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for

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Bethpage, New York

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Northern Division

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APPENDICES
TABLE OF CONTENTS

APPENDIX A - RISK-BASED PRELIMINARY REMEDIATION GOALS

APPENDIX B - SOIL CALCULATIONS

SITE 1 - SOIL CALCULATIONS

SITE 1 - SAMPLE CALCULATION OF SOIL ACTION LEVELS BASED ON LEACHING OF CONTAMINANTS TO GROUNDWATER

SITE 1 - ANALYTICAL SUMMARIES AND MAPS

SITE 1 - SOIL GAS VS. VOC CORRELATION

SITE 1 - AREA OF CONTAMINATION (FOR CAPPING ALTERNATIVES)

SITE 1 - SOIL VOLUME CALCULATIONS

SITE 2 - SOIL CALCULATIONS

SITE 2 - SAMPLE CALCULATION OF SOIL ACTION LEVELS BASED ON LEACHING OF CONTAMINANTS TO GROUNDWATER

SITE 2 - ANALYTICAL SUMMARIES AND MAPS

SITE 2 - SOIL GAS VS. VOC CORRELATION

SITE 2 - AREA OF CONTAMINATION (FOR CAPPING ALTERNATIVES)

SITE 2 - SOIL VOLUME CALCULATIONS

SITE 3 - SOIL CALCULATIONS

SITE 3 - SAMPLE CALCULATION OF SOIL ACTION LEVELS BASED ON LEACHING OF CONTAMINANTS TO GROUNDWATER

SITE 3 - ANALYTICAL SUMMARIES AND MAPS

SITE 3 - SOIL GAS VS. VOC CORRELATION

SITE 3 - AREA OF CONTAMINATION (FOR CAPPING ALTERNATIVES)

SITE 3 - SOIL VOLUME CALCULATIONS

SITES 1, 2, AND 3 - LIMITED VOC SOIL VOLUME CALCULATIONS

APPENDICES
TABLE OF CONTENTS (Cont'd)

APPENDIX C - GROUNDWATER CALCULATIONS

APPENDIX D - GROUNDWATER COMPUTER MODELING

APPENDIX E - COST ESTIMATES

SOILS COST ESTIMATES

GROUNDWATER COST ESTIMATES

APPENDIX A

RISK-BASED PRELIMINARY REMEDIATION GOALS

Development of Preliminary Remediation Goals

The development of risk-based Preliminary Remediation Goals (PRGs) for soil at the NWIRP Bethpage site was based upon methodology outlined in Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part B - Development of Risk-based Preliminary Remediation Goals (USEPA, December 1991). PRGS were derived for three receptors using the exposure scenarios outlined below:

- **Current Onsite Worker** exposures were evaluated using Industrial/Commercial Land Use PRG development equations as outlined in Sections 3.2 and 3.3 of RAGS Part B. Exposure to site media (soil) via incidental ingestion and inhalation exposure routes were considered.

- **Current Offsite Resident** exposures were evaluated using the Industrial/Commercial Land Use PRG development equations for inhalation exposures only.

- **Future Onsite Resident** exposures were considered using the Residential Land Use PRG development equations presented in Section 3.1 of RAGS, Part B. Only oral exposure to soil was evaluated in accordance with guidance.

The current onsite worker and future onsite resident scenarios are based directly on guidance as provided in RAGS Part B. The use of the Industrial/Commercial Land Use scenario is an extention of the RAGS Part B approaches, and is deemed appropriate for establishment of conservative PRGs for current residential exposure for several reasons. Site access is currently restricted by a fence that prevents direct contact with site soils. The use of the Industrial Land Use scenario incorporates risks associated with inhalation that are not evaluated under prescribed residential land use guidance. Under current land use conditiions, inhalation of volatile emissions and fugitive dust is considered the only potentially complete exposure pathway for offsite residents. PRGs were developed that considered the receptor to actually reside onsite, neglecting atmospheric dispersion effects that would result in the establishment of higher PRGs.

Inhalation risks are evaluated by considering two potential release mechanisms. One mechanism is the emission and inhalation of fugitive dust. The amount of dust generated is a function of many site-specific meteorologic and physical parameters and is estimated using the Particulate Emission Factor (PEF). The second mechanism is chemical volatilization from the soil followed by inhalation. This route is evaluated using a mass transfer model represented by the Volatilization Factor (VF). Equations for the generation of the PEF and VF are presented in RAGS, Part B, Section 3.3.

Because residential receptor exposures consider receptors with a 30 year exposure duration (6 years as a 15 Kg child and 24 years as a 70 Kg adult), ingestion rate, inhalation rate, and body weight adjustments are made under both the current and future residential land use scenarios. This procedure is advocated for the ingestion route in RAGS Part B via the use of the age-adjusted soil ingestion factor. The procedure is extended for use with the inhalation exposure route.

In accordance with RAGS Part B, soil PRGs for the Future Onsite Resident scenario are based on ingestion rates of 200 mg/day and 100 mg/day for child and adult receptors, respectively. For inhalation, an inhalation rate of 20 m^3/day is employed for both receptors. The rationale for the use of the consistent inhalation rate is that both adult and 6 year old receptors performing light activity are noted to have inhalation rates of 0.8 m^3/hour (USEPA, Exposure Factors Handbook, May 1989). The reported inhalation rates are considered conservative estimates because they represent the reasonable maximum rates for receptors in the specified age ranges.

The increased sensitivity of child residential receptors to noncarcinogenic (systemic) risks, as a result of lower body weight, have been considered in the evaluation of both current and future residential exposure for noncarcinogens only. Under this exposure scenario, the potential noncarcinogenic risks for chidren are evaluated.

Carcinogenic risks were not evaluated for children because the adult residential receptor is subject to exposure during both child and adult body weights when this receptor is evaluated. The dual receptor exposure is considered to be an accurate estimation of intake when estimating carcinogenic PRGs. Since cancer risk increase is averaged over the receptor's entire lifetime, not just the exposure duration, the additional exposure encountered by the adult receptor (in the 7 to 30 year age range) is added to the exposure obtained by the child receptor.

Sample calculations for the development of risk-based PRGs are presented in ~~Appendix~~ _. the following pages.

Development of Risk – Based Preliminary Remediation Goals (PRGs)
Scenario: Residential Land Use – Soil
Reference: RAGS, Part B, Section 3.1.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/19/93

RECEPTOR: Adult Resident (Future Onsite Scenario)

Relevant Equations:

(1) Noncarcinogenic Risks (Reduced form for HI of unity).

C(mg/kg) = (1 x RfD x AT x 365)/(CF x EF x IF)

(2) Carcinogenic Risks (Reduced form for 1E–6 incremental cancer risk).

C(mg/kg) = (1e–6 x AT x 365)/(CSF x CF x EF x IF)

Instructions:
Provide input values for (*) items and chemical specific RfD and CSF for oral exposure route only.

Input Parameters: Future Adult Onsite Residential Use Exposure

* Ingestion Rate	(mg/day)	=	100	– Adult
		=	200	– Child
* Exposure Frequency	(days/yr)	=	350	
* Exposure Duration	(yrs)	=	24	– Adult
		=	6	– Child
* Body Weight	(kg)	=	70	– Adult
		=	15	– Child
Age–adjusted soil ingestion factor (mg–yr/kg–day)		=	114.29	

Chemical	Reference Dose (Oral) (mg/kg–day)	Cancer Slope Factor (Oral) (kg–day/mg)	Noncarcinogen Preliminary Remediation Goal (mg/Kg)	Carcinogenic Preliminary Remediation Goal (mg/Kg)	Final Preliminary Remediation Goal (mg/Kg)
Arsenic	3.0E–04 (1)		82.125	N/A	82
Antimony	4.0E–04 (1)		109.5	N/A	110
Barium	7.0E–02 (1)		19162.5	N/A	19,163
Beryllium	5.0E–03 (1)	4.3E+00 (1)	1368.75	0.148546512	0.15
Cadmium	5.0E–04 (1a)		136.875	N/A	137
Chromium (III)	1.0E+00 (1)		273750	N/A	273,750
Copper	3.7E–02 (2a)		1368.75	N/A	1,369
Lead			N/A	N/A	N/A
Manganese	5.0E–03 (1a)		1368.75	N/A	1,369
Mercury	3.0E–04 (2)		82.125	N/A	82
Nickel	2.0E–02 (1)		5475	N/A	5,475
Silver	5.0E–03 (1)		1368.75	N/A	1,369
Vanadium	7.0E–03 (2)		1916.25	N/A	1,916
Zinc	3.0E–01 (1)		82125	N/A	82,125
Cyanide	2.0E–02 (1)		5475	N/A	5,475
Selenium	5.0E–03 (1)		1368.75	N/A	1,369
Thallium	7.0E–05 (2b)		19.1625	N/A	19
Heptachlor	5.0E–04 (1)	4.5E+00 (1)	136.875	0.141944444	0.142
Heptachlor epoxide	1.3E–05 (1)	9.1E+00 (1)	3.55875	0.070192308	0.070
Endrin	3.0E–04 (1)		82.125	N/A	82
Dieldrin	5.0E–05 (1)	1.6E+01 (1)	13.6875	0.039921875	0.040
Trichloroethene		1.1E–02 (3)	N/A	58.06818182	58
Tetrachloroethene	1.0E–02 (1)	5.2E–02 (3)	2737.5	12.28365385	12
Chloroform	1.0E–02 (1)	6.1E–03 (1)	2737.5	104.7131148	105
Toluene	2.0E–01 (1)		54750	N/A	54,750
Bis(2–chloroethyl)ether		1.1E+00 (1)	N/A	0.580681818	0.581
DDT	5.0E–04 (1)	3.4E–01 (1)	136.875	1.878676471	1.879
DDD		2.4E–01 (1)	N/A	2.661458333	2.661
DDE		3.4E–01 (1)	N/A	1.878676471	1.879
Chlordane	6.0E–05 (1)	1.3E+00 (1)	16.425	0.491346154	0.491
Aroclors (total)		7.7E+00 (1)	N/A	0.082954545	0.083
Bis(2–ethylhexyl)phthalate	2.0E–02 (1)	1.4E–02 (1)	5475	45.625	46
Butylbenzylphthalate	2.0E–01 (1)		54750	N/A	54,750
Di–n–butylphthalate	1.0E–01 (1)		27375	N/A	27,375
Dimethylphthalte	1.0E+01 (2)		2737500	N/A	**********
Naphthalene	4.0E–02 (2)		10950	N/A	10,950
2–Methylnaphthalene	2.0E–02 (5)		5475	N/A	5,475

Development of Risk – Based Preliminary Remediation Goals (PRGs)
Scenario: Residential Land Use – Soil
Reference: RAGS, Part B, Section 3.1.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/19/93

RECEPTOR: Adult Resident (Future Onsite Scenario)

Relevant Equations:

(1) Noncarcinogenic Risks (Reduced form for HI of unity).

