

APPENDIX C

Monitoring Well Survey Data



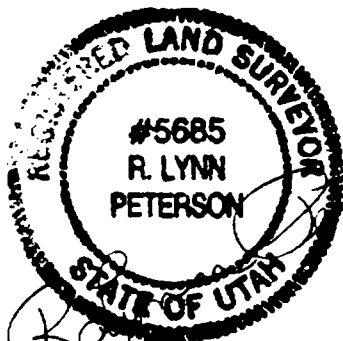
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PROJECT REPORT
TOOLE ARMY DEPOT
SOUTH AREA
TOOELE COUNTY, UTAH
USATHAMA SURVEY
1993

FOR
ENSEARCH INCORPORATED
ENVIRONMENTAL DIVISION
143 UNION BOULEVARD, SUITE 1060
LAKEWOOD, CO 80228-1824

PREPARED BY
AAA ENGINEERING & DRAFTING, INC.
1865 SOUTH MAIN STREET, SUITE 12
SALT LAKE CITY, UT 84115

FEBRUARY 1994



FEBRUARY 14, 1994



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I. INTRODUCTION

AAA Engineering & Drafting, Inc. (AAA) is a sub-contractor to Ebasco Services, Inc. to provide Surveying services for Monitoring Wells at various Solid Waste Management Units (SWMU) at Tooele Army Depot, South Area, Utah. The survey was completed using conventional survey methods.

II. DESCRIPTION OF WORK

AAA's task was to provide horizontal state plane (N.A.D. 27-Sea Level), and UTM (N.A.D. 27) coordinates and vertical elevations NGVD 1929 (based on NGS adjusted elevations-1974) for:

- A. Two (2) monitoring wells at SWMU 1, five (5) monitoring wells near SWMU 5 and 9 and eight (8) monitoring wells at SWMU 25 at Tooele South Depot Area.
- B. Preparation of report.

III. PROCEDURES, EQUIPMENT AND PERSONNEL USED ON PROJECT

- A. The horizontal surveying for Monitoring Wells was completed in accordance with Geodetic Control Network accuracy for Third Order Class II (1:5000) Surveying. Horizontal positions for all monitoring wells was accomplished by occupying existing monitoring well S-50-90 and sighting monitoring well no. S-43-90, occupying monitoring well no S-71-90 and sighting monitoring well no. S-70-90 then turning double angled sideshots to the various wells.
- B. All vertical control surveying was accomplished using differential leveling procedures from known elevations at top of metal well casings. All vertical elevations are within the required accuracy requirement of ± 0.01 feet.
- C. The horizontal control surveying was completed with a Wild T16 instrument with a top mounted Beetle 2000 EDM. Longer distances were measured with two sets of triple glass prisms. All measurements were averaged from 3 separate readings and all angle measurements were accomplished through double observations. The vertical differential loops were accomplished with a SOKKISHA B2-C automatic level.



D. PERSONNEL

AAA personnel assigned to this project were:

Lynn Peterson, Project Manager and Licensed Surveyor.

Craig Anderson, Instrument Man.

Chris Andersen, Rodman.

These personnel complied with the Ebasco Health and Safety Program.

IV. KNOWN COORDINATES AND VERTICAL ELEVATIONS:

Vertical elevations are National Geodetic Datum 1929 (ADJUSTED 1974).

A. KNOWN HORIZONTAL CONTROL POSITIONS

<u>Well No.</u>	State Plane 1927 N.A.D. (Feet)	
	<u>Northing</u>	<u>Easting</u>
S-43-90	716,777.2	1,771,531.9
S-50-90	713,629.2	1,770,871.0
S-70-90	703,629.0	1,767,581.8
S-71-90	703,648.6	1,769,902.9

B. KNOWN VERTICAL CONTROL POSITIONS

SWMU MON 25 NE	5078.07
S-50-90 (T.O.C.)	5152.87
S-68-90 (T.O.C.)	5058.99
S-70-90 (T.O.C.)	5060.75
S-71-90 (T.O.C.)	5056.05
(T.O.C.) Top of Metal Casing)	



