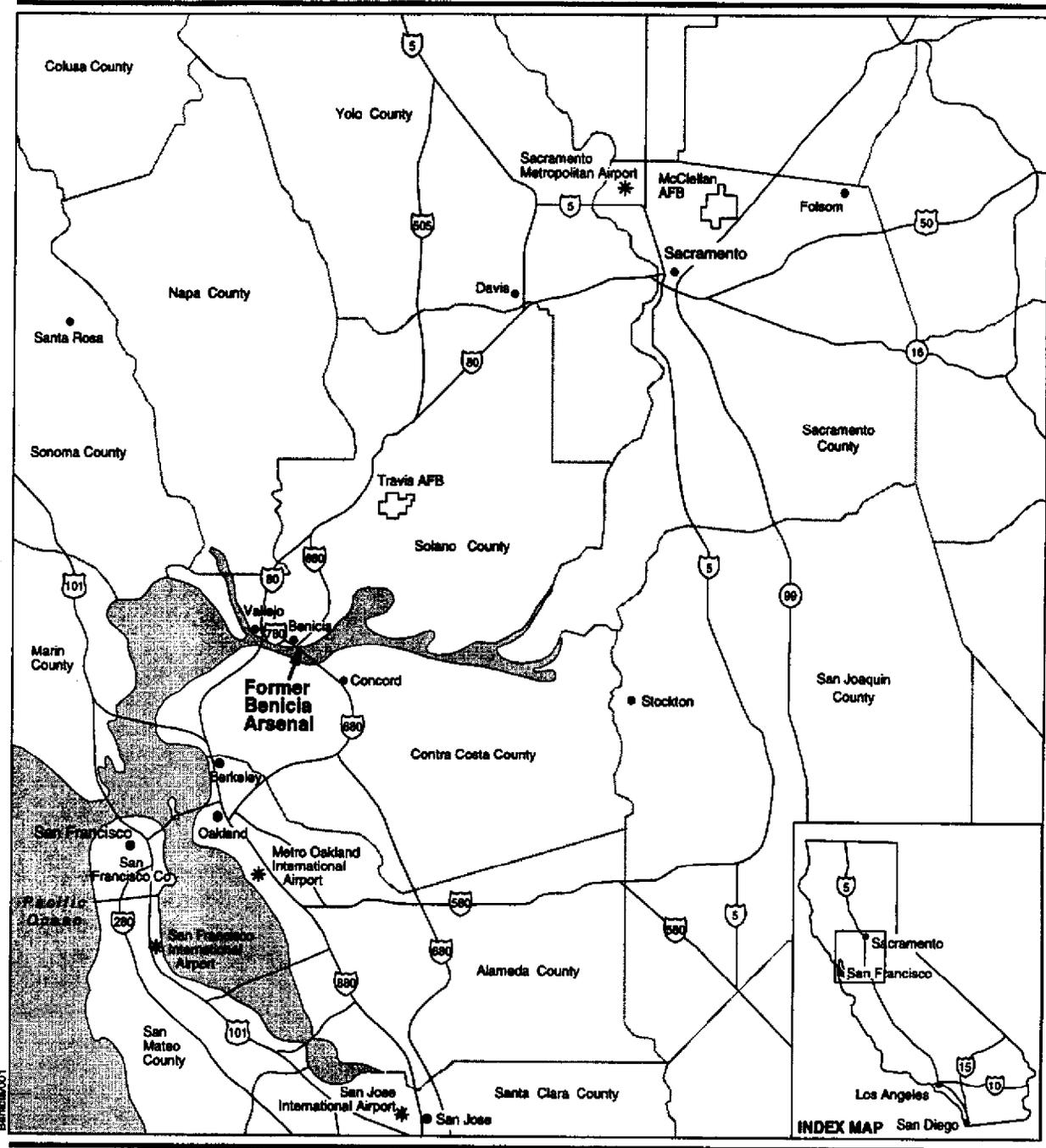
1 **1.6 GOVERNMENT AGENCIES**

2  
3 The Former Benicia Arsenal is in the city of Benicia, Solano County, California,  
4 approximately 25 miles northeast of San Francisco (see Figure 1-1). The city of  
5 Benicia is built on a peninsula of land that reaches south from the main body of  
6 Solano County and creates a prominent bend in the Carquinez Strait. Although  
7 part of Solano County, Benicia is closely linked to Contra Costa County across  
8 the Strait. The former arsenal is bordered by downtown Benicia and the  
9 Carquinez Strait to the south, Suisun Bay to the east, and residential  
10 neighborhoods to the west. The property consisted of approximately 2,728 acres  
11 extending from the Carquinez Strait and marshland along the southern portion of  
12 the site to rolling hills in the northern portion.

13  
14 The city of Benicia provides land use planning and zoning control to the Former  
15 Benicia Arsenal. Benicia's planning area covers an area of over 15,000 acres, or  
16 24 square miles. This planning area generally corresponds to Benicia's Sphere  
17 of Influence (SOI), the area designated by the Solano County Local Agency  
18 Formation Commission (LAFCO) as the probable ultimate physical boundary and  
19 service area of the city. The Solano County LAFCO is a state-mandated local  
20 agency that oversees boundary changes to cities and special districts. Benicia's  
21 1995 city limits covered a total of 14 square miles, including about 1.2 square  
22 miles of open water and 12.8 square miles of land. The land area also includes  
23 some areas of seasonal or permanent wetlands. Nearly all of the existing  
24 residential, commercial, and industrial development in the Planning Area is within  
25 the city limits.

26  
27 **1.7 OTHER STAKEHOLDERS**

28  
29 The Former Benicia Arsenal ownership includes the city of Benicia, Benicia  
30 Industries, Inc., Exxon, Pacific Gas and Electric (PG & E), Granite Management,  
31 and numerous other private commercial and residential parcels. In addition, the  
32 general public uses areas of the Former Benicia Arsenal for recreational  
33 purposes.



- EXPLANATION**
- \* Airports
  - (99) California State Highway
  - (101) U.S. Highway
  - (80) Interstate Highway
  - County Boundary



**Regional Map**

**Figure 1-1**

1 **2.0 LAND USE**  
2  
3

---

4 Land use on the Former Benicia Arsenal is primarily industrial with limited  
5 residential development in the northern portion of the site. Benicia Industries,  
6 Inc., owns a large portion of the former arsenal and maintains an industrial park  
7 throughout the central and southern portions of the property, including a port  
8 along the Carquinez Strait. Exxon Oil Company operates a refinery on  
9 approximately 400 acres. There are single-family homes to the northwest, and  
10 new housing tracts are planned for the northern portion of the property  
11 (Figure 2-1).  
12

13 Developed areas on the Former Benicia Arsenal are concentrated in the southern  
14 and central portion of the area. Benicia Industries and the city of Benicia occupy  
15 the southern portion of the site. This area is primarily used as a shipping port,  
16 industrial warehousing, and manufacturing area; however, some residential,  
17 commercial, and quasi-public land uses exist within the southern area.  
18

19 The portion of the area between Interstate (I)-780 and the water-related industrial  
20 lands is characterized by older, historic buildings and a multiplicity of uses and  
21 tenants, including studios, small professional offices, and small industrial  
22 activities, such as cabinet making. The lower arsenal Mixed Use area includes  
23 residential live/work, office, retail development, churches, limited industrial, and  
24 general commercial uses. The city proposes to increase the number and types of  
25 spaces available for living and working, to encourage a mix of compatible uses in  
26 areas of the Lower Arsenal to promote the upgrading of existing buildings, the  
27 preservation and adaptive reuse of historic buildings, and to allow new,  
28 compatible buildings to house mixed use.  
29

30 The Port of Benicia is leased to and partially owned by Benicia Industries. The  
31 Port of Benicia specializes in the shipment of automobiles and petroleum  
32 products. These lands were granted to the city by the state legislation in 1964 for  
33 uses including a harbor to accommodate and promote commerce and navigation,  
34 commercial and industrial uses, transportation facilities related to commerce and  
35 navigation, public buildings and facilities, recreation, fishing, and marinas and  
36 associated facilities. The legislation provided that the city could lease the granted  
37 lands for periods of up to 66 years for purposes consistent with the legislation.  
38 Benicia Industries leased the entire arsenal port area in 1965 and in 1975  
39 acquired the upland port areas in fee. Long-term development in the port area is  
40 expected to include port terminals and water-dependent, related industrial uses  
41 such as warehousing and storage, support transportation services, and ship  
42 maintenance and repair.  
43

44 The central portion of the site is occupied by the Exxon refinery. Exxon operates  
45 a petroleum refinery on the eastern portion of the area that is zoned for general  
46 industrial use. The western portion of the Exxon property is currently vacant and  
47 zoned for limited industrial use. An open-space buffer approximately 200 feet  
48 wide is required between the industrial area and residential land use to the east of  
49 the Former Benicia Arsenal. Limited industrial land uses allowed in this area  
50 include manufacturing, assembly, and packaging of goods primarily from



Benicia014

**EXPLANATION**

- |                               |                        |         |
|-------------------------------|------------------------|---------|
| Industrial/General            | Residential            | Sectors |
| Industrial/Limited            | Open Space             |         |
| Industrial/Waterfront Related | Parks                  |         |
| Public/Quasi-Public           | Interstate Highway     |         |
| Mixed Use                     | Former Benicia Arsenal |         |



**Future Land Use  
Former Benicia Arsenal**

**Figure 2-1**

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14

previously prepared materials; wholesale, distribution, and storage facilities; research and development facilities; and related industrial and commercial services. The western portion of the Exxon property, while zoned for limited industrial use, is expected to remain vacant.