C(mg/kg) = (1 x RfD x AT x 365)/(CF x EF x IF)

(2) Carcinogenic Risks (Reduced form for 1E–6 incremental cancer risk).

C(mg/kg) = (1e–6 x AT x 365)/(CSF x CF x EF x IF)

Instructions:
Provide input values for (*) items and chemical specific RfD and CSF for oral exposure route only.

Input Parameters: Future Adult Onsite Residential Use Exposure

* Ingestion Rate	(mg/day)	=	100	– Adult
		=	200	– Child
* Exposure Frequency	(days/yr)	=	350	
* Exposure Duration	(yrs)	=	24	– Adult
		=	6	– Child
* Body Weight	(kg)	=	70	– Adult
		=	15	– Child
Age–adjusted soil ingestion factor (mg–yr/kg–day)		=	114.29	

Chemical	Reference Dose (Oral) (mg/kg–day)	Cancer Slope Factor (Oral) (kg–day/mg)	Noncarcinogen Preliminary Remediation Goal (mg/Kg)	Carcinogenic Preliminary Remediation Goal (mg/Kg)	Final Preliminary Remediation Goal (mg/Kg)
Acenaphthene	6.0E–02 (1)		16425	N/A	16,425
Acenaphthylene			N/A	N/A	N/A
Anthracene	3.0E–01 (1)		82125	N/A	82,125
Fluoranthene	4.0E–02 (1)		10950	N/A	10,950
Pyrene	3.0E–02 (1)		8212.5	N/A	8,213
Phenanthrene			N/A	N/A	N/A
Benzo(a)anthracene			N/A	N/A	N/A
Chrysene			N/A	N/A	N/A
Benzo(b)fluoranthene			N/A	N/A	N/A
Benzo(k)fluoranthene			N/A	N/A	N/A
Benzo(a)pyrene		7.3E+00 (1)	N/A	0.0875	0.088
Indeno(1,2,3–cd)pyrene			N/A	N/A	N/A
Dibenzo(a,h)anthracene			N/A	N/A	N/A
Benzo(g,h,i)perylene			N/A	N/A	N/A
Fluorene	4.0E–02 (1)		10950	N/A	10,950
trans–1,2–Dichloroethene	2.0E–02 (1)		5475	N/A	5,475
1,1,1–Trichloroethane	9.0E–01 (2)		246375	N/A	246,375
Carbon disulfide	1.0E–01 (1)		27375	N/A	27,375
1,1–Dichloroethane	1.0E–01 (2)		27375	N/A	27,375
1,1–Dichloroethene	9.0E–03 (1)	6.0E–01 (1)	2463.75	1.064583333	1.065
Carbon tetrachloride	7.0E–04 (1)	3.7E–06 (1)	191.625	172635.1351	192
Ethylbenzene	1.0E–01 (1)		27375	N/A	27,375
Xylenes	2.0E+00 (1)		547500	N/A	547,500
Di–n–octylphthalate	2.0E–02 (4)		5475	N/A	5,475
2–Methylphenol	5.0E–02 (1)		13687.5	N/A	13,688
4–Methylphenol	5.0E–02 (2)		13687.5	N/A	13,688
2,4–Dimethylphenol	2.0E–02 (1)		5475	N/A	5,475

******** reported as a Final PRG indicates the risk based PRG is greater than pure product (> 1e6 ppm).
(1) IRIS, On Line, April 1993.
(1a) IRIS, On Line, April 1993, value based on water consumption.
(2) HEAST, FY 1992.
(2a) HEAST, FY 1992, calculated from MCL of 1.3 mg/L.
(2b) HEAST, FY 1992, chronic value for thallic oxide.
(3) USEPA, Risk Assessment Issue Paper, January, 1993.
(4) HEAST, FY 1991.
(5) Calculated from oral LD50.

Development of Risk – Based Preliminary Remediation Goals (PRGs)
Scenario: Residential Land Use – Soil
Reference: RAGS, Part B, Section 3.1.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/19/93

RECEPTOR: Child Resident (Future Onsite Scenario)

Relevant Equations:

(1) Noncarcinogenic Risks (Reduced form for HI of unity).

C(mg/kg) = (1 x RfD x AT x 365)/(CF x EF x IF)

(2) Carcinogenic Risks are not evaluated for child receptors.

Instructions:
Provide input values for (*) items and chemical specific RfD and CSF for oral exposure route only.

Input Parameters:			Future Child Onsite Residential Use Exposure	
* Ingestion Rate	(mg/day)	=	0	– Adult
		=	200	– Child
* Exposure Frequency	(days/yr)	=	350	
* Exposure Duration	(yrs)	=	0	– Adult
		=	6	– Child
* Body Weight	(kg)	=	70	– Adult
		=	15	– Child
Age–adjusted soil ingestion factor (mg–yr/kg–day)		=	80.00	

Chemical	Reference Dose (Oral) (mg/kg–day)	Cancer Slope Factor (Oral) (kg–day/mg)	Noncarcinogen Preliminary Remediation Goal (mg/Kg)	Carcinogenic Preliminary Remediation Goal (mg/Kg)	Final Preliminary Remediation Goal (mg/Kg)
Arsenic	3.0E–04 (1)		23.46428571	N/A	23
Antimony	4.0E–04 (1)		31.2857 1429	N/A	31
Barium	7.0E–02 (1)		5475	N/A	5,475
Beryllium	5.0E–03 (1)		391.0714286	N/A	391.07
Cadmium	5.0E–04 (1a)		39.10714286	N/A	39
Chromium (III)	1.0E+00 (1)		78214.28571	N/A	78,214
Copper	3.7E–02 (2a)		391.0714286	N/A	391
Lead			N/A	N/A	N/A
Manganese	5.0E–03 (1a)		391.0714286	N/A	391
Mercury	3.0E–04 (2)		23.46428571	N/A	23
Nickel	2.0E–02 (1)		1564.285714	N/A	1,564
Silver	5.0E–03 (1)		391.0714286	N/A	391
Vanadium	7.0E–03 (2)		547.5	N/A	548
Zinc	3.0E–01 (1)		23464.28571	N/A	23,464
Cyanide	2.0E–02 (1)		1564.285714	N/A	1,564
Selenium	5.0E–03 (1)		391.0714286	N/A	391
Thallium	7.0E–05 (2b)		5.475	N/A	5
Heptachlor	5.0E–04 (1)		39.10714286	N/A	39.107
Heptachlor epoxide	1.3E–05 (1)		1.016785714	N/A	1.017
Endrin	3.0E–04 (1)		23.46428571	N/A	23
Dieldrin	5.0E–05 (1)		3.910714286	N/A	3.911
Trichloroethene			N/A	N/A	N/A
Tetrachloroethene	1.0E–02 (1)		782.1428571	N/A	782
Chloroform	1.0E–02 (1)		782.1428571	N/A	782
Toluene	2.0E–01 (1)		15642.85714	N/A	15,643
Bis(2–chloroethyl)ether			N/A	N/A	N/A
DDT	5.0E–04 (1)		39.10714286	N/A	39.107
DDD			N/A	N/A	N/A
DDE			N/A	N/A	N/A
Chlordane	6.0E–05 (1)		4.692857143	N/A	4.693
Aroclors (total)			N/A	N/A	N/A
Bis(2–ethylhexyl)phthalate	2.0E–02 (1)		1564.285714	N/A	1,564
Butylbenzylphthalate	2.0E–01 (1)		15642.85714	N/A	15,643
Di–n–butylphthalate	1.0E–01 (1)		7821.428571	N/A	7,821
Dimethylphthalte	1.0E+01 (2)		782142.8571	N/A	782,143
Naphthalene	4.0E–02 (2)		3128.571429	N/A	3,129
2–Methylnaphthalene	2.0E–02 (4)		1564.285714	N/A	1,564

Development of Risk – Based Preliminary Remediation Goals (PRGs)
Scenario: Residential Land Use – Soil
Reference: RAGS, Part B, Section 3.1.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/19/93

RECEPTOR: Child Resident (Future Onsite Scenario)

Relevant Equations:

(1) Noncarcinogenic Risks (Reduced form for HI of unity).

C(mg/kg) = (1 x RfD x AT x 365)/(CF x EF x IF)

(2) Carcinogenic Risks are not evaluated for child receptors.

Instructions:
Provide input values for (*) items and chemical specific RfD and CSF for oral exposure route only.

Input Parameters:			Future Child Onsite Residential Use Exposure	
* Ingestion Rate	(mg/day)	=	0	– Adult
		=	200	– Child
* Exposure Frequency	(days/yr)	=	350	
* Exposure Duration	(yrs)	=	0	– Adult
		=	6	– Child
* Body Weight	(kg)	=	70	– Adult
		=	15	– Child
Age–adjusted soil ingestion factor (mg–yr/kg–day)		=	80.00	

Chemical	Reference Dose (Oral) (mg/kg–day)	Cancer Slope Factor (Oral) (kg–day/mg)	Noncarcinogen Preliminary Remediation Goal (mg/Kg)	Carcinogenic Preliminary Remediation Goal (mg/Kg)	Final Preliminary Remediation Goal (mg/Kg)
Acenaphthene	6.0E–02 (1)		4692.857143	N/A	4,693
Acenaphthylene			N/A	N/A	N/A
Anthracene	3.0E–01 (1)		23464.28571	N/A	23,464
Fluoranthene	4.0E–02 (1)		3128.571429	N/A	3,129
Pyrene	3.0E–02 (1)		2346.428571	N/A	2,346
Phenanthrene			N/A	N/A	N/A
Benzo(a)anthracene			N/A	N/A	N/A
Chrysene			N/A	N/A	N/A
Benzo(b)fluoranthene			N/A	N/A	N/A
Benzo(k)fluoranthene			N/A	N/A	N/A
Benzo(a)pyrene			N/A	N/A	N/A
Indeno(1,2,3–cd)pyrene			N/A	N/A	N/A
Dibenzo(a,h)anthracene			N/A	N/A	N/A
Benzo(g,h,i)perylene			N/A	N/A	N/A
Fluorene	4.0E–02 (1)		3128.571429	N/A	3,129
trans–1,2–Dichloroethene	2.0E–02 (1)		1564.285714	N/A	1,564
1,1,1–Trichloroethane	9.0E–01 (2)		70392.85714	N/A	70,393
Carbon disulfide	1.0E–01 (1)		7821.428571	N/A	7,821
1,1–Dichloroethane	1.0E–01 (2)		7821.428571	N/A	7,821
1,1–Dichloroethene	9.0E–03 (1)		703.9285714	N/A	703.929
Carbon tetrachloride	7.0E–04 (1)		54.75	N/A	55
Ethylbenzene	1.0E–01 (1)		7821.428571	N/A	7,821
Xylenes	2.0E+00 (1)		156428.5714	N/A	156,429
Di–n–octylphthalate	2.0E–02 (3)		1564.285714	N/A	1,564
2–Methylphenol	5.0E–02 (1)		3910.714286	N/A	3,911
4–Methylphenol	5.0E–02 (2)		3910.714286	N/A	3,911
2,4–Dimethylphenol	2.0E–02 (1)		1564.285714	N/A	1,564

******** reported as a Final PRG indicates the risk based PRG is greater than pure product (> 1e6 ppm).
(1) IRIS, On Line, April 1993.
(1a) IRIS, On Line, April 1993, value based on water consumption.
(2) HEAST, FY 1992.
(2a) HEAST, FY 1992, calculated from MCL of 1.3 mg/L.
(2b) HEAST, FY 1992, chronic value for thallic oxide.
(3) HEAST, FY 1991.
(4) Calculated from oral LD50.