C. LEVEL CIRCUITS

	CLOSURE
Well S-50-90 to Well S-50-90 (S-108-93)	0.000'
Well S-50-90 to Well S-50-90 (S-109-93 & S-110-93)	0.005'
Well S-108-93 to Well S-108-93 (TBM TS94-1)	0.005'
TBM TS94-1 to TBM TS94-1 S-111-93 & S-112-93)	0.005'
SWMU Mon 25ME to SWMU Mon 25NE (S-98-92 & S-100-92)	0.08 (Adjusted over 16 turns)
Well S-71-90 to Well S-71-90 (S-96-92)	0.010'
Well S-71-90 to Well S-71-90 (S-93-92)	0.010'
Well S-68-90 to Well S-68-90 (S-97-92, S-99-92 & S-95-92)	0.040' (Adjusted over 12 turns)
Well S-99-92 to Well S-99-92 (S-101-92 & S-102-92)	0.010'

AAA used Holguin Software to compute and balance Traverse Closures. Also a P.C. using National Geodetic Survey programs (Corps Con) to calculate conversion from SPC to Geodetic Positions and then to UTM coordinates was used.



V. FIELD SURVEY NOTES

5-10-93

T. L. PETERSON

CH. C. ANDERSON

65"

WINDY

TOO LEG SOUTH DEPOT

EBASCO

SCALE FACTOR

(.99968922)

C-7

5-10-93

T. L. PETERSON

OR C. ANDERSON

65°

WINDY

TIDELE SOUTH DEPOT

EBASCO

SCALE FACTOR

(.99968422)

C-8

STA	+	HI	-	ELEV.
				5078.07
4.615		5082.685		
			4.360 4.355	5078.325
10.165		5088.490		
			5.200 5.195	5083.290
6.075		5089.365		
			8.400 8.400	5080.960
1.650		5082.510		
			17.255 17.250	5065.255
0.950		5066.205		
			13.300 13.295	5052.905
1.290		5054.195		
			6.390 6.385	5047.805
4.350		5052.155		
			5.150 5.145	5047.005
4.655		5051.660		
			5.245 5.240	5046.315
			2.655 2.650	5049.00
			2.895 2.890	5048.76
			3.410 3.405	5046.25
5.620		5051.940		
			3.070 3.065	5048.870

1976
ENVO M.M. 25 N.E. (ADJUSTED)

WELL NO. GROUND
S-98-92 TOP M. CASING
TOP PVC CASING

5-11-73

T. L. PETERSON

CH. C. ANDERSON

72° SUNNY

BREEZY

TOOELE SOUTH DEPOT AREA
LEBOSCO

C-11

TO S-71-90 WELL (11)
 SIGHT 30/29 (10)
 ... 31/35
 X'S RT 163-30-45
 327-00-50 163-30-25
 V4 89-19-50
 EDM 1598.78
 1598.79
 1598.79
 NO 1598.68 S.L.D. (1598.18)
 TO S-96-92 (14)

C-12

TO S-71-90- (11)
 SIGHT SECT COR (10)
 X'S LT 137-04-50
 274-09-40 137-04-50
 V4 89-28-50
 EDM 2121.87
 2121.97 } 2121.95
 2122.02
 NO 2121.87 S.L.D. (2121.18)
 TO S-93-92 (15)

TO S-71-90 SIGHT
 SECTION COR.
 X'S RT 70-03-40 70-03-30
 140-07-00
 V4 89-20-00
 EDM 3184.47 }
 3184.47 } 3184.48
 3184.50 }
 NO 3184.26 S.L.D. (3183.25)
 TO "W.E. 90" (12)

TO S-71-90 SIGHT (11)
 SECTION COR (11)
 X'S RT 162-27-00 62-07-20
 124-54-40
 V4 89-22-00
 EDM 3284.60 }
 3284.72 } 3284.68
 3284.71 }
 NO 3284.48 S.L.D. (3283.44)
 TO
 WK PT CANE-I
 S-97-92 (16)

STA	+	HI	-	ELEV
				5056.05
	3.475	5059.525		
			2.585	5056.940
	6.970	5063.910		
			1.340	5062.570
	10.335	5072.905		
			1.395	5071.51
			1.235	5071.67
			3.650	5069.255
C-13			9.556	5063.350
	1.900	5065.250		
			7.525	5057.725
	2.750	5060.475		
			4.410	5056.065
	25.430		25.415	