The northern portion of the site is primarily open space with some residential housing. The area is zoned for limited industrial, public/quasi public, parks, and residential use. A small portion of the northwest corner of the Former Benicia Arsenal is used for single-family residential housing. The portion of the Former Benicia Arsenal north of the Exxon Refinery is planned for limited industrial, residential, open space, and park use. While there are no current plans to develop the limited industrial area, the residential area is expected to be developed into single-family housing units at a density of up to seven units per acre.

### 3.0 EXISTING INSTITUTIONAL CONTROLS

---

Both public and private institutional controls presently exist or are proposed that limit land use, and in some instances, public access on the Former Benicia Arsenal. Although some of these controls were adopted for reasons unrelated to OE, they will serve to constrain future land uses on the Former Benicia Arsenal as long as they remain in place. Institutional controls for the Former Benicia Arsenal include:

- City of Benicia General Plan
- Real Estate Disclosure Statements
- On-site Access Restrictions.

The City of Benicia Draft General Plan includes Community Health and Safety policies and programs that provide the general public with information on emergency response and preparedness for credible worst-case scenarios from potential industrial hazards. Specific policies and programs proposed for implementation include:

- Using documents that are already publicly available, make available in the library a list of all known contaminated sites in Benicia, their chemical contents and conditions, and how contamination occurred.
- Providing readers with easy directions on how to access information about contaminated sites in Benicia.
- Establishing an environmental commission composed of residents, business people, school representatives, and appropriate city staff that is answerable to the City Council that would identify, inventory, and then update sources of hazards in Benicia.
- Protecting existing and future development from contaminated sites, hazardous landfill waste and debris, chemical spills, and other hazards including unexploded OE waste.
- Working with state and federal agencies to require that unauthorized hazardous substances be removed from neighborhoods or that other appropriate measures be taken to ensure that such substances do not present health risks to the neighborhood.
- Promoting enforcement of regulatory requirements over the entire term of monitoring of identified hazardous sites within the city limits, especially sites in residential neighborhoods and near school playing fields and parks.
- Requiring that all sites known or suspected to have UXO and/or toxic history be tested and remediated before any development can occur.
- Prohibiting residential development on any land formerly operated as landfill or dump, including land formerly owned or used by the military for military wastes, until the waste and contamination is removed

1 [with proper agency oversight] or remediated as required by the  
2 appropriate regulatory agencies.  
3

- 4 • Where environmental testing has been required by state regulatory  
5 agencies but is not yet completed, withholding city approvals for site  
6 grading and other construction activities until a site evaluation is  
7 available that provides a reasonable basis for determining that it is  
8 safe to commence such activities.  
9

10 The State of California Civil Code (Section 1102) requires real estate disclosure  
11 statements on real estate property proposed for transfer. These disclosure  
12 statements include notifications of natural hazards such as earthquake faults and  
13 flood plains as well as disclosure notices of special local district taxation. Section  
14 1102.15 of the Civil Code requires the seller of residential real property to  
15 disclose knowledge of any area within 1 mile of the residential property that was  
16 once used for military training purposes and that may contain potentially explosive  
17 munitions.  
18

19 On-site access restrictions are evident on some land parcels on the Former  
20 Benicia Arsenal. The Exxon petroleum refinery is fenced, and access is  
21 controlled by gated entry. The gates are manned by security guards or are  
22 closed and locked. In addition, Exxon periodically patrols the property. The  
23 proposed residential area in the northern portion of the site (Sector 3) is also  
24 fenced and patrolled by security guards on a 24-hour basis. The rest of the  
25 Former Benicia Arsenal is accessible to the general public.

## 4.0 CONCLUSIONS

---

The city of Benicia's draft General Plan health and safety policies and programs are being implemented to protect the public health and safety from potential UXO on the Former Benicia Arsenal. For example, the city is currently implementing actions on the planned residential community on the northern portion of the site to remove any potential UXO before approving site development and grading plans for the project. In addition, the city of Benicia is working with the landowners, lessors, and stakeholders to protect the public health and safety from sites potentially contaminated with UXO on other locations at the Former Benicia Arsenal by requiring property owners to limit access to the general public.

Benicia's General Plan, when adopted, should provide additional opportunity for institutional controls that will protect the general public from the potential for UXO at the Former Benicia Arsenal. These include:

- Establishment of an administrative record to make the documents on the Former Benicia Arsenal available to the general public.
- Identification, inventory, and update of sources of hazards on the Former Benicia Arsenal using the city's environmental commission.
- Withholding of city approval for site improvements that require excavation until site evaluations have been completed that provide a reasonable basis for determining that the site is safe.
- Continuing of requirements for public access restrictions by property owners on selected parcels within the boundaries of the Former Benicia Arsenal.
- Establishment through the California Civil Code, Section 1102.6a, of additional real estate disclosure statements for non-residential properties within the boundaries of the Former Benicia Arsenal.

## 1 5.0 BIBLIOGRAPHY

---

- 2
- 3
- 4 City of Benicia, 1998. Edited Draft General Plan. November.
- 5
- 6 City of Benicia, 1998. Benicia General Plan Draft Environmental Impact Report. January.
- 7
- 8 Jacobs Engineering, 1998. Draft Benicia Arsenal Records Research Report, March.
- 9
- 10 U.S. Army Corps of Engineers, St. Louis District, 1994. Archives Search Report Findings Benicia Arsenal.
- 11 March.
- 12
- 13 U.S. Army Corps of Engineers, St. Louis District, 1994. Archives Search Report Conclusions and
- 14 Recommendations Benicia Arsenal. March.

**APPENDIX A**  
**SUMMARIES OF INTERVIEWS AND**  
**INSTITUTIONAL DATA SUMMARY FORM**

Institutional Data Survey Form

**Institutional Data Survey Form  
Engineering Evaluation/Cost Analysis (EE/CA)  
Former Benicia Arsenal  
Benicia, California**

DATE: February 4, 1999

TIME: \_\_\_\_\_

PLACE: Benicia California

1. Name of Respondent: Heather Chin Chu McLaughlin

Title: City Attorney

Elected:        Yes  No

Appointed:  Yes        No

2. Length of time in present position: 2 years

Length of time with organization: 2 years

3. Name and address of organization: City Hall  
250 East L St.  
Benicia, Ca 94510

Phone: 707/746-4216

FAX: 707/746-1196

4. Name and address of headquarters office, if different from above:  
\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

FAX: \_\_\_\_\_

Institutional Data Survey Form

5. Type of organization (Check one)

- Private Business
- Federal Government
- State Government
- Local Government
- Special District
- Civic or Service Organization
- Professional Society
- Special Interest Group
  - Environmental
  - Recreation
  - Other \_\_\_\_\_

6. How many persons are employed full time in your organization? \_\_\_\_\_

7. How many part time employees are on your payroll (include seasonal)? \_\_\_\_\_

8. Approximately how many employees could be classified by the following:

- |                  |                        |
|------------------|------------------------|
| Managerial _____ | Engineers _____        |
| Surveying _____  | Accountants _____      |
| Biologist _____  | Resource Planner _____ |
| Attorney _____   | Other _____            |
|                  | (Specify) _____        |

9. Are any of the above skills retained by your organization in a consulting capacity?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. What is the jurisdictional level of the organization?

- National
- State
- Multiparish/Multicounty
- Parish/County
- Subparish/Subcounty
- Municipal
- Submunicipal

11. What geographic area(s) is served by the organization?

City of Benicia

\_\_\_\_\_

\_\_\_\_\_

Institutional Data Survey Form

12. Does your organization have a concern or responsibility for public safety and related land management?

Yes  No

13. Which of the following categories of work best described your organization's activities (more than one may be checked).

- Finance
- Operation of Existing Facilities
- Maintenance of Existing Facilities
- Planning New Facilities
- Engineering and/or Construction
- Regulation
- Enforcement
- Basic Research
- Legislative Involvement
- Public Education
- Resource Use

14. If you were to list subjects that are important to the work of your organization, which of the following would rank high?

- Public Safety
  - Recreational use of water/land resources
  - Conservation of wildlife
  - Management of resources related to water
  - Control of land use
  - Environmental preservation
  - Other
- General Municipal Services
- \_\_\_\_\_
- \_\_\_\_\_

15. In terms of public safety/resource management, how important is your organization to the following clientele groups? Rank the following 5 (most important to 1 (least important)

- \_\_\_\_\_ General Public
- \_\_\_\_\_ Agriculturists
- \_\_\_\_\_ Small Business
- \_\_\_\_\_ Large Business
- \_\_\_\_\_ Recreationalists
- \_\_\_\_\_ Environmentalists
- \_\_\_\_\_ Other (specify) \_\_\_\_\_

**Institutional Data Survey Form**

16. What other organizations do you regularly come in contact with during the course of your work?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

17. Rank the above as to "most" - "least" contact (5 = most, 1 = least)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

18. What specific regulations and /or rules dealing with public safety/management does your organization use?

Federal laws/regulations: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

State laws/regulations: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Agency rules/policies: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other Sources: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

19. Does your organization have jurisdiction over other organizations?

Yes  No

20. If yes, please list these organizations.  
Depends on the situation.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Institutional Data Survey Form**

21. Please indicate if the following documents exist and if they could be made available to the Corps of Engineers.

	Exist	Available
Statement of Purpose	_____	_____
Description of Organizational Structure	_____	_____
Statement of Goals and Objectives	_____	_____
Description of Programs	_____	_____
Charter and/or Bylaws	_____	_____
Annual Report and/or Budget	_____	_____
Regulations/laws on:		
Financial Capability	_____	_____
Program Operation	_____	_____
Governing Body Structure	_____	_____
Area of Jurisdiction	_____	_____

22. Who should be contacted to obtain available copies?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Institutional Data Survey Form

ORGANIZATIONAL FUNCTIONS AND AIMS

The purpose of this inquiry is to learn about the operations of the organization and its work. In order to develop a uniform analysis, the following terms will be used to describe the organization: purpose, goals, objectives, programs, and activities. The example shows how these terms might apply to an imaginary organization. These terms may or may not apply fully to your situation. This will be determined as we go along.