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/20/93

RECEPTOR: Current Worker
EXPOSURE: Incidental ingestion of site soils and inhalation of fugitive dust and volatile emissions.

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 2.9e-4 / ((5e-5 x CSFing) + (CSFinh x ((20/VF) + (20/PEF))))
(reduced form for target noncancer risk of unity)
PRG = 102 / ((5e-5 / RfDing) + (1/RfDinh)((20/VF) + (20/PEF)))

Input parameters:

LS =	540	(m)	ED =	7.88E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc =	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF =	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Arsenic	3.0E-04 (1)			1.5E+01 (1)	612.00	1.75	1.75
Antimony	4.0E-04 (1)				816.00	0.00	816
Barium	7.0E-02 (1)	1.0E-04 (2c)			917.17	0.00	917
Beryllium	5.0E-03 (1)		4.3E+00 (1)	8.4E+00 (1)	10200.00	0.94	0.942
Cadmium	5.0E-04 (1a)			6.3E+00 (1)	1020.00	4.17	4.17
Chromium (III) and (VI)	1.0E+00 (1)	6.0E-07 (4a)		4.2E+01 (1c)	5.54	0.62	0.625
Copper	3.7E-02 (2a)				75480.00	0.00	75,480
Lead					0.00	0.00	N/A
Manganese	5.0E-03 (1a)	1.0E-04 (1)			846.49	0.00	846
Mercury	3.0E-04 (2)	9.0E-05 (2)			352.40	0.00	352
Nickel	2.0E-02 (1)			8.4E-01 (2)	40800.00	31.24	31.24
Silver	5.0E-03 (1)				10200.00	0.00	10,200
Vanadium	7.0E-03 (2)				14280.00	0.00	14,280
Zinc	3.0E-01 (1)				612000.00	0.00	612,000
Cyanide	2.0E-02 (1)				40800.00	0.00	40,800
Selenium	5.0E-03 (1)				10200.00	0.00	10,200
Thallium	7.0E-05 (2b)				142.80	0.00	143
Heptachlor	5.0E-04 (1)		4.5E+00 (1)	4.6E+00 (1)	1020.00	1.05	1.051
Heptachlor epoxide	1.3E-05 (1)		9.1E+00 (1)	9.1E+00 (1)	26.52	0.52	0.522
Endrin	3.0E-04 (1)				612.00	0.00	612
Dieldrin	5.0E-05 (1)		1.6E+01 (1)	1.6E+01 (1)	102.00	0.30	0.297
Trichloroethene			1.1E-02 (3)		0.00	527.27	527
Tetrachloroethene	1.0E-02 (1)		5.2E-02 (3)		20400.00	111.54	112
Chloroform	1.0E-02 (1)		6.1E-03 (1)	8.1E-02 (1)	20400.00	0.03	0.029
Toluene	2.0E-01 (1)	1.0E-01 (1)			19513.23	0.00	19,513
Bis(2-chloroethyl)ether			1.1E+00 (1)	1.2E+00 (1)	0.00	0.02	0.024
DDT	5.0E-04 (1)		3.4E-01 (1)	3.4E-01 (1)	1020.00	13.97	14
DDD			2.4E-01 (1)		0.00	24.17	24
DDE			3.4E-01 (1)		0.00	17.06	17
Chlordane	6.0E-05 (1)		1.3E+00 (1)	1.3E+00 (1)	122.40	3.65	3.65
Aroclors (total)			7.7E+00 (1)		0.00	0.75	0.753
Bis(2-ethylhexyl)phthalate	2.0E-02 (1)		1.4E-02 (1)		40800.00	414.29	414
Butylbenzylphthalate	2.0E-01 (1)				408000.00	0.00	408,000
Di-n-butylphthalate	1.0E-01 (1)				204000.00	0.00	204,000
Dimethylphthalte	1.0E+01 (2)				20400000.00	0.00	1,000,000
Naphthalene	4.0E-02 (2)				81600.00	0.00	81,600
2-Methylnaphthalene	2.0E-02 (5)				40800.00	0.00	40,800

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/20/93

RECEPTOR: Current Worker
EXPOSURE: Incidental ingestion of site soils and inhalation of fugitive dust and volatile emissions.

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 2.9e-4 / ((5e-5 x CSFing) + (CSFinh x ((20/VF) + (20/PEF))))
(reduced form for target noncancer risk of unity)
PRG = 102 / ((5e-6 / RfDing) + (1/RfDinh)((20/VF) + (20/PEF)))

Input parameters:						
LS =	540	(m)	ED =	7.88E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc =	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF =	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Acenaphthene	6.0E-02 (1)				122400.00	0.00	122,400
Acenaphthylene					0.00	0.00	N/A
Anthracene	3.0E-01 (1)				612000.00	0.00	612,000
Fluoranthene	4.0E-02 (1)				81600.00	0.00	81,600
Pyrene	3.0E-02 (1)				61200.00	0.00	61,200
Phenanthrene					0.00	0.00	N/A
Benzo(a)anthracene					0.00	0.00	N/A
Chrysene					0.00	0.00	N/A
Benzo(b)fluoranthene					0.00	0.00	N/A
Benzo(k)fluoranthene					0.00	0.00	N/A
Benzo(a)pyrene			7.3E+00 (1)	6.1E+00 (2)	0.00	0.67	0.670
Indeno(1,2,3-cd)pyrene					0.00	0.00	N/A
Dibenzo(a,h)anthracene					0.00	0.00	N/A
Benzo(g,h,i)perylene					0.00	0.00	N/A
Fluorene	4.0E-02 (1)				81600.00	0.00	81,600
trans-1,2-Dichloroethene	2.0E-02 (1)				40800.00	0.00	40,800
1,1,1-Trichloroethane	9.0E-01 (2)	3.0E-01 (2c)			222.30	0.00	222
Carbon disulfide	1.0E-01 (1)	3.0E-03 (2)			1.86	0.00	1.865
1,1-Dichloroethane	1.0E-01 (2)				204000.00	0.00	204,000
1,1-Dichloroethene	9.0E-03 (1)		6.0E-01 (1)	1.8E-01 (1)	18360.00	9.07	9.066
Carbon tetrachloride	7.0E-04 (1)		3.7E-06 (1)	5.3E-02 (1)	1428.00	0.06	0.056
Ethylbenzene	1.0E-01 (1)	3.0E-01 (1)			1291.95	0.00	1,292
Xylenes	2.0E+00 (1)	9.0E-02 (4)			181.22	0.00	181
Di-n-octylphthalate	2.0E-02 (4)				40800.00	0.00	40,800
2-Methylphenol	5.0E-02 (1)				102000.00	0.00	102,000
4-Methylphenol	5.0E-02 (2)				102000.00	0.00	102,000
2,4-Dimethylphenol	2.0E-02 (1)				40800.00	0.00	40,800

(1) IRIS, On Line, April 1993.
(1a) IRIS, On Line, April 1993, value based on water consumption.
(1b) IRIS, On Line, April 1993, value for Cr (III).
(1c) IRIS, On Line, April 1993, value for Cr (VI).
(2) HEAST, FY 1992.
(2a) HEAST, FY 1992, calculated from MCL of 1.3 mg/L.
(2b) HEAST, FY 1992, chronic value for thallic oxide.
(2c) HEAST, FY 1992, calculated from RfC determined from alternate method.
(3) USEPA, Risk Assessment Issue Paper, January, 1993.
(4) HEAST, FY 1991.
(4a) HEAST, FY 1991, chronic inhalation RfD for Cr (III) and (VI)
(5) Calculated from oral LD50.

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/22/93

RECEPTOR: Current Offsite Resident (Adult)
EXPOSURE: Inhalation of fugitive dust and volatile emissions.

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 1.975e-5 / (CSFinh x ((1/VF) + (1/PEF)))
(reduced form for target noncancer risk of unity)
PRG = 8.45 * RfDinh / ((1/VF) + (1/PEF))

Input parameters:

LS =	540	(m)	ED =	9.46E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc =	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF :	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Arsenic				1.5E+01 (1)	0.00	2.38	2.38
Antimony					0.00	0.00	N/A
Barium		1.0E-04 (2c)			1529.45	0.00	1,529
Beryllium				8.4E+00 (1)	0.00	4.26	4.256
Cadmium				6.3E+00 (1)	0.00	5.67	5.67
Chromium (III) and (VI)		6.0E-07 (4B)		4.2E+01 (1c)	9.18	0.85	0.851
Copper					0.00	0.00	N/A
Lead					0.00	0.00	N/A
Manganese		1.0E-04 (1)			1529.45	0.00	1,529
Mercury		9.0E-05 (2)			1376.51	0.00	1,377
Nickel				8.4E-01 (2)	0.00	42.56	42.56
Silver					0.00	0.00	N/A
Vanadium					0.00	0.00	N/A
Zinc					0.00	0.00	N/A
Cyanide					0.00	0.00	N/A
Selenium					0.00	0.00	N/A
Thallium					0.00	0.00	N/A
Heptachlor				4.6E+00 (1)	0.00	7.77	7.77
Heptachlor epoxide				9.1E+00 (1)	0.00	3.93	3.928
Endrin					0.00	0.00	N/A
Dieldrin				1.6E+01 (1)	0.00	2.23	2.234
Trichloroethene					0.00	0.00	N/A
Tetrachloroethene					0.00	0.00	N/A
Chloroform				8.1E-02 (1)	0.00	0.04	0.044
Toluene		1.0E-01 (1)			37116.85	0.00	37,117
Bis(2-chloroethyl)ether				1.2E+00 (1)	0.00	0.04	0.036
DDT				3.4E-01 (1)	0.00	105.14	105.1
DDD					0.00	0.00	N/A
DDE					0.00	0.00	N/A
Chlordane				1.3E+00 (1)	0.00	27.50	27.50
Aroclors (total)					0.00	0.00	N/A
Bis(2-ethylhexyl)phthalate					0.00	0.00	N/A
Butylbenzylphthalate					0.00	0.00	N/A
Di-n-butylphthalate					0.00	0.00	N/A
Dimethylphthalte					0.00	0.00	N/A
Naphthalene					0.00	0.00	N/A
2-Methylnaphthalene					0.00	0.00	N/A

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/22/93

RECEPTOR: Current Offsite Resident (Adult)
EXPOSURE: Inhalation of fugitive dust and volatile emissions.