NGVD 1929 (1974 ADJUSTED)
TOP METAL CASING S-71-90

WELL S-96-92 TOP PVC CASING
TOP METAL CASING
GROUND

TBM TOP METAL CASING S-71-90

STA	+	HI	-	ELEV
				5056.05
2.375	5058.425			
		1.375	5057.050	
8.760	5065.800			
		2.575	5063.230	
6.560	5069.795			
		3.735	5066.06	
6.965	5073.025			
		0.050	5072.975	
			5072.745	
			5072.955	
		2.880	5070.145	
		7.090	5065.935	
4.280	5070.215			
		7.425	5062.790	
3.125	5065.915			
		9.025	5056.890	
0.980	5057.870			
		1.805	5056.065	
33.095		33.030		
			5072.975	
2.595	5075.570			
		2.825	5072.745	
		2.615	5072.955	

C-14

TBM	S-71-90	TOP METAL CASING
WELL NO	TBM	TOP OF METAL CAP NORTH SIDE
S-93-92	TOP METAL CASING	
	TOP PVC CASING	
	GROUND	
S-71-90	TBM	TOP CASING
TBM	TOP CAP S-93-92	
	TOP METAL CASING	
	TOP PVC CASING	

TO NEBO (12) SIGHT 5-71-90 (11)

4'S LT 172-04-50 172-05-00

384-10-00

UX 90-37-10

EDM 2922.96

2923.00 } 2922.93

2922.83

NO 2922.76 S.L.D. (2921.84)

TO S-101-92 WEST WELL

(17)

C-15

TO NEBO (14) SIGHT 5-71-90 (11)

4'S LT 167-53-20

335-46-50 167-53-25

UX 90-51-10

EDM 2584.64

2584.70 } 2584.68

2584.71

NO 2584.40 S.L.D. (2583.58)

TO S-102-92 EAST WELL

(18)

TO NEBO (13) SIGHT 5-71-90 (11)

4'S LT 136-58-45

273-57-20 136-58-40

UX 90-14-50

EDM 3370.13

3370.13 } 3370.14

3370.15

NO 3370.11 S.L.D. (3369.05)

TO S-100-92 NORTH WELL

(19)

TO NEBO SIGHT 5-71-90

4'S

5-12-93

A. L. PETERSON

C. CARLSON

SONNY 80°

TOOELE SOUTH DEPOT AREA

FB2510

	(17)		(11)
TO NEBO SIGHT			5-71-90
K5 LT	164-49-18		
	359-38-50	164-49-25	
V4	90-23-00		
EDM	5727.97		
	5727.81	5727.93	
	5728.00		
NO	5727.80	S.L.D.	(5725.99)
TO	5-98-92	(20)	

	(12)		(11)
TO NEBO SIGHT			5-71-90
K5 LT	184-39-40		
	09-19-05	184-39-33	
V4	91-08-30		
EDM	2067.97		
	2067.96	2067.96	
	2067.94		
NO	2067.55	S.L.D.	(2066.90)
TO	5-99-92	(21)	

	(12)		(11)
TO NEBO SIGHT			5-71-90
K5 RT	121-15-35		
	242-31-00	12-15-30	
V4	90-51-30		
EDM	2973.66		
	2973.61	2973.61	
	2973.57		
NO	2973.28	S.L.D.	(2972.34)
TO	5-95-92	(22)	

	(12)		(11)
TO NEBO SIGHT			5-71-90
K5 RT	129-59-00		
	250-41-45	129-53-53	
V4	90-43-10		
EDM	4218.00		
	4218.10	4218.10	
	4218.11		
NO	4217.76	S.L.D.	(4216.43)
TO	5-18-98	(23)	