1. What is the overall purpose of this organization? \_\_\_\_\_

General Municipal Services

2. What are the goals and/or objectives of this organization? Is there a written statement of goals and/or objectives? See Attachment For Mission Statement

a. Goal	Objective	_____
b. Goal	Objective	_____
c. Goal	Objective	_____
d. Goal	Objective	_____
e. Goal	Objective	_____
f. Goal	Objective	_____
g. Goal	Objective	_____
h. Goal	Objective	_____

**Institutional Dam Survey Form**

3. The programs and supporting activities of this organization are very important because they describe the nature of the work performed. What programs and activities are conducted?

a. Program Title \_\_\_\_\_  
Program Description \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ Long Range \_\_\_\_\_ Short Range

Supports goal/objective Number \_\_\_\_\_

**Support Activities**

- (1) \_\_\_\_\_
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_
- (4) \_\_\_\_\_

b. Program Title \_\_\_\_\_  
Program Description \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ Long Range \_\_\_\_\_ Short Range

Supports goal/objective Number \_\_\_\_\_

**Support Activities**

- (1) \_\_\_\_\_
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_
- (4) \_\_\_\_\_

**Institutional Data Survey Form**

c. Program Title \_\_\_\_\_  
Program Description \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ Long Range \_\_\_\_\_ Short Range

Supports goal/objective Number \_\_\_\_\_

**Support Activities**

- (1) \_\_\_\_\_
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_
- (4) \_\_\_\_\_

d. Program Title \_\_\_\_\_  
Program Description \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ Long Range \_\_\_\_\_ Short Range

Supports goal/objective Number \_\_\_\_\_

**Support Activities**

- (1) \_\_\_\_\_
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_
- (4) \_\_\_\_\_

Institutional Data Survey Form

**FINANCIAL AND LEGAL AUTHORITIES**

Legal Basis

1. What is the basis for the creation of your organization?

- Federal Law
- State Law
- Local Law
- Public Charter
- Special Act
- Private Charter
- Other (specify) \_\_\_\_\_

2. What powers and /or authorities does your organization exercise?

- Make Laws
- Make Rules
- Make Policy
- Taxing Power
- Purchase Property
- Condemn Land
- Make Contracts
- Sell Bonds
- Receive Gifts
- Land Use Control
- Other Municipal Services

3. Of the powers and/or authorities noted, which have been or are presently being exercised? In what way is each power/authority applied?

Power	Application
-All	
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**Institutional Data Survey Form**

4. Which of the following activities does your organization perform?

- Appoint paid staff
- Retain professional Services
- Create a Subordinate Organization
- Perform Maintenance Service on Public Facilities
- Operate Public Facilities
- Other (specify) \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Institutional Data Survey Form

Financial Basis

1. Which of the following provides your organization with revenue?

General Appropriations

Fees

Gifts and Endowments

Taxes

Grants

Other (Specify) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Has the trend in appropriations (Fees, Gifts and Endowments, Taxes, Grants, Other) in recent years been:

Increasing

Decreasing

About the Same

3. What effect, if any, has this trend in annual appropriations (Fees, Gifts and Endowments, Taxes, Grants, Other) had on your organization?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Any effect on resource management programs? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Do you think future appropriations (Fees, Gifts and Endowments, Taxes, Grants, Other) patterns will be similar to trends?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**APPENDIX F**  
**COST ESTIMATE DATA**

## APPENDIX F - ABSTRACT

---

This appendix presents assumptions and rough order of magnitude (ROM) cost estimates for the risk management alternatives proposed and evaluated within this engineering evaluation/cost analysis (EE/CA). The estimates are intended for comparative purposes for the evaluation of the proposed alternatives. The ROM estimates are not intended as a fixed cost proposal for the implementation of a specific risk management alternative. For risk management alternatives that are clearances, costs were developed based on proven technologies, U.S. Army Corps of Engineers (USACE) procedures, and current methodologies for the clearance of surface and subsurface unexploded ordnance (UXO). Service and materials costs for the ROM estimates were developed from applicable Means® Building Construction Data for 1996, limited input from UXO contractors, and professional judgment.

This section provides cost estimates and costing assumptions associated with conducting the various risk management alternatives at the Former Benicia Arsenal. Separate cost estimates have been provided for implementing these alternatives for each of the five sectors evaluated for ordnance and explosives (OE). There are no costs associated with implementing the No Further Action (NoFA) Alternative. Included in this appendix are the estimated costs for the following alternatives evaluated for each sector at the Former Benicia Arsenal:

- Alternative 2 - Institutional Controls
- Alternative 3 - Surface Clearance of UXO
- Alternative 4 - Detection and Clearance of UXO to Depth

Costs for various Institutional Controls (i.e., access controls and behavior modifications) that are available to landowners and local agencies are presented in Table 4-1.

**Table 4-1. Estimated Costs for Various Types of Institutional Controls**

Access Controls and Behavior Modifications	Unit Cost
Warning Signs on Fences	\$32 each
Warning Signs on Posts	\$37 each
Display Case	\$875 each
Fencing	\$2 per linear foot
UXO Awareness/Safety Training Video and Brochures	\$25,000 each

Note: Costs in this table do not include labor and other associated fees.

**Former Benicia Arsenal  
Cost Estimate Assumptions  
Alternative 2 (Institutional Controls)**

- Cost estimate is for installing display cases and warning signs, and producing a UXO awareness/safety training video for City of Benicia personnel, property owners within the investigation areas, and interested members of the public.
- One free-standing, post-mounted display case would be required and would be installed at the Benicia Camel Barn Museum in Sector 5. No display cases would be required for the other sectors since people are not expected to congregate at any specific locations within these areas. Costs do not include periodic maintenance on the display cases since it is assumed that the maintenance would be performed by City of Benicia personnel.
- Warning signs would be required and would be installed at each access point for roads entering sectors having the potential for OE exposure. Costs include material for replacement signs over five years.
- Installation and set up of the display case and warning signs would be performed by a USACE contractor.
- Cost assumes the USACE contractor would develop material to be shown in the display case.
- Work week will consist of four 10-hour days, not to exceed 40 hours per week. No stand-down time is assumed for weather, natural disasters, federal holidays, or denied access to any areas.
- No stand-down time due to the discovery of a threatened or endangered species or significant cultural resources has been costed.
- Cost includes development and production of a UXO awareness/safety training video and brochures to be distributed to the City of Benicia, property owners within the areas of investigation, and interested members of the public.
- The UXO awareness/safety training video would be produced on location over a 1-day period by a Senior UXO Supervisor and video camera operator. The Senior UXO Supervisor would travel the day before and after the training video is taped. The video camera operator would be from the local area. Training hand-out materials will be minimal.
- Per Diem is based upon the rates established in the revised edition of the Joint Travel Regulations as of January 1, 1999, for the area.
- Mobilization/demobilization cost assumes round-trip air transportation between the East Coast and Oakland, California, and travel-related labor, per diem, and rental vehicles for the USACE contractor representatives, Senior UXO Supervisor, and UXO Specialist.

- Coordination between the project team leaders and property owners shall be sufficient to allow unlimited access to each area at the time that the work in that area is scheduled to be performed.
- Cost assumes that construction or utilization of on-site facilities will not be required during the execution of this alternative.
- Cost for equipment assumes no Government-Furnished Equipment (GFE).
- A hand-held magnetometer will be used by the UXO specialist to assist in monitoring.
- Vegetation removal would be performed by the Benicia Fire Department using controlled burns.
- Personnel for display case installation and set-up includes an on-site UXO monitor and two USACE contractor personnel.
- Personnel for warning sign installation includes an on-site UXO monitor and a sign installation crew consisting of a project foreman and two laborers.
- Personnel for the UXO Awareness/Safety Training video includes a Senior UXO Supervisor and video camera operator.
- Costs have been determined based on costs associated with previous experience on this and similar projects and the 1996 Means® *Building Construction Data, 54th Edition*.

## Costing Parameters Alternative 2 (Institutional Controls)

• Physical controls:

	Sector 2	Sector 3A	Sector 3B	Sector 4	Sector 5
Display Case	0	0	0	0	1
Warning Signs on Fences	3	25	13	27	12
Warning Signs on Posts	4	0	0	0	4
Replacement Signs	1	3	2	3	2
Adequate Fences (existing)	1,380 LF	12,400 LF	3,000 LF	13,450 LF	4,200 LF

- Management controls: Produce a UXO awareness/safety training video for City of Benicia personnel, property owners within the investigation areas, and interested members of the public.