Relevant Equations:
(reduced form for 1E-6 target cancer risk)
PRG = 1.975e-5 / (CSFinh x ((1/VF) + (1/PEF)))
(reduced form for target noncancer risk of unity)
PRG = 8.45 * RfDinh / ((1/VF) + (1/PEF))

Input parameters:

LS =	540	(m)	ED =	9.46E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc =	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF =	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Acenaphthene					0.00	0.00	N/A
Acenaphthylene					0.00	0.00	N/A
Anthracene					0.00	0.00	N/A
Fluoranthene					0.00	0.00	N/A
Pyrene					0.00	0.00	N/A
Phenanthrene					0.00	0.00	N/A
Benzo(a)anthracene					0.00	0.00	N/A
Chrysene					0.00	0.00	N/A
Benzo(b)fluoranthene					0.00	0.00	N/A
Benzo(k)fluoranthene					0.00	0.00	N/A
Benzo(a)pyrene				6.1E+00 (2)	0.00	5.81	5.81
Indeno(1,2,3-cd)pyrene					0.00	0.00	N/A
Dibenzo(a,h)anthracene					0.00	0.00	N/A
Benzo(g,h,i)perylene					0.00	0.00	N/A
Fluorene					0.00	0.00	N/A
trans-1,2-Dichloroethene					0.00	0.00	N/A
1,1,1-Trichloroethane		3.0E-01 (2c)			403.52	0.00	404
Carbon disulfide		3.0E-03 (2)			3.38	0.00	3.38
1,1-Dichloroethane					0.00	0.00	N/A
1,1-Dichloroethene				1.8E-01 (1)	0.00	198.60	198.6
Carbon tetrachloride				5.3E-02 (1)	0.00	0.08	0.084
Ethylbenzene		3.0E-01 (1)			2359.73	0.00	2,360
Xylenes		9.0E-02 (4)			328.91	0.00	329
Di-n-octylphthalate					0.00	0.00	N/A
2-Methylphenol					0.00	0.00	N/A
4-Methylphenol					0.00	0.00	N/A
2,4-Dimethylphenol					0.00	0.00	N/A

(1) IRIS, On Line, April 1993.
(1a) IRIS, On Line, April 1993, value based on water consumption.
(1b) IRIS, On Line, April 1993, value for Cr (III).
(1c) IRIS, On Line, April 1993, value for Cr (VI).
(2) HEAST, FY 1992.
(2a) HEAST, FY 1992, calculated from MCL of 1.3 mg/L.
(2b) HEAST, FY 1992, chronic value for thallic oxide.
(2c) HEAST, FY 1992, calculated from RfC determined from alternate method.
(3) USEPA, Risk Assessment Issue Paper, January, 1993.
(4) HEAST, FY 1991.
(4a) HEAST, FY 1991, chronic inhalation RfD for Cr (III) and (VI)
(5) Calculated from oral LD50.

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/22/93

RECEPTOR: Current Offsite Resident (Child)
EXPOSURE: Inhalation of fugitive dust and volatile emissions.

Relevant Equations:
Carcinogenic PRGs are not developed for child receptors.

(reduced form for target noncancer risk of unity)
PRG = 0.782 * RfDinh / ((1/VF) + (1/PEF))

Input parameters:

LS =	540	(m)	ED =	9.46E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc =	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF :	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Arsenic					0.00	0.00	N/A
Antimony					0.00	0.00	N/A
Barium		1.0E-04 (2c)			141.54	0.00	142
Beryllium					0.00	0.00	N/A
Cadmium					0.00	0.00	N/A
Chromium (III) and (VI)		6.0E-07 (4a)			0.85	0.00	0.849
Copper					0.00	0.00	N/A
Lead					0.00	0.00	N/A
Manganese		1.0E-04 (1)			141.54	0.00	142
Mercury		9.0E-05 (2)			127.39	0.00	127
Nickel					0.00	0.00	N/A
Silver					0.00	0.00	N/A
Vanadium					0.00	0.00	N/A
Zinc					0.00	0.00	N/A
Cyanide					0.00	0.00	N/A
Selenium					0.00	0.00	N/A
Thallium					0.00	0.00	N/A
Heptachlor					0.00	0.00	N/A
Heptachlor epoxide					0.00	0.00	N/A
Endrin					0.00	0.00	N/A
Dieldrin					0.00	0.00	N/A
Trichloroethene					0.00	0.00	N/A
Tetrachloroethene					0.00	0.00	N/A
Chloroform					3434.96	0.00	3,435
Toluene		1.0E-01 (1)			0.00	0.00	N/A
Bis(2-chloroethyl)ether					0.00	0.00	N/A
DDT					0.00	0.00	N/A
DDD					0.00	0.00	N/A
DDE					0.00	0.00	N/A
Chlordane					0.00	0.00	N/A
Aroclors (total)					0.00	0.00	N/A
Bis(2-ethylhexyl)phthalate					0.00	0.00	N/A
Butylbenzylphthalate					0.00	0.00	N/A
Di-n-butylphthalate					0.00	0.00	N/A
Dimethylphthalte					0.00	0.00	N/A
Naphthalene					0.00	0.00	N/A
2-Methylnaphthalene							

Development of Risk-Based Preliminary Remediation Goals (PRGs)
Scenario: Industrial Land Use - Soil
Reference: RAGS, Part B, Section 3.2.2

SITE: NWIRP Bethpage
LOCATION: Bethpage, NY
DATE: 04/22/93

RECEPTOR: Current Offsite Resident (Child)
EXPOSURE: Inhalation of fugitive dust and volatile emissions.

Relevant Equations:
Carcinogenic PRGs are not developed for child receptors

(reduced form for target noncancer risk of unity)
PRG = 0.782 * RfDinh / ((1/VF) + (1/PEF))

Input parameters:						
LS =	540	(m)	ED =	9.46E+08	(sec)
V =	2.75	(m/s)	E =	0.35	(unitless)
DH =	2	(m)	foc=	0.001842	(unitless)
A =	1.6E+09	(cm2)	Ps =	1.76	(gm/cm3)
			PEF :	1.81E+06	(m3/kg)

Chemical	Reference Dose (Oral) (mg/kg/day)	Reference Dose (Inhalation) (mg/kg/day)	Oral Cancer Slope Factor (mg-day/kg)	Inhalation Cancer Slope Factor (mg-day/kg)	Preliminary Risk-based Goal Noncarcinogens (mg/kg)	Preliminary Risk-based Goal Carcinogens (mg/kg)	Final Risk-based Goal (mg/kg)
Acenaphthene					0.00	0.00	N/A
Acenaphthylene					0.00	0.00	N/A
Anthracene					0.00	0.00	N/A
Fluoranthene					0.00	0.00	N/A
Pyrene					0.00	0.00	N/A
Phenanthrene					0.00	0.00	N/A
Benzo(a)anthracene					0.00	0.00	N/A
Chrysene					0.00	0.00	N/A
Benzo(b)fluoranthene					0.00	0.00	N/A
Benzo(k)fluoranthene					0.00	0.00	N/A
Benzo(a)pyrene					0.00	0.00	N/A
Indeno(1,2,3-cd)pyrene					0.00	0.00	N/A
Dibenzo(a,h)anthracene					0.00	0.00	N/A
Benzo(g,h,i)perylene					0.00	0.00	N/A
Fluorene					0.00	0.00	N/A
trans-1,2-Dichloroethene					0.00	0.00	N/A
1,1,1-Trichloroethane		3.0E-01 (2c)			37.34	0.00	37
Carbon disulfide		3.0E-03 (2)			0.31	0.00	0.31
1,1-Dichloroethane					0.00	0.00	N/A
1,1-Dichloroethene					0.00	0.00	N/A
Carbon tetrachloride					0.00	0.00	N/A
Ethylbenzene		3.0E-01 (1)			218.38	0.00	218
Xylenes		9.0E-02 (4)			30.44	0.00	30
Di-n-octylphthalate					0.00	0.00	N/A
2-Methylphenol					0.00	0.00	N/A
4-Methylphenol					0.00	0.00	N/A
2,4-Dimethylphenol					0.00	0.00	N/A

(1) IRIS, On Line, April 1993.
(1a) IRIS, On Line, April 1993, value based on water consumption.
(1b) IRIS, On Line, April 1993, value for Cr (III).
(1c) IRIS, On Line, April 1993, value for Cr (VI).
(2) HEAST, FY 1992.
(2a) HEAST, FY 1992, calculated from MCL of 1.3 mg/L.
(2b) HEAST, FY 1992, chronic value for thallic oxide.
(2c) HEAST, FY 1992, calculated from RfC determined from alternate method
(3) USEPA, Risk Assessment Issue Paper, January, 1993.
(4) HEAST, FY 1991.
(4a) HEAST, FY 1991, chronic inhalation RfD for Cr (III) and (VI)
(5) Calculated from oral LD50.

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT: NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER: 1953
SUBJECT: CALCULATION of AVERAGE MOISTURE CONTENT and SOIL DENSITY	
BASED ON	DRAWING NUMBER
BY: N. J. STRAAB / CHECKED BY: [illegible] (5/6/93)	APPROVED BY / DATE: 04/23/93

PURPOSE: CALCULATE AVERAGE PERCENT MOISTURE and DENSITY OF SOILS COLLECTED FROM SITES 1, 2, and 3.

Sample ID	% MOISTURE	DENSITY (g^{m}/cm^3)
BP-SB-1-11003	6.5	1.4
BP-SB-1-11503	3.9	1.4
BP-SB-2-20403/-D(1)	7.2 (1a)	2.55 (1a,2)
BP-SB-2-21503	4.6	1.2
BP-SB-3-31603	9.3	2.2
BP-SB-3-32803	28.6	1.8
$\bar{X}$	10.0 (6.3)(3) ✓	1.76 ✓
SD (S)	9.3 (2.2)(3) ✓	0.53 ✓

(1) FIELD DUPLICATE Samples.

(1a) AVERAGE of FIELD DUPLICATE RESULTS.