⑩
 T. @ NEBO SIGHT S-71-90
 4'S RT 68-31-20
 137-02-50 68-31-25

VA 90-40-00
 EDM 1832.28
 1832.29 } 1832.29
 1832.28 }

NO. 1832.17 S.L.O. (1831.59)
 TO VA COR. ~~30~~
 31

NO VA COR 30
 SIGHT NEBO 31
 4'S RT 83-42-35
 167-25-20 83-42-40

VA 90-26-00
 EDM 2647.02
 2647.02 } 2647.02

2647.03
 NO. 2646.94 S.L.O. (2646.10)
 TO COR 30 | 25
 31 | 37

30 | 29
 T. @ 31 | 34 SIGHT ~~30~~
 51

4'S RT 137-42-40
 275-25-20

VA 502.32-00

EDM 502.02

502.01 } 502.01

502.01 }

NO. 501.99 S.L.O. (501.83)
 TO 5-71-98

C-19

STA	+	HT	-	ALOV
				5058.99
5.501				
5.500	5064.491		1.603	
			1.605	5062.888
10.016				
18.015	5080.904		11.698	
			1.700	5079.206
7.006				
7.805	5087.012			
			0.475	5086.537
			0.300	5086.712
			3.050	5083.962
			14.505	
1.801				5072.509
1.800	5074.310		13.043	
			13.045	5061.267
1.511				
1.510	5062.778		8.423	
			8.475	5054.305
1.326				
1.385	5055.691		7.893	
			7.895	5047.798
3.451				
3.450	5051.249			
			2.305	5048.944
			2.105	5049.144
			4.710	5046.539
			5.360	
			5.368	5045.891
5.391				
5.390	5051.282		5.993	
			5.995	5045.289
44.87			58.580	

WELL - 588-90 TOP METAL CASING
ADJUSTED

WELL - 5797-92 TOP PVC CASING
" METAL "
GROUND

WELL - 599-92 TOP PVC CASING
" METAL "
GROUND

C-20

STA	+	HT	-	ELEV
	6.391			
	6.390	5051.680	4.318	
			4.320	5047.362
	5.486			
	8.485	5050.848		
			4.790	5046.058
			4.550	5046.298
			6.870	5043.978
		7.373	7.375	5043.976
	8.526			
	8.525	5053.001	1.253	
			1.255	5050.748
	8.476			
	8.475	5053.224	0.233	
			0.235	5058.991
	71.725		71.765	"
	71.747		71.747	"
	+0.00167		-0.00167	

WELL NO. S-25-92		TOP PVC CASING (WPT)
		TOP METAL "
		GROUND

STA	+	H.I.	-	ELEV
				5049.111
2.375		5051.519		
			2.575	5048.944
9.245		5058.189		
			2.615	5055.574
5.760		5061.334		
			2.015	5059.319
			1.865	5059.449
			4.525	5056.869
			7.570	5053.769
			7.375	5053.959
			9.790	5051.649
			11.205	5050.129
3.375		5053.509		
			6.355	5047.149
4.545		5051.699		
			2.560	5049.134
25.300			25.31	

C-21

				METAL
TBM	TOP	CASING	5-99-92	
WELL	5-101-92	TOP	PVC	CASING
		"	METAL	"
				GROUND
WELL	5-102-92	TOP	PVC	CASING
		"	METAL	"
				GROUND
TBM	TOP	CASING	5-99-92	

C-22

1-04-94

A. PETERSON
OF CLANDERSON
CEPOVY
90°

TOWELE SOUTH DEPT AREA
EBASEO

SCALE FACTOR
(.99968422)
(S.L. DIST)

TQ 5-50-90 (52)

SIGHT 5-43-90 (51)

4'S RT 176-36-10 } 176-36-15
353-12-30 }

VA 90-32-20

EDM 536.26 }
536.28 } 536.28
536.29 }

HD 536.25 (536.08)

TO 5-108-93 (53)

TQ 5-50-90 (52)

SIGHT 5-43-90 (51)

4'S RT 113-01-40 } 113-01-40
200-23-20 }

VA 90-03-30

EDM 669.28 }
669.29 } 669.29
669.30 }

HD 669.29 (669.08)

TO 5-109-93 (54)

TQ 5-50-90 (52)

SIGHT 5-43-90 (51)

4'S RT 32-56-40 } 32-56-35
65-53-10 }

VA 89-31-20

EDM 1563.78 }
1563.90 } 1562.99
1562.98 }

HD 1562.94 (1562.45)

TO 5-110-93 (55)

TQ 5-50-90 (52)

SIGHT 5-43-90 (51)