- The production estimates include:
- |                                      |              |
|--------------------------------------|--------------|
| Display case installation/set-up:    | 2 cases/day  |
| Warning sign installation:           | 25 signs/day |
| Warning sign with post installation: | 7 signs/day  |
| UXO awareness/safety video:          | 1 day        |

- Each task includes the following personnel:

Project Personnel	Display Case	Warning Signs	Safety Video
Senior UXO Supervisor	-	-	1
UXO Specialist	1	1	-
Land Surveyor	-	-	-
Video Camera Operator	-	-	1
Contractor Personnel	2	-	-
Foreman	-	1	-
Laborer	-	2	-

- Working days: Video: 1 day

	Sector 2	Sector 3A	Sector 3B	Sector 4	Sector 5
Display Cases	-	-	-	-	0.5 day
Warning Signs on Fences	0.1 day	1 day	0.6 day	1.1 days	0.5 day
Warning Signs on Posts	0.6 day	-	-	-	0.6 day

- Calendar days: Video: 1 day

	Sector 2	Sector 3A	Sector 3B	Sector 4	Sector 5
Display Cases	-	-	-	-	1 day
Warning Signs on Fences	1 day	1 day	1 day	2 days	1 day
Warning Signs on Posts	1 day	-	-	-	1 day

**Alternative 2  
Institutional Controls  
Warning Signs - Sector 2**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$1,360	Each	1	\$1,360
Vehicle Rental (Small 4x4)	\$45	Day	1	\$45
Fuel	\$7	Day	1	\$7
UXO Monitor - Labor	\$350	Day	0.7	\$245
UXO Monitor - Equipment	\$12	Day	1	\$12
UXO Monitor - Per Diem	\$80	Day	1	\$80
Warning Sign Materials (without posts)	\$32	Each	3	\$96
Warning Sign Materials (includes posts)	\$37	Each	4	\$148
Replacement Sign Materials	\$32	Each	1	\$32
Installation - Labor	\$990	Day	0.7	\$693
Installation - Equipment	\$150	Day	1	\$150
<b>TOTAL</b>				<b>\$2,868</b>

UXO = unexploded ordnance

**Alternative 2  
Institutional Controls  
Warning Signs - Sector 3A**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$1,360	Each	1	\$1,360
Vehicle Rental (Small 4x4)	\$45	Day	1	\$45
Fuel	\$7	Day	1	\$7
UXO Monitor - Labor	\$350	Day	1	\$350
UXO Monitor - Equipment	\$12	Day	1	\$12
UXO Monitor - Per Diem	\$80	Day	1	\$80
Warning Sign Materials	\$32	Each	25	\$800
Replacement Sign Materials	\$32	Each	3	\$96
Installation - Labor	\$990	Day	1	\$990
Installation - Equipment	\$150	Day	1	\$150
<b>TOTAL</b>				<b>\$3,890</b>

UXO = unexploded ordnance

**Alternative 2  
Institutional Controls  
Warning Signs - Sector 3B**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$1,360	Each	1	\$1,360
Vehicle Rental (Small 4x4)	\$45	Day	1	\$45
Fuel	\$7	Day	1	\$7
UXO Monitor - Labor	\$350	Day	0.6	\$210
UXO Monitor - Equipment	\$12	Day	1	\$12
UXO Monitor - Per Diem	\$80	Day	1	\$80
Warning Sign Materials	\$32	Each	13	\$416
Replacement Sign Materials	\$32	Each	2	\$64
Installation - Labor	\$990	Day	0.6	\$594
Installation - Equipment	\$150	Day	1	\$150
<b>TOTAL</b>				<b>\$2,938</b>

UXO = unexploded ordnance

**Alternative 2  
Institutional Controls  
Warning Signs - Sector 4**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$1,360	Each	1	\$1,360
Vehicle Rental (Small 4x4)	\$45	Day	2	\$90
Fuel	\$7	Day	2	\$14
UXO Monitor - Labor	\$350	Day	1.1	\$385
UXO Monitor - Equipment	\$12	Day	2	\$24
UXO Monitor - Per Diem	\$80	Day	2	\$160
Warning Sign Materials	\$32	Each	27	\$864
Replacement Sign Materials	\$32	Each	3	\$96
Installation - Labor	\$990	Day	1.1	\$1,089
Installation - Equipment	\$150	Day	2	\$300
<b>TOTAL</b>				<b>\$4,372</b>

UXO = unexploded ordnance

**Alternative 2  
Institutional Controls  
Warning Signs - Sector 5**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$1,360	Each	1	\$1,360
Vehicle Rental (Small 4x4)	\$45	Day	2	\$90
Fuel	\$7	Day	2	\$14
UXO Monitor - Labor	\$350	Day	1.1	\$385
UXO Monitor - Equipment	\$12	Day	2	\$24
UXO Monitor - Per Diem	\$80	Day	2	\$160
Warning Sign Materials (without posts)	\$32	Each	12	\$384
Warning Sign Materials (includes posts)	\$37	Each	4	\$148
Replacement Sign Materials	\$32	Each	2	\$64
Installation - Labor	\$990	Day	1.1	\$1,089
Installation - Equipment	\$150	Day	2	\$300
<b>TOTAL</b>				<b>\$4,014</b>

UXO = unexploded ordnance

**Alternative 2  
Institutional Controls  
Display Case - Sector 5**

Event	Unit Cost	Unit	Quantity	Total Cost
Mobilization/Demobilization	\$4,304	Each	1	\$4,304
Vehicle Rental (Small 4x4)	\$45	Day	2	\$90
Fuel	\$7	Day	2	\$14
UXO Monitor - Labor	\$350	Day	0.5	\$175
UXO Monitor - Equipment	\$12	Day	1	\$12
UXO Monitor - Per Diem	\$80	Person (day)	1 (1 day)	\$80
Display Case Materials	\$875	Each	1	\$875
Installation/Set-up - Labor	\$840	Day	0.5	\$420
Installation/Set-up -Equipment	\$50	Day	1	\$50
Installation/Set-up - Per Diem	\$80	Person (day)	2 (1 day)	\$160
<b>TOTAL</b>				<b>\$6,180</b>

UXO = unexploded ordnance

<b>Alternative 2</b> <b>Institutional Controls</b> <b>UXO Awareness/Safety Training Video &amp; Brochures</b>				
Event	Unit Cost	Unit	Quantity	Total Cost
Project Planning, Brochure Development	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$1,600	Each	1	\$1,600
Vehicle Rental (Mid-size car)	\$35	Day	3	\$105
Fuel	\$7	Day	3	\$21
Labor	\$736	Day	1	\$736
Per Diem	\$80	Person (day)	1 (1 day)	\$80
Equipment	\$47	Each	1	\$47
<b>TOTAL</b>				<b>\$27,589</b>

**Alternative 2**  
**Institutional Controls**  
**UXO Construction Support**

Event	Unit Cost	Unit	Quantity	Total Cost
Labor	\$700	Day	18	\$12,600
Equipment	\$38	Day	30	\$1,140
<b>TOTAL</b>				<b>\$13,740</b>

**Former Benicia Arsenal  
Cost Estimate Assumptions  
Alternative 3 (Surface Clearance of UXO)**

- Work week will consist of four 10-hour days, not to exceed 40 hours per week. No stand-down time is assumed for weather, natural disasters, federal holidays, or denied access to any areas.
- No stand-down time due to the discovery of a threatened or endangered species or significant cultural resources has been costed.
- Per Diem is based upon the rates established in the revised edition of the Joint Travel Regulations as of January 1, 1999, for the area.
- Mobilization/demobilization cost assumes project management, geophysical equipment operators, and UXO supervisors/specialists are not available locally and will require rental vehicles and transportation reimbursement for air travel between the East Coast and Oakland, California.
- Coordination between UXO specialists and property owners shall be sufficient to allow unlimited access to each area at the time that the work in that area is scheduled to be performed.
- The cost estimate for Alternative 3 assumes the costs for the Work Plan and the Health and Safety Plan are the same as for Alternative 4.
- Site facilities include a site trailer, facsimile and telephone equipment and service, three portable toilets, and purchase of bottled water.
- Cost for equipment assumes no Government-Furnished Equipment (GFE) including vehicles and explosives for demolition purposes.
- Hand-held magnetometers will be used by UXO specialists to assist in surface clearances.
- It is assumed all OE-related scrap and scrap metal will be removed, collected, and recycled through a local scrap dealer.
- Vegetation removal would be performed by the Benicia Fire Department using controlled burns.
- Land survey teams will establish a 100-foot x 100-foot grid system in area selected for surface clearance activities.
- Any and all UXO recovered will be blown in place, if possible.
- Demolitions will be performed up to twice a day during the surface clearance.
- Costs have been determined based on costs associated with previous experience on this and similar projects and the 1996 Means® *Building Construction Data, 54th Edition*.