(2) REPORTED AS SPECIFIC GRAVITY.

(3) STATISTICAL ANALYSIS BASED ON 5 Samples (LESS DATA FROM BP-SB-3-32803).

CLIENT: NAVY CLEAN - BETHPAGE	JOB NUMBER: 1953
SUBJECT: PARTICULATE EMISSION FACTOR (PEF) CALCULATION.	
BASED ON: RAGS, PART B, Section 3.3.2	DRAWING NUMBER:
BY: N. J. STRAUB / CHECKED BY: (5/6/93)	APPROVED BY: / DATE: 04/20/93

PURPOSE: CALCULATE THE PEF FOR SURFACE SOIL AT NWIRP, BETHPAGE FOR INCLUSION IN A FUGITIVE DUST EMISSIONS MODEL.

RELEVANT EQUATIONS:

$$PEF(m^3/kg) = \frac{LS \times V \times DH \times 3600\ s/hr}{A} \times \frac{1000\ g\,m/kg}{0.036 \times (1-G) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)}$$

WHERE:

LS = WIDTH of CONTAMINATED AREA (m)
V = WIND SPEED IN MIXING ZONE (m/s)
DH = DIFFUSION HEIGHT (m)
A = AREA of CONTAMINATION (m^2)
0.036 = RESPIRABLE FRACTION ($g\,m/m^2 \cdot hr$)
G = FRACTION OF VEGETATIVE COVER (UNITLESS)
U_m = MEAN ANNUAL WINDSPEED (m/s)
U_t = EQUIVALENT THRESHOLD WINDSPEED @ 10 m (m/s)
F(x) = FUNCTION DEPENDENT ON U_m and U_t (UNITLESS)

Sample CALCULATION:

ASSUMPTIONS –

$V = \frac{1}{2} U_m = \frac{1}{2}(5.5\ m/s) = 2.75\ m/s$ *
DH = 2 m
G = 0
U_m = 5.5 m/s

U_t = 6.37 m/s

RATIONALE

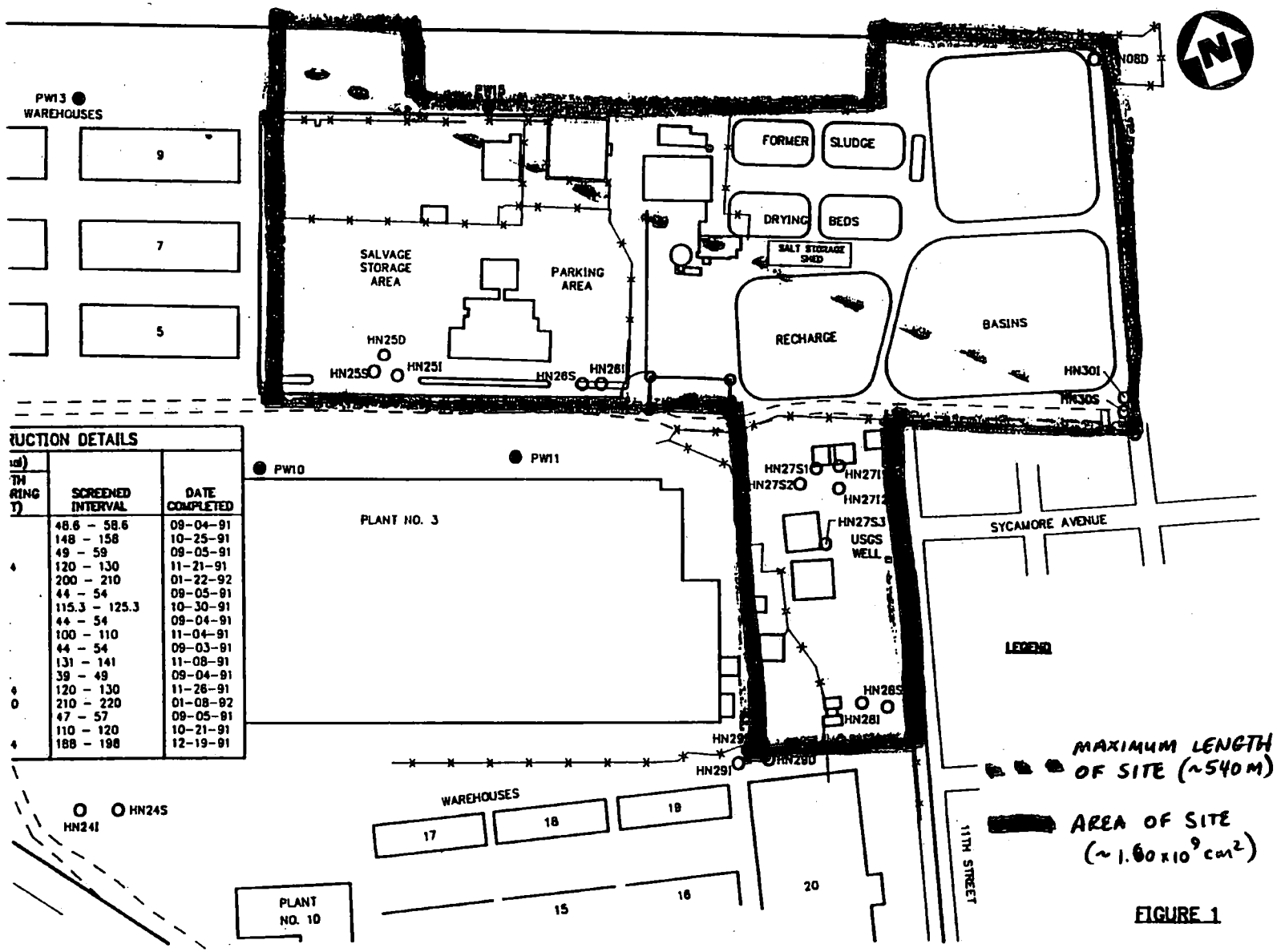
AS PER RAGS, PART B GUIDANCE
RECEPTOR BREATHING ZONE
ZERO PERCENT VEG. COVER
MEAN ANNUAL WINDSPEED FOR NEW YORK, NEW YORK.
FUGITIVE DUST EMISSIONS MODEL, FINAL RI, NWIRP BETHPAGE, HNUS, MAY 1992.

* CALCULATED AS PER USEPA, GUIDANCE ON REMEDIAL ACTIONS FOR SUPERFUND SITES WITH PCB CONTAMINATION, OERR, EPA/540/G-90/007, AUG. 1990, APP. B, p.7.

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT	NAVY CLEAN - NWIRP BETHPAGE
JOB NUMBER	1953
SUBJECT	PEF CALCULATION
BASED ON	RAGS, PART B GUIDANCE
DRAWING NUMBER	
BY	NJS
CHECKED BY	[signature] 5/6/93
APPROVED BY	
DATE	04/20/93



RUCTION DETAILS

SCREENED INTERVAL	DATE COMPLETED
48.6 - 58.6	09-04-91
148 - 158	10-25-91
49 - 59	09-05-91
120 - 130	11-21-91
200 - 210	01-22-92
44 - 54	09-05-91
115.3 - 125.3	10-30-91
44 - 54	09-04-91
100 - 110	11-04-91
44 - 54	09-03-91
131 - 141	11-08-91
39 - 49	09-04-91
120 - 130	11-26-91
210 - 220	01-08-92
47 - 57	09-05-91
110 - 120	10-21-91
188 - 198	12-19-91

FIGURE 1

REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

CLIENT: NAVY CLEAN - BETHPAGE	JOB NUMBER: 1953
SUBJECT: PARTICULATE EMISSION FACTOR (PEF) CALCULATION	
BASED ON: RAGS, PART B, SECTION 3.3.2	DRAWING NUMBER:
BY: NJ STRAUB / CHECKED BY: (5/6/93)	APPROVED BY: / DATE: 04/20/93

① Calc F(x) (FROM COWHERD, 1984)

$$x = 0.886 \frac{u_t}{u_M} = 0.886\left(\frac{6.37\ m/s}{5.5\ m/s}\right) = 1.03$$

FROM COWHERD, 1984, FIGURE 4-3 (GRAPH of F(x) vs x)..

$$\boxed{x = 1.03, \quad F(1.03) = 1.57}$$

② CALCULATE PEF (ASSUME LS = 540 m, A = 1.62×10^5 m², G = 0)

$$PEF = \frac{(540\,m)(\frac{1}{2})(5.5\,m/s)(2\,m)(3600\,s/hr)}{1.62 \times 10^5\ m^2} \times \frac{1000\,g\,m/kg}{\left(\frac{0.036}{g/m^2 \cdot hr}\right) \times (1-0) \times \left(\frac{5.5\,m/s}{6.37\,m/s}\right)^3 \times 1.57}$$

$$PEF = 1.81 \times 10^6\ m^3/kg \checkmark$$

REFERENCES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA), RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B - DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS). INTERIM. OSWER DIRECTIVE 9285.7-01 B. OFFICE OF EMERGENCY and REMEDIAL RESPONSE. WASHINGTON, DC 20460.

COWHERD, JA, ET AL. 1984. RAPID ASSESSMENT OF EXPOSURE TO PARTICULATE EMISSIONS FROM SURFACE CONTAMINATED SITES. MIDWEST RESEARCH INSTITUTE. KANSAS CITY, MO.

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT: NAVY CLEAN - NWIRP BETHPAGE		JOB NUMBER: 1953	
SUBJECT: CALCULATION of VOLATILIZATION FACTOR			
BASED ON: RAGS, PART B GUIDANCE		DRAWING NUMBER:	
BY: N.J. STRAUB NJS	CHECKED BY: (5/6/93)	APPROVED BY:	DATE: 04/22/93

PURPOSE: TO CALCULATE SOIL CHEMICAL VOLATILIZATION FACTOR FOR INCLUSION IN PRG DEVELOPMENT CALCULATIONS.