~~4'S RT 113-01-40 } 113-01-40
200-23-20 }~~

~~VA 90-03-30~~

~~EDM 2097.17 }
2097.16 } 2097.16
2097.15 }~~

~~HD 2097.10 (2096.44)~~

~~TO WK FT TS944 (56)~~

TO TS941 (56)

SIGHT S-50-90 (52)

F'S RT 165-40-00 } 165-40-10
331-20-20 }

V₅ 90-15-10

EDM 2142.18

2142.20 } 2142.20

2142.22 }

HD 2142.18 (2141.50)

TO S-111-93 (57)

TO TS941

F'S RT 165-17-00 } 165-17-03
330-34-05 }

V₅ 90-11-10

EDM 3709.29

3709.30 } 3709.29

3709.29 }

HD 3709.27 (3708.10)

TO S-112-93 (58)

STA	+	HI	-	ELEV
				5152.87
2.017		5154.880		
		6.825		5148.055
2.790		5150.845		
		4.510		5146.335
		4.740		5146.105
		6.420		5144.425
		3.060		5147.785
4.725		5152.510		
		1.745		5150.765
		2.090		5150.420
		4.180		5148.330
		1.120		5151.390
3.570		5154.960		
		2.090		5152.870
13.095		13.095		

TOP METAL CASING S-50-90									
TOP METAL CASING S-108-93									
" PVC " "									
" @ GROUND " "									
TOP METAL CASING S-109-93									
" PVC " "									
" @ GROUND " "									
S-50-90 TOP METAL CASING									

C-25

STA	+	HI	-	ELEV
				5152.87
2.090		5154.90		
			4.890	5150.070
7.490		5157.510		
			2.735	5154.825
6.830		5161.655		
			3.420	5158.235
6.770		5165.065		
			0.110	5164.895
			0.320	5164.685
			2.430	5162.575
			0.085	5164.220
0.550		5165.470		
			7.395	5158.075
4.980		5163.095		
			6.865	5156.190
0.345		5156.535		
			2.725	5153.81
1.520		5155.330		
			2.455	5152.875
30.575			30.570	

TOP METAL CASING 5-50-90																			
PVC																			
GROUND																			
TOP METAL CASING 5-50-90																			
PVC																			
GROUND																			
TOP METAL CASING 5-50-90																			
PVC																			
GROUND																			

C-26

STA + HI - ELEV

5146.335

1.730 5148.065

3.030 5145.035

3.790 5148.825

8.365 5140.460

2.215 5142.675

7.015 5135.660

6.885 5142.545

3.025 5139.520

8.095 5147.615

2.035 5145.580

2.290 5147.870

1.525 5146.345

35.005

24.995

C-27

T.P. MERK CROWES - 108-93

T.P. MERK TS 94-1

T.P. MERK TOP METAL CASING S-108-93

C-28

STA	+	HT	-	ELEV
				5135.660
3.940	5139.600			
		6.590		5133.060
4.750	5137.810			
		9.335		5128.475
3.645	5132.120			
		5.360		5126.760
4.650	5131.410			
		5.085		5126.325
5.000	5131.325			
		3.760		5127.565
		3.980		5127.345
		6.010		5125.315
		3.278		5128.050
2.660	5130.710			
		5.595		5125.165
4.680	5129.845			
		6.155		5123.690
4.130	5127.820			
		2.280		5125.540
		2.470		5125.350
		4.990		5122.830
		2.055		5125.765
2.395	5128.110			

TABM T594-1

TOP METAL CASING 5-111-93
 " PVC " " "
 GROUND

TOP METAL CASING 5-112-93
 " PVC " " "
 GROUND

STA	+	HI	-	ELEV
			4.335	5123.775
6.260		5130.035		
			4.860	5125.175
5.665		5130.840		
			4.815	5126.025
5.250		5131.275		
			4.400	5126.875
4.360		5131.235		
			3.945	5127.290
8.255		5135.545		
			2.685	5132.860
5.460		5138.37		
			5.265	5133.055
6.910		5139.65		
			4.300	5135.665

TBM 7594-1

77.960 77.955

C-29

C-30

8-19-93

T. L. PETERSON

CH. C. ANDERSON

AT. CLOY

75.50

TODDLE SOUTH

EBOSLO.