Personnel for Alternative 3 includes an on-site Project Manager, Site Safety Officer, Senior UXO Supervisor, QC Specialist, one land survey team, two surface clearance teams, and a demolition team. Each team includes the following personnel:

Personnel	Project Management/ QC Team	Land Survey Team	Surface Clearance Team	Demolition/ Demolition Team
Project Manager	1	-	-	-
Site Safety Officer	1	-	-	-
QC Specialist	1	-	-	-
Senior UXO Supervisor	1	-	-	-
UXO Supervisor	-	-	1	1
UXO Specialist	-	1	4	1
Surveyor	-	1	-	-
Blaster	-	-	-	1

QC = quality control

UXO = unexploded ordnance



<b>Alternative 3 (Surface Clearance of UXO)</b>				
<b>Sector 2</b>				
<b>Event</b>	<b>Unit Cost</b>	<b>Unit</b>	<b>Quantity</b>	<b>Total Cost</b>
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$25,776	Each	1	\$25,776
Site Set-up/Take-down	\$6,100	Each	1	\$6,100
Site Facilities/Office Equipment	\$1,495	Month	0.1	\$150
Vehicle Rental (Large 4x4)	\$400	Week	2	\$800
Vehicle Rental (Small 4x4)	\$300	Week	5	\$1,500
Fuel	\$30	Week	7	\$210
Project Management - Labor	\$1,930	Day	2	\$3,860
Project Management - Equipment*	\$131	Day	2	\$262
Project Management - Per Diem*	\$80	Person (day)	4 (2 days)	\$640
Land Survey - Labor	\$700	Team (day)	1 (0.7 days)	\$490
Land Survey - Equipment*	\$143	Team (day)	1 (1 day)	\$143
Land Survey - Per Diem*	\$80	Person (day)	1 (1 day)	\$80
OE Surface Clearance - Labor	\$1,820	Team (day)	2 (1.3 days)	\$4,732
OE Surface Clearance - Equipment*	\$55	Team (day)	2 (2 days)	\$220
OE Surface Clearance - Per Diem*	\$80	Person (day)	10 (2 days)	\$1,600
Demolition - Labor	\$1,190	Team (day)	1 (1.3 days)	\$1,547
Demolition - Explosives/Equipment*	\$64	Team (day)	1 (2 days)	\$128
Demolition - Per Diem*	\$80	Person (day)	3 (2 days)	\$480
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$103,718</b>

Notes: (a) Average cost per acre = \$6,915.

(\*) Based on calendar days

OE = ordnance and explosives

**Costing Parameters  
Alternative 3 (Surface Clearance of UXO)  
Sector 3A**

- Clearance area:                      Surface clearance:        126 acres  
   Land survey (grids):     549 grids
  
- The production estimates include:
  - Surface clearance:        12 acres/day
  - Land survey (grids):     100 acres/day
  
- Project personnel:                  Project management/quality control:
  - (1) On-Site Project Manager
  - (1) Site Safety Officer
  - (1) Senior UXO Supervisor
  - (1) Quality Control Specialist  
  - Land survey:                        1 Team
    - (1) Land Surveyor
    - (1) UXO Specialist
  
  - Surface clearance:                2 Teams
    - (2) UXO Supervisor
    - (8) UXO Specialist
  
  - Demolition:                        1 Team
    - (1) UXO Supervisor
    - (1) UXO Specialist
    - (1) Blaster
  
- Work days:                            Surface clearance:                10.5 days (12 acres/day)  
   Land survey (grids):            5.5 days (100 grids/day)
  
- Calendar days:                      Surface clearance:                17 days  
   Land survey (grids):            9 days

<b>Alternative 3 (Surface Clearance of UXO)</b>				
<b>Sector 3A</b>				
<b>Event</b>	<b>Unit Cost</b>	<b>Unit</b>	<b>Quantity</b>	<b>Total Cost</b>
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$25,776	Each	1	\$25,776
Site Set-up/Take-down	\$6,100	Each	1	\$6,100
Site Facilities/Office Equipment	\$1,495	Month	0.5	\$748
Vehicle Rental (Large 4x4)	\$400	Week	6	\$2,400
Vehicle Rental (Small 4x4)	\$300	Week	14	\$4,200
Fuel	\$30	Week	20	\$600
Project Management - Labor	\$1,930	Day	16.0	\$30,880
Project Management - Equipment*	\$131	Day	17	\$2,227
Project Management - Per Diem*	\$80	Person (day)	4 (17 days)	\$5,440
Land Survey - Labor	\$700	Team (day)	1 (5.5 days)	\$3,850
Land Survey - Equipment*	\$143	Team (day)	1 (9 days)	\$1,287
Land Survey - Per Diem*	\$80	Person (day)	1 (9 days)	\$720
OE Surface Clearance - Labor	\$1,820	Team (day)	2 (10.5 days)	\$38,220
OE Surface Clearance - Equipment*	\$55	Team (day)	2 (17 days)	\$1,870
OE Surface Clearance - Per Diem*	\$80	Person (day)	10 (17 days)	\$13,600
Demolition - Labor	\$1,190	Team (day)	1 (10.5 days)	\$12,495
Demolition - Explosives/Equipment*	\$64	Team (day)	1 (17 days)	\$1,088
Demolition - Per Diem*	\$80	Person (day)	3 (17 days)	\$4,080
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$210,581</b>

Notes: (a) Average cost per acre = \$1,671.

(\*) Based on calendar days

OE = ordnance and explosives

**Costing Parameters  
Alternative 3 (Surface Clearance of UXO)  
Sector 3B**

- Clearance area:                      Surface clearance:        45 acres  
   Land survey (grids):    196 grids
  
- The production estimates include:  
   Surface clearance:        12 acres/day  
   Land survey (grids):    100 acres/day
  
- Project personnel:                    Project management/quality control:  
   (1) On-Site Project Manager  
   (1) Site Safety Officer  
   (1) Senior UXO Supervisor  
   (1) Quality Control Specialist
  
- Land survey:                    1 Team  
   (1) Land Surveyor  
   (1) UXO Specialist
  
- Surface clearance:        2 Teams  
   (2) UXO Supervisor  
   (8) UXO Specialist
  
- Demolition:                  1 Team  
   (1) UXO Supervisor  
   (1) UXO Specialist  
   (1) Blaster
  
- Work days:                              Surface clearance:            3.8 days (12 acres/day)  
   Land survey (grids):        2.0 days (100 grids/day)
  
- Calendar days:                        Surface clearance:            4 days  
   Land survey (grids):        2 days

<b>Alternative 3 (Surface Clearance of UXO)</b>				
<b>Sector 3B</b>				
<b>Event</b>	<b>Unit Cost</b>	<b>Unit</b>	<b>Quantity</b>	<b>Total Cost</b>
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$25,776	Each	1	\$25,776
Site Set-up/Take-down	\$6,100	Each	1	\$6,100
Site Facilities/Office Equipment	\$1,495	Month	0.25	\$374
Vehicle Rental (Large 4x4)	\$400	Week	20	\$800
Vehicle Rental (Small 4x4)	\$300	Week	8	\$2,400
Fuel	\$30	Week	10	\$300
Project Management - Labor	\$1,930	Day	5.8	\$11,194
Project Management - Equipment*	\$131	Day	9	\$1,179
Project Management - Per Diem*	\$80	Person (day)	4 (9 days)	\$2,880
Land Survey - Labor	\$700	Team (day)	1 (2 days)	\$1,400
Land Survey - Equipment*	\$143	Team (day)	1 (2 days)	\$286
Land Survey - Per Diem*	\$80	Person (day)	1 (2 days)	\$160
OE Surface Clearance - Labor	\$1,820	Team (day)	2 (3.8 days)	\$13,832
OE Surface Clearance - Equipment*	\$55	Team (day)	2 (4 days)	\$440
OE Surface Clearance - Per Diem*	\$80	Person (day)	10 (4 days)	\$3,200
Demolition - Labor	\$1,190	Team (day)	1 (3.8 days)	\$4,522
Demolition - Explosives/Equipment*	\$64	Team (day)	1 (4 days)	\$256
Demolition - Per Diem*	\$80	Person (day)	3 (4 days)	\$960
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$131,059</b>

Notes: (a) Average cost per acre = \$2,912.

(\*) Based on calendar days

OE = ordnance and explosives

**Costing Parameters  
Alternative 3 (Surface Clearance of UXO)  
Sector 4**

- Clearance area:                      Surface clearance:      49 acres  
   Land survey (grids):    213 grids
  
- The production estimates include:
  - Surface clearance:      12 acres/day
  - Land survey (grids):    100 acres/day
  
- Project personnel:                      Project management/quality control:
  - (1)    On-Site Project Manager
  - (1)    Site Safety Officer
  - (1)    Senior UXO Supervisor
  - (1)    Quality Control Specialist  
  - Land survey:                              1 Team
  - (1)    Land Surveyor
  - (1)    UXO Specialist  
  - Surface clearance:                      2 Teams
  - (2)    UXO Supervisor
  - (8)    UXO Specialist  
  - Demolition:                                1 Team
  - (1)    UXO Supervisor
  - (1)    UXO Specialist
  - (1)    Blaster
  
- Work days:                                Surface clearance:                      4.1 days    (12 acres/day)  
   Land survey (grids):                      2.1 days    (100 acres/day)
  
- Calendar days:                              Surface clearance:                      8 days  
   Land survey (grids):                      3 days

### Alternative 3 (Surface Clearance of UXO)

#### Sector 4

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$25,776	Each	1	\$25,776
Site Set-up/Take-down	\$6,100	Each	1	\$6,100
Site Facilities/Office Equipment	\$1,495	Month	0.3	\$449
Vehicle Rental (Large 4x4)	\$400	Week	4	\$1,600
Vehicle Rental (Small 4x4)	\$300	Week	9	\$2,700
Fuel	\$30	Week	13	\$390
Project Management - Labor	\$1,930	Day	6.1	\$11,773
Project Management - Equipment*	\$131	Day	8	\$1,048
Project Management - Per Diem*	\$80	Person (day)	4 (8 days)	\$2,560
Land Survey - Labor	\$700	Team (day)	1 (2.1 days)	\$1,470
Land Survey - Equipment*	\$143	Team (day)	1 (3 days)	\$429
Land Survey - Per Diem*	\$80	Person (day)	1 (3 days)	\$240
OE Surface Clearance - Labor	\$1,820	Team (day)	2 (4.1 days)	\$14,924
OE Surface Clearance - Equipment*	\$55	Team (day)	2 (8 days)	\$880
OE Surface Clearance - Per Diem*	\$80	Person (day)	10 (8 days)	\$6,400
Demolition - Labor	\$1,190	Team (day)	1 (4.1 days)	\$4,879
Demolition - Explosives/Equipment*	\$64	Team (day)	1 (8 days)	\$512
Demolition - Per Diem*	\$80	Person (day)	3 (8 days)	\$1,920
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$139,050</b>

Notes: (a) Average cost per acre = \$2,838.