RELEVANT EQUATIONS:

① VOLATIZATION FACTOR

$$VF\left(m^3/kg\right) = \frac{(LS \times V \times DH)}{A} \times \frac{(3.14 \times \alpha \times T)^{1/2}}{(2 \times D_{ei} \times E \times K_{as} \times 10^{-3} kg/g)}$$

WHERE $\alpha = \dfrac{D_{ei} \times E}{E + \dfrac{\rho_s(1-E)}{K_{as}}}$

WHERE:
- LS = LENGTH of SIDE of contaminated zone (m) (see attached FIGURE)
- V = WINDSPEED IN MIXING ZONE (m/s) = ½ U_m
- DH = DIFFUSION HEIGHT (m)
- A = AREA OF CONTAMINATED ZONE (cm^2)
- α = CALCULATED VALUE
- T = EXPOSURE INTERVAL (DURATION) (seconds)
- D_{ei} = EFFECTIVE DIFFUSIVITY (cm^2/s) = $D_i \times E^{1/3}$
- E = TRUE SOIL POROSITY (UNITLESS)
- K_{as} = SOIL/AIR PARTITION COEFFICIENT ($gm\ soil/cm^3\ air$) = $\frac{41H}{K_d}$
- ρ_s = TRUE SOIL DENSITY (gm/cm^3)
- D_i = MOLECULAR DIFFUSIVITY (cm^2/s)
- K_d = SOIL-WATER PARTITION COEFFICIENT = $K_{oc} f_{oc}$ (cm^3/gm)
- K_{oc} = ORGANIC CARBON PARTITION COEFFICIENT (cm^3/gm)
- f_{oc} = FRACTION ORGANIC CARBON (UNITLESS)
- H = HENRY'S LAW CONSTANT ($atm \cdot m^3/mol$)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALC of SOIL VOLATILIZATION FACTOR	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY TJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

SOLVE FOR α:

$$\alpha = \frac{D_{ei} \times E}{E + \frac{\rho_s(1-E)}{K_{as}}} = \frac{(D_i \times E^{0.33}) \times E}{E + \frac{\rho_s(1-E)K_{oc}f_{oc}}{41H}} = \frac{D_i \times E^{1.33}}{E + \frac{\rho_s(1-E)K_{oc}f_{oc}}{41H}} \; ; \quad D_{ei} = D_i \times E^{0.33} \quad K_{as} = \frac{41H}{K_{oc}f_{oc}}$$

FOR TOLUENE:

$D_i = 8.6 \times 10^{-6}$ cm²/s (USEPA, TSDF, Nov. 1989)

$H = 6.0 \times 10^{-3}$ atm m³/mol (USEPA, TSDF, Nov. 1989)

$K_{oc} = 3.0 \times 10^{2}$ cm³/gm (USEPA, AQUATIC FATE PROCESS DATA..., DECEMBER 1982)

FOR BETHPAGE NWIRP SOILS:

$E = 0.35$ (ASSUMED SOIL POROSITY)

$f_{oc} = 0.001842$ (SITE SPECIFIC AVG VALUE)

$\rho_s = 1.76$ gm/cm³ (SITE SPECIFIC AVG VALUE)

$$\alpha = \frac{(8.6\times10^{-6}\ \mathrm{cm^2/s})(0.35)^{1.33}}{0.35 + \frac{(1.76\ \mathrm{gm/cm^3})(1-0.35)(3.0\times10^{2}\ \frac{\mathrm{cm^3}}{\mathrm{gm}})(0.001842)}{(41\ \frac{\mathrm{mol}}{\mathrm{atm\cdot m^3}})(6.0\times10^{-3}\ \frac{\mathrm{atm\cdot m^3}}{\mathrm{mol}})}}$$

$$\boxed{\alpha = 7.29\times10^{-7}\ \mathrm{cm^2/s}}$$

SOLVE FOR VF:

$$VF = \frac{(540\ \mathrm{m})(2.75\ \mathrm{m/s})(2\ \mathrm{m})}{(300\ \mathrm{m})(540\ \mathrm{m})(100\ \mathrm{cm/m})^2} \times \frac{\left[(3.14)(7.29\times10^{-7}\frac{\mathrm{cm^2}}{\mathrm{s}})(7.88\times10^{8}\ \mathrm{s})\right]^{1/2}(3\times10^{2}\frac{\mathrm{cm^3}}{\mathrm{gm}})(0.001842)}{(2)(8.6\times10^{-6}\frac{\mathrm{cm^2}}{\mathrm{s}})(0.35)^{1.33}(41)(6.0\times10^{-3}\frac{\mathrm{atm\cdot m^3}}{\mathrm{mol}})(10^{-3}\ \mathrm{kg/gm})}$$

$$= 1.83\times10^{-6}\left(\frac{\mathrm{m^3}}{\mathrm{cm\cdot s}}\right) \times 2.24\times10^{10}\ \left(\frac{\mathrm{cm\cdot s}}{\mathrm{kg}}\right)$$

$$\boxed{VF = 4.11\times10^{4}\ \mathrm{m^3/kg}}$$

CALCULATION WORKSHEET

Order No. 19116 (01-01)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION of VOLATILIZATION FACTOR	
BASED ON RAGS, PART B	DRAWING NUMBER
BY NHS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

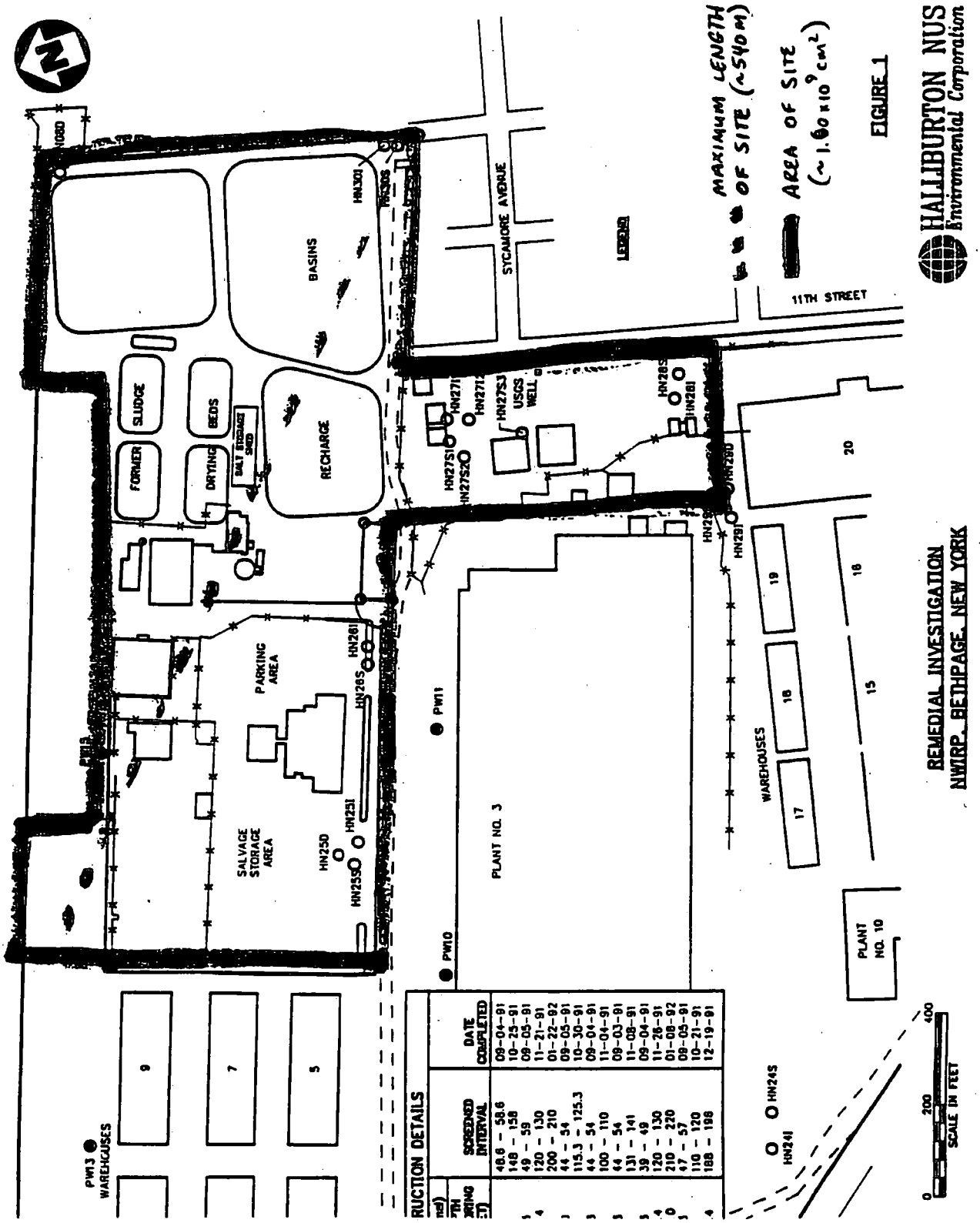


FIGURE 1

HALLIBURTON NUS Environmental Corporation

REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

RUCTION DETAILS		
SCREENED INTERVAL	DATE COMPLETED
48.6 - 58.6	09-04-91
148 - 158	10-25-91
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47 - 57	09-05-91
110 - 120	10-21-91
188 - 198	12-19-91

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION of VOLATILIZATION. FACTOR	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY NJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

REFERENCES:

USEPA, RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B, DEVELOPMENT of RISK-BASED PRELIMINARY REMEDIATION GOALS). INTERIM. OSWER DIRECTIVE 9285.7-01B. OFFICE of EMERGENCY and REMEDIAL RESPONSE. WASHINGTON DC 20460.

USEPA, HAZARDOUS WASTE TREATMENT, STORAGE, and DISPOSAL FACILITIES (TSDF) - AIR EMISSION MODELS. REVIEW DRAFT. CHEMDAT7 SUMMARY (APPENDIX A and D). EMISSION STANDARDS DIVISION, OFFICE of AIR QUALITY PLANNING and STANDARDS, RESEARCH TRIANGLE PARK, NC, 27711, NOVEMBER 1989.

USEPA, AQUATIC FATE PROCESS DATA FOR ORGANIC PRIORITY POLLUTANTS. FINAL REPORT. OFFICE of WATER REGULATIONS and STANDARDS. WASHINGTON DC 20460, DECEMBER 1982

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 7953
SUBJECT CALCULATION of RISK-BASED PRGs FOR SOIL	
BASED ON RAGS, PARTB GUIDANCE	DRAWING NUMBER
BY N.J. STRAUB	CHECKED BY (5/6/93)
APPROVED BY	DATE 04/22/93

PURPOSE: CALCULATE PRELIMINARY REMEDIATION GOALS (PRGS) BASED ON AN ASSUMED NONCARCINOGENIC HAZARD INDEX OF UNITY (HI=1.0) and A CARCINOGENIC RISK INCREASE OF 10^{-6}.