K @ 5-71-90
SIGHT 5-70-90

DISTANCE BETWEEN ,

V 4 89-52-30

EDM 2321.87

2321.87

2321.87

~~KD~~

KS PT 28-10-40

56-21-20 28-10-40

54-32-15 28-10-45

TO PT NEBO

VI COORDINATES

TOOELE SOUTH DEPOT MONITORING WELLS

02-14-94

SWMU NO	WELL NO	STATE PLANE (SEA LEVEL) 1927 N.A.D. (FEET) CENTRAL ZONE		UTM COORDINATES 1927 N.A.D. (METERS) ZONE 12		GEOGRAPHICS		ELEVATION		
		NORTH	EAST	NORTH	EAST	LATITUDE (N)	LONGITUDE (W)	TOP PVC CASING	GROUND	
1	8-93-92	703,627.899	1,772,023.979	4,457,491.015	388,015.628	40°15'44.25"	112°19'00.88"	5072.95	5070.14	
	8-96-92	705,015.396	1,770,729.528	4,457,916.408	387,623.575	40°15'57.85"	112°19'17.74"	5071.51	5069.25	
25	8-95-92	703,595.016	1,764,537.798	4,457,494.053	385,734.201	40°15'43.24"	112°20'37.44"	5046.06	5043.98	
	8-97-92	704,776.732	1,766,819.347	4,457,850.194	386,431.553	40°15'55.13"	112°20'08.15"	5086.54	5083.96	
	8-98-92	709,023.632	1,762,887.758	4,459,151.277	385,240.836	40°16'36.73"	112°20'59.39"	5048.76	5046.31	
	8-99-92	705,936.698	1,765,182.184	4,458,206.544	385,934.661	40°16'06.44"	112°20'29.41"	5048.94	5046.54	
	8-100-92	708,308.006	1,765,971.610	4,458,927.809	386,179.374	40°16'29.95"	112°20'19.51"	5076.88	5074.67	
	8-101-92	706,829.316	1,764,708.876	4,458,479.391	385,791.981	40°16'15.23"	112°20'34.07"	5059.32	5056.81	
	8-102-92	706,781.908	1,765,099.495	4,458,464.262	385,910.937	40°16'14.79"	112°20'30.58"	5053.76	5051.54	
	A DIRECT TIE FROM TRAVERSE WAS MADE TO S-18-88									
	S-18-88	703,520.703	1,763,186.255	4,457,473.765	385,322.195	40°15'42.38"	112°20'54.86"	5037.58	5035.34	
THESE COORDINATES WERE COMPUTED BY USING DIRECT TIES										
FROM S-18-88 TO GEONEX CONTROL (S-16-88 THRU S-22-88)										
	S-16-88	703,787.391	1,778,666.713	4,457,528.036	390,040.228	40°15'46.42"	112°17'35.21"	5099.57	5097.10	
	S-17-88	703,784.539	1,774,288.865	4,457,534.800	388,706.109	40°15'46.00"	112°18'31.68"	5077.37	5075.45	
	S-19-88	703,332.436	1,758,562.278	4,457,424.461	383,912.728	40°15'40.08"	112°21'54.48"	5059.71	5057.37	
	S-22-88	703,291.951	1,754,467.240	4,457,419.272	382,664.706	40°15'39.29"	112°22'47.30"	5046.93	5044.41	
5 & 9	8-108-93	713,098.954	1,770,792.125	4,460,379.400	387,656.759	40°17'17.74"	112°19'17.89"	5146.11	5144.43	
	"	8-109-93	713,246.538	1,771,419.851	4,460,423.279	387,848.312	40°17'19.25"	112°19'09.80"	5150.42	5148.33
	"	8-110-93	714,737.875	1,771,971.950	4,460,876.787	388,019.165	40°17'34.04"	112°19'02.86"	5164.69	5162.58
	"	8-111-93	710,412.649	1,773,579,236	4,459,555.903	388,501.419	40°16'51.44"	112°18'41.61"	5127.35	5125.32
	"	8-112-93	709,366.283	1,774,745.303	4,459,234.996	388,854.942	40°16'41.20"	112°18'26.44"	5125.35	5122.83

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