(\*) Based on calendar days

OE = ordnance and explosives

**Costing Parameters  
Alternative 3 (Surface Clearance of UXO)  
Sector 5**

- Clearance area:           Surface clearance:     30 acres  
                                  Land survey (grids):   130 grids
  
- The production estimates include:
  - Surface clearance:     12 acres/day
  - Land survey (grids):   100 acres/day
  
- Project personnel:       Project management/quality control:
  - (1) On-Site Project Manager
  - (1) Site Safety Officer
  - (1) Senior UXO Supervisor
  - (1) Quality Control Specialist  
  - Land survey:             1 Team
    - (1) Land Surveyor
    - (1) UXO Specialist
  
  - Surface clearance:     2 Teams
    - (2) UXO Supervisor
    - (8) UXO Specialist
  
  - Demolition:             1 Team
    - (1) UXO Supervisor
    - (1) UXO Specialist
    - (1) Blaster
  
- Work days:               Surface clearance:       2.5 days   (12 acres/day)  
                                  Land survey (grids):   1.3 days   (100 acres/day)
  
- Calendar days:         Surface clearance:       3 days  
                                  Land survey (grids):   2 days

<b>Alternative 3 (Surface Clearance of UXO)</b>				
<b>Sector 5</b>				
<b>Event</b>	<b>Unit Cost</b>	<b>Unit</b>	<b>Quantity</b>	<b>Total Cost</b>
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$25,776	Each	1	\$25,776
Site Set-up/Take-down	\$6,100	Each	1	\$6,100
Site Facilities/Office Equipment	\$1,495	Month	0.2	\$299
Vehicle Rental (Large 4x4)	\$400	Week	2	\$800
Vehicle Rental (Small 4x4)	\$300	Week	5	\$1,500
Fuel	\$30	Week	7	\$210
Project Management - Labor	\$1,930	Day	3.5	\$6,755
Project Management - Equipment*	\$131	Day	4	\$524
Project Management - Per Diem*	\$80	Person (day)	4 (4 days)	\$1,280
Land Survey - Labor	\$700	Team (day)	1 (1.3 days)	\$910
Land Survey - Equipment*	\$143	Team (day)	1 (2 days)	\$286
Land Survey - Per Diem*	\$80	Person (day)	1 (2 days)	\$160
OE Surface Clearance - Labor	\$1,820	Team (day)	2 (2.5 days)	\$9,100
OE Surface Clearance - Equipment*	\$55	Team (day)	2 (3 days)	\$330
OE Surface Clearance - Per Diem*	\$80	Person (day)	10 (3 days)	\$2,400
Demolition - Labor	\$1,190	Team (day)	1 (2.5 days)	\$2,975
Demolition - Explosives/Equipment*	\$64	Team (day)	1 (3 days)	\$192
Demolition - Per Diem*	\$80	Person (day)	3 (3 days)	\$720
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$115,317</b>

Notes: (a) Average cost per acre = \$3,844.

(\*) Based on calendar days

OE = ordnance and explosives

**Former Benicia Arsenal  
Cost Estimate Assumptions  
Alternative 4 (Detection and Clearance of UXO to Depth)**

- Work week will consist of four 10-hour days, not to exceed 40 hours per week. No stand-down time is assumed for weather, natural disasters, federal holidays, or denied access to any areas.
- No stand-down time due to the discovery of a threatened or endangered species or significant cultural resources has been costed.
- Per diem is based upon the rates established in the revised edition of the Joint Travel Regulations as of January 1, 1999, for the area.
- Mobilization/demobilization cost assumes project management, geophysical equipment operators, and UXO supervisors/specialists are not available locally and will require rental vehicles and transportation reimbursement for air travel between the East Coast and Oakland, California.
- Coordination between UXO specialists and property owners shall be sufficient to allow unlimited access to each area at the time that the work in that area is scheduled to be performed.
- The cost estimate for Alternative 4 assumes the costs for the Work Plan and the Health and Safety Plan are the same for Alternative 3.
- Site facilities include a site trailer, facsimile and telephone equipment and service, five portable toilets, rental and dumping cost of the trash bin, and the purchase of bottled water.
- Cost for equipment assumes no GFE including vehicles and explosives for demolition purposes.
- Geophysical techniques will be used to assist in subsurface anomaly investigations.
- Vegetation removal would be performed by the Benicia Fire Department using controlled burns.
- No surface clearance costs are included in any of the subsurface anomaly clearance alternatives (see Alternative 3).
- It is assumed all OE-related scrap and scrap metal will be removed, collected, and recycled through a local scrap dealer.
- Any and all UXO recovered will be blown in place, if possible.
- Demolitions will be performed up to twice a day during the anomaly investigation.
- Land survey teams will establish a 100-foot x 100-foot grid system in the area selected for subsurface clearance activities.
- Cost associated with holiday leave/travel has not been included.

- No costs for database/GIS deliverables have been included.
- Site security costs have not been included.
- Costs have been determined based on costs associated with previous experience on this and similar projects and the 1996 Means® *Building Construction Data, 54th Edition*.
- The personnel to be utilized under Alternative 4 during the geophysical mapping phase include an on-site project manager, Site Safety Officer, QC Specialist, Geophysicist, three data analysts, and one to two land survey teams, and three geophysical mapping teams.
- The personnel to be utilized under Alternative 4 during the anomaly investigation phase include an on-site project manager, Site Safety Officer, QC Specialist, Senior UXO Supervisor, one to two land survey teams, four anomaly investigation teams, and a demolition team.
- Each team includes the following personnel:

Personnel	G.M. Project Management	A.I. Project Management	Land Survey Team	Geophysical Mapping Team	Anomaly Investigation Team	Demolition Team
Project Manager	1	1	-	-	-	-
Site Safety Officer	1	1	-	-	-	-
QC Specialist	1	1	-	-	-	-
Sr. UXO Supervisor	-	1	-	-	-	-
Geophysicist	1	-	-	-	-	-
UXO Supervisor	-	-	-	-	1	1
UXO Specialist	-	-	1	1	3	1
Surveyor	-	-	1	-	-	-
EM 61 Operator	-	-	-	1	-	-
Blaster	-	-	-	-	-	1
Laborer	-	-	-	1	-	-
Data Analyst	3	-	-	-	-	-

A.I. = anomaly investigation  
G.M. = geophysical mapping  
QC = quality control  
UXO = unexploded ordnance

**Costing Parameters**  
**Alternative 4 (Detection and Clearance of UXO to Depth)**  
**Sector 2**

- Clearance area:
 

Subsurface clearance total area:	15 acres
Land survey (grids):	65 grids
Total expected anomalies:	1,455 anomalies
Land survey (points):	1,455 points
  
- The production estimates include:
 

Land survey (grids):	100 grids/day
Geophysical mapping:	24 grids/day
Land survey (points):	150 points/day
Anomaly investigation:	344 anomalies/day
  
- Project personnel:
 

Project management (Geophysical mapping/data processing):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Geophysicist
(3)	Data Analyst
Project management (Anomaly investigation):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Senior UXO Supervisor
Land survey: 1 Team	
(1)	Land Surveyor
(1)	UXO Specialist
Geophysical mapping: 3 Teams	
(3)	UXO Specialist
(3)	EM 61 Operator
(3)	Laborer
Anomaly investigation: 4 Teams	
(4)	UXO Supervisor
(12)	UXO Specialist
Demolition removal: 1 Team	
(1)	UXO Supervisor
(1)	Blaster
(1)	UXO Specialist
  
- Work days:
 

Land survey (grids):	0.7 days (100 grids/day)
Geophysical mapping:	2.7 days (24 grids/day)
Land survey (points):	9.7 days (150 points/day)
Anomaly investigation:	4.2 days (344 anomalies/day)
  
- Calendar days:
 

Land survey (grids):	1 day
Geophysical mapping:	3 days
Land survey (points):	16 days
Anomaly investigation:	8 days