RELEVANT EQUATIONS:

① RESIDENTIAL LAND USE (FUTURE ONSITE RESIDENT - ADULT)

FROM RAGS, PART B, EQUATIONS 4' and 5' ARE DERIVED FOR RESIDENTIAL LAND USE SCENARIO:

- NONCARCINOGENS - $PRG\ (mg/kg) = (2.7\times10^5)(RFD_o)$ (5')
- CARCINOGENS - $PRG\ (mg/kg) = \dfrac{0.64}{CSF_o}$ (4')

WHERE, PRG = CALCULATED PRG IN mg/kg

RFD_o = ORAL REFERENCE DOSE IN mg/kg·day

CSF_o = ORAL CANCER SLOPE FACTOR IN kg·day/mg

Sample calculation (Heptachlor Epoxide - $RFD_o = 1.3\times10^{-5}$ mg/kgday, $CSF_o = 9.1\times10^{0}$ kgday/mg)

- NC - $PRG = (2.7\times10^5)(1.3\times10^{-5}) = 3.51$ mg/kg ✓
- CARC - $PRG = \dfrac{0.64}{9.1\times10^0} = 0.070$ mg/kg

PRELIMINARY REMEDIATION GOAL THAT IS ACCEPTED IS LOWER, NON-ZERO GOAL:

$$\boxed{PRG = 0.070\ mg/kg}$$ ✓

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION of SOIL PRGS	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY NJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

RELEVANT EQUATIONS (CON'T.)

(2) INDUSTRIAL/COMMERCIAL LAND USE (CURRENT ONSITE WORKER)

FROM RAGS, PART B, EQUATIONS 6' and 7' ARE DEVELOPED FOR WORKER EXPOSURE TO SITE CONDITIONS AT NWIRP BETHPAGE. WORKER EXPOSURE IS ASSUMED TO BE RESULT OF INCIDENTAL INGESTION and INHALATION of FUGITIVE PARTICULATES and VOLATILE EMISSIONS. THE LATTER TWO PARAMETERS ARE ESTIMATED BY PARTICULATE EMISSION FACTOR (PEF) and CHEMICAL-SPECIFIC VOLATILIZATION FACTOR (VF) VALUES (SEE RAGS, PART B, Sects 3.2 and 3.3

- NONCARCINOGENS

$$PRG\left(\frac{mg}{kg}\right) = \frac{102}{\left[\frac{5\times10^{-5}}{RFD_o} + \left(\frac{1}{RFD_i}\left(\frac{20}{VF} + \frac{20}{PEF}\right)\right)\right]} \quad (7')$$

- CARCINOGENS

$$PRG\left(\frac{mg}{kg}\right) = \frac{2.9\times10^{-4}}{\left[(5\times10^{-5})(CSF_o) + \left(CSF_i\left(\frac{20}{VF} + \frac{20}{PEF}\right)\right)\right]} \quad (6')$$

CLIENT NAVY CLEAN - NWIRB BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION of PRGs FOR SOIL	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY WJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

Sample Calculation (Toluene - $RfD_o = 2\times10^{-1}$ mg/kg·day ; CHLOROFORM - $CSF_o = 6.1\times10^{-3}$ kg·day/mg
$RfD_i = 1\times10^{-1}$ mg/kg·day $CSF_i = 8.1\times10^{-2}$ kg·day/mg)

$VF(Tol) = 4.11\times10^{4}$ m³/kg ; $VF(CHCl_3) = 1.80\times10^{2}$ m³/kg ; $PEF = 1.81\times10^{6}$ m³/kg *

- Ncan (Tol)

$$PRG = \frac{102}{\left[\frac{5\times10^{-5}}{2\times10^{-1}} + \left(\frac{1}{1\times10^{-1}}\left(\frac{20}{4.11\times10^{4}} + \frac{20}{1.81\times10^{6}}\right)\right)\right]} = \boxed{19515 \text{ mg/kg}}$$ ✓

- Carc ($CHCl_3$)

$$PRG = \frac{2.9\times10^{-4}}{\left[(5\times10^{-5})(6.1\times10^{-3}) + \left(8.1\times10^{-2}\left(\frac{20}{1.8\times10^{2}} + \frac{20}{1.81\times10^{6}}\right)\right)\right]} = \boxed{0.032 \text{ mg/kg}}$$

* VF/PEF Calculated for site-specific parameters in attached sheets.

(3) INDUSTRIAL/COMMERCIAL Land Use (CURRENT OFFSITE RESIDENT)

FOR CURRENT OFFSITE RESIDENTIAL EXPOSURE, INHALATION RISKS ONLY ARE CONSIDERED. CURRENT ACCESS TO THE SITE IS CONTROLLED BY A FENCE AROUND THE SITE, THEREBY ELIMINATING THE NECESSITY OF CONSIDERING EXPOSURE DUE TO INCIDENTAL INGESTION. BY EVALUATING CURRENT RESIDENTIAL EXPOSURE WITH PRG DEVELOPMENT FOR THE INDUSTRIAL EXPOSURE, INHALATION EXPOSURE IS CONSIDERED IN A MOST CONSERVATIVE MANNER. DISPERSION and DOWNWIND DILUTION OF CONTAMINANTS, WHICH WOULD RESULT IN HIGHER PRG VALUES, ARE NOT CONSIDERED. EXPOSURE AT THE

CLIENT NAVY CLEAN - NWIRP BETHPAGE		JOB NUMBER 1953	
SUBJECT CALCULATION of PRGs for SOIL			
BASED ON RAGS, PART B GUIDANCE		DRAWING NUMBER	
BY WJS	CHECKED BY (5/6/93)	APPROVED BY	DATE 04/22/93

SOURCE AREA BY THE RECEPTOR, NOT AT THE SITE BOUNDARY, PROVIDES AN ADDITIONAL MEASURE OF CONSERVATISM TO THE PRG CALCULATION.

THE FOLLOWING EXPOSURE INPUT PARAMETERS HAVE BEEN INCORPORATED and ARE SUBSTITUTED FOR STANDARD DEFAULT VALUES AS APPROPRIATE:

PARAMETER	VALUE	RATIONALE
BODY WEIGHT (BW)	70 kg - ADULT 15 kg - CHILD	RAGS GUIDANCE (USEPA, MARCH 25, 1991)
AVERAGING TIME (AT)	ED × 365 d/yr - NONCARC. LT × 365 d/yr - CARCINOGENS	RAGS GUIDANCE (USEPA, DECEMBER, 1989)
EXPOSURE FREQUENCY (EF)	350 day/yr - RESIDENT	USEPA, MARCH 25, 1991.
EXPOSURE DURATION (ED)	30 YEAR - RESIDENT (6 YR as child, 24 YR AS ADULT)	USEPA, MARCH 25, 1991.
LIFETIME (LT)	70 YR	USEPA, DECEMBER, 1989.
INHALATION RATE (IR_{AIR})	20 m^3/day - ADULT and CHILD RESIDENT	USEPA, MARCH 25, 1991 and EXPOSURE FACTORS Handbook (USEPA, MAY 1991)

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALC of PRGS FOR SOIL	
BASED ON RAGS, PART B	DRAWING NUMBER
BY NJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

BY INPUTTING PARAMETERS INTO EQUATIONS 6 and 7, REDUCED FORMS ARE OBTAINED:

• NONCARCINOGENS (EQU. 7)

$$Conc\left(\frac{mg}{kg}\right) = \frac{(\text{TARGET HAZARD INDEX}) \times BW \times AT}{ED \times EF \times \left[\frac{1}{RFD_{inh}}\left(IR_{AIR}\right)\left(\frac{1}{VF} + \frac{1}{PEF}\right)\right]}$$

(7) - modified to eliminate ingestion

$$= \frac{THI \times AT}{EF \times \left(\frac{1}{RFD_{inh}}\right) \times \left(IR_{AIR}\right) \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)} \times \left[\frac{BW_{CHILD}}{ED_{CHILD}} + \frac{BW_{ADULT}}{ED_{ADULT}}\right] \checkmark$$

$$= \frac{(1.0)(30\,YR)(365\,day/YR)}{(350\,day/YR)\left(\frac{1}{RFD_i}\right)(20\,m^3/day)\left(\frac{1}{VF} + \frac{1}{PEF}\right)} \times \left[\frac{15\,kg}{6\,YR} + \frac{70\,kg}{24\,YR}\right]$$

$$\boxed{PRG\,(mg/kg) = \frac{169\,(RFD_{INH})}{\left(\frac{20}{VF} + \frac{20}{PEF}\right)}}$$

(REDUCED FORM of EQ 7 FOR ADULT RESIDENT) ✓

SIMILARLY FOR CHILD RESIDENTS....

$$Conc = \frac{(1.0)(6\,YR)(365\,day/YR)(15\,kg)}{(350\,day/YR)\left(\frac{1}{RFD_i}\right)(20\,m^3/day)\left(\frac{1}{VF} + \frac{1}{PEF}\right)(6\,YR)}$$

$$\boxed{PRG\,(mg/kg) = \frac{15.64\,(RFD_{inh})}{\left(\frac{20}{VF} + \frac{20}{PEF}\right)}}$$

✓ (REDUCED FORM of EQ 7 FOR CHILD RESIDENTS)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION OF PRGs for SOIL	
BASED ON RAGS, PART B	DRAWING NUMBER
BY TLS / CHECKED BY 5/6/93	APPROVED BY / DATE 04/22/93

• CARCINOGENS (EQUATION 6)

$$\text{Conc}\left(\frac{mg}{kg}\right) = \frac{(\text{TARGET RISK}) \times BW \times AT}{EF \times ED \times \left[CSF_{inh} \times IR_{AIR} \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right]}$$

(6) - modified to eliminate ingestion

$$= \frac{TR \times AT}{EF \times CSF_{INH} \times \left(\frac{IR_{AIR}}{VF} + \frac{IR_{AIR}}{PEF}\right)} \times \left[\frac{BW_{CHILD}}{ED_{CHILD}} + \frac{BW_{ADULT}}{ED_{ADULT}}\right]$$

$$= \frac{(10^{-6})(70\,YR)(365\,day/YR)}{(350\,\frac{day}{YR})(CSF_i)\left(\frac{20}{VF} + \frac{20}{PEF}\right)} \times \left[\frac{15\,kg}{6\,YR} + \frac{70\,kg}{24\,YR}\right]$$

$$\boxed{PRG\left(mg/kg\right) = \frac{3.95 \times 10^{-4}}{(CSF_i)\left(\frac{20}{VF} + \frac{20}{PEF}\right)}} \checkmark$$

(REDUCED FORM of EQ. 6 FOR ADULT RESIDENT)

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION of PRGs FOR SOIL	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY MHS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

Sample Calculation

- ADULT RESIDENT

-NONCARCINOGENS (TOLUENE $RFD_i = 1\times10^{-1}$ mg/kg·day)

$$PRG = \frac{169(1\times10^{-1})}{\left(\frac{20}{4.5\times10^{4}} + \frac{20}{1.81\times10^{6}}\right)} = \boxed{37100 \text{ mg/kg}} \checkmark$$

- CARCINOGENS (CHLOROFORM $CSF_i = 8.1\times10^{-2}$ kg·day/mg)

$$PRG = \frac{3.95\times10^{-4}}{(8.1\times10^{-2})\left(\frac{20}{1.80\times10^{2}} + \frac{20}{1.81\times10^{6}}\right)} = \boxed{0.044 \text{ mg/kg}} \checkmark$$

- CHILD RESIDENT

-NONCARCINOGENS (TOLUENE $RFD_i = 1\times10^{-1}$ mg/kg·day)

$$PRG = \frac{(15.64)(1\times10^{-1})}{\left(\frac{20}{4.5\times10^{4}} + \frac{20}{1.81\times10^{6}}\right)} = \boxed{3430 \text{ mg/kg}} \checkmark$$

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT PRG DEVELOPMENT - SOIL	
BASED ON RAGS, PART B GUIDANCE	DRAWING NUMBER
BY NJS / CHECKED BY (5/6/93)	APPROVED BY / DATE 04/22/93

REFERENCES:

USEPA, RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART B, DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS). INTERIM. OSWER DIRECTIVE 9285.7-01B. OFFICE OF EMERGENCY AND REMEDIAL RESPONSE. WASHINGTON DC 20460.