**Alternative 4**  
**(Detection and Clearance of UXO to Depth)**  
**Sector 2**

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$57,152	Each	1	\$57,152
Site Set-up/Take-down	\$8,400	Each	1	\$8,400
Site Facilities/Office Equipment	\$1,495	Month	0.4	\$598
Vehicle Rental (Large 4x4)	\$400	Week	1	\$400
Vehicle Rental (Small 4x4)	\$300	Week	22	\$6,600
Fuel	\$30	Week	23	\$690
Proj. Mgmt. (Geophysical) - Labor	\$3,180	Day	2.7	\$8,586
Proj. Mgmt. (Geophysical) - Equipment*	\$586	Day	3	\$1,758
Proj. Mgmt. (Geophysical) - Per Diem*	\$80	Person (day)	7 (3 days)	\$1,680
Proj. Mgmt. (Anomaly Inv.) - Labor	\$1,930	Day	9.7	\$18,721
Proj. Mgmt. (Anomaly Inv.) - Equipment*	\$112	Day	16	\$1,792
Proj. Mgmt. (Anomaly Inv.) - Per Diem*	\$80	Person (day)	4 (16 days)	\$5,120
Land Survey (Grids/Points) - Labor	\$700	Team (day)	1 (10.4 days)	\$7,280
Land Survey (Grids/Points) - Equipment*	\$145	Team (day)	1 (17 days)	\$2,465
Land Survey (Grids/Points) - Per Diem*	\$80	Person (day)	2 (17 days)	\$2,720
Geophysical Mapping - Labor	\$970	Team (day)	3 (2.7 days)	\$7,857
Geophysical Mapping - Equipment*	\$74	Team (day)	3 (3 days)	\$666
Geophysical Mapping - Per Diem*	\$80	Person (day)	6 (3 days)	\$1,440
Anomaly Investigation - Labor	\$1,470	Team (day)	4 (4.2 days)	\$24,696
Anomaly Investigation - Equipment*	\$31	Team (day)	4 (8 days)	\$992
Anomaly Investigation - Per Diem*	\$80	Person (day)	16 (8 days)	\$10,240
Demolition - Labor	\$1,190	Team (day)	1 (4.2 days)	\$4,998
Demolition - Equipment*	\$64	Team (day)	1 (8 days)	\$512
Demolition - Per Diem*	\$80	Person (day)	3 (8 days)	\$1,920
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$232,283</b>

Notes: (a) Average cost per acre = \$15,486.

(\*) Based on Calendar Days

**Costing Parameters**  
**Alternative 4 (Detection and Clearance of UXO to Depth)**  
**Sector 3A**

- **Clearance area:**
  - Subsurface clearance total area: 131 acres
  - Land survey (grids): 570 grids
  - Total expected anomalies: 12,738 anomalies
  - Land survey (points): 12,738 points
  
- **The production estimates include:**
  - Land survey (grids): 200 grids/day
  - Geophysical mapping: 24 grids/day
  - Land survey (points): 300 points/day
  - Anomaly investigation: 344 anomalies/day
  
- **Project personnel:**
  - Project management (Geophysical mapping/data processing):
    - (1) On-Site Project Manager
    - (1) Site Safety Officer
    - (1) Quality Control Supervisor
    - (1) Geophysicist
    - (3) Data Analyst
  
  - Project management (Anomaly investigation):
    - (1) On-Site Project Manager
    - (1) Site Safety Officer
    - (1) Quality Control Supervisor
    - (1) Senior UXO Supervisor
  
  - Land survey: 2 Teams
    - (2) Land Surveyor
    - (2) UXO Specialist
  
  - Geophysical mapping: 3 Teams
    - (3) UXO Specialist
    - (3) EM 61 Operator
    - (3) Laborer
  
  - Anomaly investigation: 4 Teams
    - (4) UXO Supervisor
    - (12) UXO Specialist
  
  - Demolition removal: 1 Team
    - (1) UXO Supervisor
    - (1) Blaster
    - (1) UXO Specialist
  
- **Work days:**
  - Land survey (grids): 2.9 days (200 grids/day)
  - Geophysical mapping: 23.8 days (24 grids/day)
  - Land survey (points): 42.5 days (300 points/day)
  - Anomaly investigation: 37.0 days (344 anomalies/day)
  
- **Calendar days:**
  - Land survey (grids): 3 days
  - Geophysical mapping: 42 days
  - Land survey (points): 74 days
  - Anomaly investigation: 64 days

**Alternative 4**  
**(Detection and Clearance of UXO to Depth)**  
**Sector 3A**

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$62,592	Each	1	\$62,592
Site Set-up/Take-down	\$8,400	Each	1	\$8,400
Site Facilities/Office Equipment	\$1,495	Month	4	\$5,980
Vehicle Rental (Large 4x4)	\$400	Week	8	\$3,200
Vehicle Rental (Small 4x4)	\$300	Week	158	\$47,400
Fuel	\$30	Week	166	\$4,980
Proj. Mgmt. (Geophysical) - Labor	\$3,180	Day	23.8	\$75,684
Proj. Mgmt. (Geophysical) - Equipment*	\$586	Day	42	\$24,612
Proj. Mgmt. (Geophysical) - Per Diem*	\$80	Person (day)	7 (42 days)	\$23,520
Proj. Mgmt. (Anomaly Inv.) - Labor	\$1,930	Day	37.0	\$71,410
Proj. Mgmt. (Anomaly Inv.) - Equipment*	\$112	Day	64	\$7,168
Proj. Mgmt. (Anomaly Inv.) - Per Diem*	\$80	Person (day)	4 (64 days)	\$20,480
Land Survey (Grids/Points) - Labor	\$700	Team (day)	2 (45.4 days)	\$63,560
Land Survey (Grids/Points) - Equipment*	\$145	Team (day)	2 (77 days)	\$22,330
Land Survey (Grids/Points) - Per Diem*	\$80	Person (day)	4 (77 days)	\$24,640
Geophysical Mapping - Labor	\$970	Team (day)	3 (23.8 days)	\$69,258
Geophysical Mapping - Equipment*	\$232	Team (day)	3 (42 days)	\$29,232
Geophysical Mapping - Per Diem*	\$80	Person (day)	6 (42 days)	\$20,160
Anomaly Investigation - Labor	\$1,470	Team (day)	4 (37.0 days)	\$217,560
Anomaly Investigation - Equipment*	\$31	Team (day)	4 (64 days)	\$7,936
Anomaly Investigation - Per Diem*	\$80	Person (day)	16 (64 days)	\$81,920
Demolition - Labor	\$1,190	Team (day)	1 (37.0 days)	\$44,030
Demolition - Equipment*	\$64	Team (day)	1 (64 days)	\$4,096
Demolition - Per Diem*	\$80	Person (day)	3 (64 days)	\$15,360
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$1,010,508</b>

Notes: (a) Average cost per acre = \$7,714.

(\*) Based on Calendar Days

**Costing Parameters**  
**Alternative 4 (Detection and Clearance of UXO to Depth)**  
**Sector 3B**

- Clearance area:
 

Subsurface clearance total area:	47 acres
Land survey (grids):	205 grids
Total expected anomalies:	4,570 anomalies
Land survey (points):	4,570 points
  
- The production estimates include:
 

Land survey (grids):	200 grids/day
Geophysical mapping:	24 grids/day
Land survey (points):	300 points/day
Anomaly investigation:	344 anomalies/day
  
- Project personnel:
 

Project management (Geophysical mapping/data processing):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Geophysicist
(3)	Data Analyst
Project management (Anomaly investigation):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Senior UXO Supervisor
Land survey: 2 Teams	
(2)	Land Surveyor
(2)	UXO Specialist
Geophysical mapping: 3 Teams	
(3)	UXO Specialist
(3)	EM 61 Operator
(3)	Laborer
Anomaly investigation: 4 Teams	
(4)	UXO Supervisor
(12)	UXO Specialist
Demolition removal: 1 Team	
(1)	UXO Supervisor
(1)	Blaster
(1)	UXO Specialist
  
- Work days:
 

Land survey (grids):	1.0 days (200 grids/day)
Geophysical mapping:	8.5 days (24 grids/day)
Land survey (points):	15.2 days (300 points/day)
Anomaly investigation:	13.3 days (344 anomalies/day)
  
- Calendar days:
 

Land survey (grids):	1 day
Geophysical mapping:	15 days
Land survey (points):	25 days
Anomaly investigation:	23 days

**Alternative 4**  
**(Detection and Clearance of UXO to Depth)**  
**Sector 3B**

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$62,592	Each	1	\$62,592
Site Set-up/Take-down	\$8,400	Each	1	\$8,400
Site Facilities/Office Equipment	\$1,495	Month	1.5	\$2,243
Vehicle Rental (Large 4x4)	\$400	Week	3	\$1,200
Vehicle Rental (Small 4x4)	\$300	Week	56	\$16,800
Fuel	\$30	Week	59	\$1,770
Proj. Mgmt. (Geophysical) - Labor	\$3,180	Day	8.5	\$27,030
Proj. Mgmt. (Geophysical) - Equipment*	\$586	Day	15	\$8,790
Proj. Mgmt. (Geophysical) - Per Diem*	\$80	Person (day)	7 (15 days)	\$8,400
Proj. Mgmt. (Anomaly Inv.) - Labor	\$1,930	Day	13.3	\$25,669
Proj. Mgmt. (Anomaly Inv.) - Equipment*	\$112	Day	23	\$2,576
Proj. Mgmt. (Anomaly Inv.) - Per Diem*	\$80	Person (day)	4 (23 days)	\$7,360
Land Survey (Grids/Points) - Labor	\$700	Team (day)	2 (16.2 days)	\$22,680
Land Survey (Grids/Points) - Equipment*	\$145	Team (day)	2 (26 days)	\$7,540
Land Survey (Grids/Points) - Per Diem*	\$80	Person (day)	4 (26 days)	\$8,320
Geophysical Mapping - Labor	\$970	Team (day)	3 (8.5 days)	\$24,735
Geophysical Mapping - Equipment*	\$232	Team (day)	3 (15 days)	\$10,440
Geophysical Mapping - Per Diem*	\$80	Person (day)	6 (15 days)	\$7,200
Anomaly Investigation - Labor	\$1,470	Team (day)	4 (13.3 days)	\$78,204
Anomaly Investigation - Equipment*	\$31	Team (day)	4 (23 days)	\$2,852
Anomaly Investigation - Per Diem*	\$80	Person (day)	16 (23 days)	\$29,440
Demolition - Labor	\$1,190	Team (day)	1 (13.3 days)	\$15,827
Demolition - Equipment*	\$64	Team (day)	1 (23 days)	\$1,472
Demolition - Per Diem*	\$80	Person (day)	3 (23 days)	\$5,520
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$436,540</b>

Notes: (a) Average cost per acre = \$9,288.

(\*) Based on Calendar Days

**Costing Parameters**  
**Alternative 4 (Detection and Clearance of UXO to Depth)**  
**Sector 4**

- Clearance area:
 

Subsurface clearance total area:	54 acres
Land survey (grids):	235 grids
Total expected anomalies:	2,902 anomalies
Land survey (points):	2,902 points
  
- The production estimates include:
 

Land survey (grids):	200 grids/day
Geophysical mapping:	24 grids/day
Land survey (points):	300 points/day
Anomaly investigation:	344 anomalies/day
  
- Project personnel:
 

Project management (Geophysical mapping/data processing):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Geophysicist
(3)	Data Analyst
Project management (Anomaly investigation):	
(1)	On-Site Project Manager
(1)	Site Safety Officer
(1)	Quality Control Supervisor
(1)	Senior UXO Supervisor
Land survey: 2 Teams	
(2)	Land Surveyor
(2)	UXO Specialist
Geophysical mapping: 3 Teams	
(3)	UXO Specialist
(3)	EM 61 Operator
(3)	Laborer
Anomaly investigation: 4 Teams	
(4)	UXO Supervisor
(12)	UXO Specialist
Demolition removal: 1 Team	
(1)	UXO Supervisor
(1)	Blaster
(1)	UXO Specialist
  
- Work days:
 

Land survey (grids):	1.2 days (200 grids/day)
Geophysical mapping:	9.8 days (24 grids/day)
Land survey (points):	9.7 days (300 points/day)
Anomaly investigation:	8.4 days (344 anomalies/day)
  
- Calendar days:
 

Land survey (grids):	2 days
Geophysical mapping:	17 days
Land survey (points):	16 days
Anomaly investigation:	15 days

**Alternative 4**  
**(Detection and Clearance of UXO to Depth)**  
**Sector 4**

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$58,512	Each	1	\$58,512
Site Set-up/Take-down	\$8,400	Each	1	\$8,400
Site Facilities/Office Equipment	\$1,495	Month	2	\$2,990
Vehicle Rental (Large 4x4)	\$400	Week	4	\$1,600
Vehicle Rental (Small 4x4)	\$300	Week	54	\$16,200
Fuel	\$30	Week	58	\$1,740
Proj. Mgmt. (Geophysical) - Labor	\$3,180	Day	9.8	\$31,164
Proj. Mgmt. (Geophysical) - Equipment*	\$586	Day	17	\$9,962
Proj. Mgmt. (Geophysical) - Per Diem*	\$80	Person (day)	7 (17 days)	\$9,520
Proj. Mgmt. (Anomaly Inv.) - Labor	\$1,930	Day	8.4	\$16,212
Proj. Mgmt. (Anomaly Inv.) - Equipment*	\$112	Day	15	\$1,680
Proj. Mgmt. (Anomaly Inv.) - Per Diem*	\$80	Person (day)	4 (15 days)	\$4,800
Land Survey (Grids/Points) - Labor	\$700	Team (day)	2 (10.9 days)	\$15,260
Land Survey (Grids/Points) - Equipment*	\$145	Team (day)	2 (18 days)	\$5,220
Land Survey (Grids/Points) - Per Diem*	\$80	Person (day)	4 (18 days)	\$5,760
Geophysical Mapping - Labor	\$970	Team (day)	3 (9.8 days)	\$28,518
Geophysical Mapping - Equipment*	\$232	Team (day)	3 (17 days)	\$11,832
Geophysical Mapping - Per Diem*	\$80	Person (day)	6 (17 days)	\$8,160
Anomaly Investigation - Labor	\$1,470	Team (day)	4 (8.4 days)	\$49,392
Anomaly Investigation - Equipment*	\$31	Team (day)	4 (15 days)	\$1,860
Anomaly Investigation - Per Diem*	\$80	Person (day)	16 (15 days)	\$19,200
Demolition - Labor	\$1,190	Team (day)	1 (8.4 days)	\$9,996
Demolition - Equipment*	\$64	Team (day)	1 (15 days)	\$960
Demolition - Per Diem*	\$80	Person (day)	3 (15 days)	\$3,600
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$377,538</b>

Notes: (a) Average cost per acre = \$6,991.

(\*) Based on Calendar Days

**Costing Parameters**  
**Alternative 4 (Detection and Clearance of UXO to Depth)**  
**Sector 5**

- **Clearance area:**
  - Subsurface clearance total area: 35 acres
  - Land survey (grids): 152 grids
  - Total expected anomalies: 5,252 anomalies
  - Land survey (points): 5,252 points
  
- **The production estimates include:**
  - Land survey (grids): 200 grids/day
  - Geophysical mapping: 24 grids/day
  - Land survey (points): 300 points/day
  - Anomaly investigation: 344 anomalies/day
  
- **Project personnel:**
  - Project management (Geophysical mapping/data processing):**
    - (1) On-Site Project Manager
    - (1) Site Safety Officer
    - (1) Quality Control Supervisor
    - (1) Geophysicist
    - (3) Data Analyst
  
  - Project management (Anomaly investigation):**
    - (1) On-Site Project Manager
    - (1) Site Safety Officer
    - (1) Quality Control Supervisor
    - (1) Senior UXO Supervisor
  
  - Land survey: 2 Teams**
    - (2) Land Surveyor
    - (2) UXO Specialist
  
  - Geophysical mapping: 3 Teams**
    - (3) UXO Specialist
    - (3) EM 61 Operator
    - (3) Laborer
  
  - Anomaly investigation: 4 Teams**
    - (4) UXO Supervisor
    - (12) UXO Specialist
  
  - Demolition removal: 1 Team**
    - (1) UXO Supervisor
    - (1) Blaster
    - (1) UXO Specialist
  
- **Work days:**
  - Land survey (grids): 0.8 days (200 grids/day)
  - Geophysical mapping: 6.3 days (24 grids/day)
  - Land survey (points): 17.5 days (300 points/day)
  - Anomaly investigation: 15.3 days (344 anomalies/day)
  
- **Calendar days:**
  - Land survey (grids): 1 day
  - Geophysical mapping: 11 days
  - Land survey (points): 30 days
  - Anomaly investigation: 25 days

**Alternative 4**  
**(Detection and Clearance of UXO to Depth)**  
**Sector 5**

Event	Unit Cost	Unit	Quantity	Total Cost
Work Plan and Safety Plans	\$25,000	Each	1	\$25,000
Mobilization/Demobilization	\$58,512	Each	1	\$58,512
Site Set-up/Take-down	\$8,400	Each	1	\$8,400
Site Facilities/Office Equipment	\$1,495	Month	2.5	\$3,738
Vehicle Rental (Large 4x4)	\$400	Week	2	\$800
Vehicle Rental (Small 4x4)	\$300	Week	58	\$17,400
Fuel	\$30	Week	60	\$1,800
Proj. Mgmt. (Geophysical) - Labor	\$3,180	Day	6.3	\$20,034
Proj. Mgmt. (Geophysical) - Equipment*	\$586	Day	11	\$6,446
Proj. Mgmt. (Geophysical) - Per Diem*	\$80	Person (day)	7 (11 days)	\$6,160
Proj. Mgmt. (Anomaly Inv.) - Labor	\$1,930	Day	15.3	\$29,529
Proj. Mgmt. (Anomaly Inv.) - Equipment*	\$112	Day	25	\$2,800
Proj. Mgmt. (Anomaly Inv.) - Per Diem*	\$80	Person (day)	4 (25 days)	\$8,000
Land Survey (Grids/Points) - Labor	\$700	Team (day)	2 (18.3 days)	\$25,620
Land Survey (Grids/Points) - Equipment*	\$145	Team (day)	2 (31 days)	\$8,990
Land Survey (Grids/Points) - Per Diem*	\$80	Person (day)	4 (31 days)	\$9,920
Geophysical Mapping - Labor	\$970	Team (day)	3 (6.3 days)	\$18,333
Geophysical Mapping - Equipment*	\$232	Team (day)	3 (11 days)	\$7,656
Geophysical Mapping - Per Diem*	\$80	Person (day)	6 (11 days)	\$5,280
Anomaly Investigation - Labor	\$1,470	Team (day)	4 (15.3 days)	\$89,964
Anomaly Investigation - Equipment*	\$31	Team (day)	4 (25 days)	\$3,100
Anomaly Investigation - Per Diem*	\$80	Person (day)	16 (25 days)	\$32,000
Demolition - Labor	\$1,190	Team (day)	1 (15.3 days)	\$18,207
Demolition - Equipment*	\$64	Team (day)	1 (25 days)	\$1,600
Demolition - Per Diem*	\$80	Person (day)	3 (25 days)	\$6,000
Final Report	\$30,000	Each	1	\$30,000
<b>TOTAL(a)</b>				<b>\$445,289</b>

Notes: (a) Average cost per acre = \$12,723.

(\*) Based on Calendar Days