USEPA, MARCH 25, 1991, RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL SUPPLEMENTAL GUIDANCE, "STANDARD DEFAULT EXPOSURE FACTORS". INTERIM FINAL. OFFICE OF EMERGENCY AND REMEDIAL RESPONSE. WASHINGTON DC 20460. OSWER DIRECTIVE 9285.6-03

USEPA, DECEMBER 1989, RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART A). INTERIM FINAL. OFFICE OF EMERGENCY AND REMEDIAL RESPONSE. WASHINGTON DC 20460 EPA/540/1-89/002.

USEPA, MAY 1989, EXPOSURE FACTORS HANDBOOK, OFFICE OF HEALTH AND ENVIRONMENTAL ASSESSMENT. WASHINGTON DC 20460. EPA/600/8-89/043.

APPENDIX B

SOIL CALCULATIONS

SITE 1

SOIL CALCULATIONS

SITE 1

SOIL ACTION LEVELS

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 1 - FORMER DRUM MARSHALING AREA
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 1**
SITE AREA (SF)	65,000
INFILTRATION FLOW RATE (CFY)	74,750
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.00
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcinogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 1						
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE (ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	9.30	64,000	527,000	9.30	200	Y(1,2)
Tetrachloroethene	5	5	5	5	364.0	0.67049	26.8	14,000	112,000	26.8	4,800	Y(1,2)
Chloroform	50		7	7	44.00	0.08105	4.54	110,000	29.0	4.54	ND	N
Toluene	5	1000	5	5	300.0	0.55260	22.1	20,000,000	3,435,000	22.1	ND	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.358	4,000,000	102,000,000	0.358	ND	N
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.205	640	24.0	0.205	ND	N
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	5,750	2,100	14,000	2,100	170	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,135	2,900	24,200	1,135	ND	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	3,243	2,100	17,100	2,100	270	N
Chlordane	2	2	0.1	0.1	140,000	257.9	206	540	3,650	206	240	Y (1)
Total PCB's	0.5	0.5	0.1	0.1				10,000	753 **	10,000	1,470,000	Y(1,2)
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	117,938,894		414,000	414,000	130	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	125,310	20,000,000	408,000,000	125,310	180	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	1,929,775	8,000,000	204,000,000	1,930,000	16.0	N
Dimethyl phthalate	50		50	50	17.40	0.03205	12.8	80,000,000	1,000,000,000 *	12.8	ND	N
Naphthalene	50		10	10	940.0	1.731	139	300,000	81,600,000	139	53.0	N
2-Methylnaphthalene	50			50	5,800	10.68			40,800,000	40,800,000	160	N
Acenaphthene	50		20	20	4,600	8.473	1,356	5,000,000	122,400,000	1,356	53.0	N
Acenaphthylene	50			50	2,500	4.605					ND	N
Anthracene	50		50	50	14,000	25.79	10,320	20,000,000	612,000,000	10,320	66.0	N
Fluoranthene	50		50	50	38,000	70.00	28,010	3,000,000	81,600,000	28,010	1,100	N
Pyrene	50		50	50	38,000	70.00	28,010	2,000,000	61,200,000	28,010	950	N
Phenanthrene	50		50	50	14,000	25.79	10,320			10,320	700	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	5.90	220		5.90	550	Y (1)
Chrysene	50		0.002	0.002	200,000	368.4	5.90			5.90	580	Y (1)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	16.2	220		16.2	680	Y (1)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	16.2	220		16.2	620	Y (1)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	1,622	61.0	670	61.0	620	Y (1)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	47.2			47.2	430	Y (1)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	34.1	14.0		14.0	150	Y (1)
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,179,389			1,179,389	420	N
Fluorene	50		50	50	7,300	13.45	5,381	3,000,000	81,600,000	5,381	44.0	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	4.35	2,000,000	40,800,000	4.35	6.00	Y (2)
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.12	7,000,000	37,000	1.12	72.0	Y (2)
Carbon disulfide	50		3500	50	14.20	0.02616	10.5	8,000,000	310	10.5	ND	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.21	8,000,000	204,000,000	2.21	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	4.79	12,000	9,070	4.79	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	32.4	5,400	56.0	32.4	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	81.1	8,000,000	218,000	81.1	ND	N
Xylenes	50	10,000		50	248.0	0.45682	182.8	200,000,000	30,400	183	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	40,800,000	2,000,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.722	4,000,000	102,000,000	0.722	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	2.83	2,000,000	40,800,000	2.83	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	7.08	160	1050	7.08	ND	N
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.065	77.0	522	0.065	ND	N
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.251	44.0	297	0.251	ND	N
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.251	200,000	612,000	0.251	4.70	Y (2)

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NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 1 - FORMER DRUM MARSHALING AREA
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 1**
SITE AREA (SF)	65,000
INFILTRATION FLOW RATE (CFY)	74,750
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.00
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 1					
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	5.38	5.38	3,380	Y(1,2)
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	816	30.0	9.80	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	142	142	59.0	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	1.46	0.160	ND	N
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	4.79	4.79	4.50	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)		400	61.1	N
Copper		1000	1000	1000					75,480	75,480	8.50	N
Lead		15	50	15	7.80	0.000	7.80	500		500	8.50	N
Manganese	300	50	600	50	167	0.000	167	20,000	142	142	167	Y (2)
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	127	20.0	0.160	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	34.5	34.5	19.2	N
Silver	50	100	100	50	0.128	0.023	0.165	200	10,200	200	6.30	N
Vanadium			250	250	17.9	0.000	17.9	600	14,280	600	39.3	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	612,000	20,000	17.9	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	40,800	2,000	13.3	N
Selenium	10	50	40	10	0.495	0.156	0.752		10,200	10,200	ND	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	143	6.00	0.740	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 1 - FORMER DRUM MARSHALING AREA
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 1**
SITE AREA (SF)	65,000
INFILTRATION FLOW RATE (CFY)	74,750
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.00
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcenogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 1						
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	9.30	64,000	58,100	9.30	200	Y(1,2)
Tetrachloroethene	5	5	5	5	364.0	0.67049	26.8	14,000	12,300	26.8	4,800	Y(1,2)
Chloroform	50		7	7	44.00	0.08105	4.54	110,000	105,000	4.54	ND	N
Toluene	5	1000	5	5	300.0	0.55260	22.1	20,000,000	15,643,000	22.1	ND	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.358	4,000,000	3,911,000	0.358	ND	N
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.205	640	581	0.205	ND	N
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	5,750	2,100	1,880	1,880	170	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,135	2,900	2,660	1,135	ND	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	3,243	2,100	1,880	1,880	270	N
Chlordane	2	2	0.1	0.1	140,000	257.9	206	540	491	206	240	Y (1)
Total PCB's	0.5	0.5	0.1	0.1				1,000	83.0 **	1,000	1,470,000	Y(1,2)
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	117,938,894		45,600	45,600	130	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	125,310	20,000,000	15,643,000	125,310	180	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	1,929,775	8,000,000	7,821,000	1,930,000	16.0	N
Dimethyl phthalate	50		50	50	17.40	0.03205	12.8	80,000,000	782,143,000	12.8	ND	N
Naphthalene	50		10	10	940.0	1.731	139	300,000	3,129,000	139	53.0	N
2-Methylnaphthalene	50			50	5,800	10.68			1,564,000	1,564,000	160	N
Acenaphthene	50		20	20	4,600	8.473	1,356	5,000,000	4,693,000	1,356	53.0	N
Acenaphthylene	50			50	2,500	4.605					ND	N
Anthracene	50		50	50	14,000	25.79	10,320	20,000,000	23,464,000	10,320	66.0	N
Fluoranthene	50		50	50	38,000	70.00	28,010	3,000,000	3,129,000	28,010	1,100	N
Pyrene	50		50	50	38,000	70.00	28,010	2,000,000	2,346,000	28,010	950	N
Phenanthrene	50		50	50	14,000	25.79	10,320			10,320	700	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	5.90	220		5.90	550	Y (1)
Chrysene	50		0.002	0.002	200,000	368.4	5.90			5.90	580	Y (1)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	16.2	220		16.2	680	Y (1)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	16.2	220		16.2	620	Y (1)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	1,622	61.0	87.5	61.0	620	Y (1)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	47.2			47.2	430	Y (1)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	34.1	14.0		14.0	150	Y (1)
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,179,389			1,179,389	420	N
Fluorene	50		50	50	7,300	13.45	5,381	3,000,000	3,129,000	5,381	44.0	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	4.35	2,000,000	1,564,000	4.35	6.00	Y (2)
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.12	7,000,000	70,393,000	1.12	72.0	Y (2)
Carbon disulfide	50		3500	50	14.20	0.02616	10.5	8,000,000	7,821,000	10.5	ND	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.21	8,000,000	7,821,000	2.21	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	4.79	12,000	1,060	4.79	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	32.4	5,400	54,800	32.4	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	81.1	8,000,000	7,821,000	81.1	ND	N
Xylenes	50	10,000		50	248.0	0.45682	182.8	200,000,000	156,429,000	183	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	1,564,000	1,564,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.722	4,000,000	3,911,000	0.361	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	2.83	2,000,000	1,564,000	1.42	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	7.08	160	142	7.08	ND	N
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.065	77.0	70.2	0.065	ND	N
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.251	44.0	39.9	0.251	ND	N
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.251	200,000	23,500	0.251	4.70	Y (2)

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 1 - FORMER DRUM MARSHALING AREA
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 1**
SITE AREA (SF)	65,000
INFILTRATION FLOW RATE (CFY)	74,750
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.00
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 1					
	DRINKING WATER LAWS		GUIDELINES									
	New York MCL (ug/l)	NPDWR MCL (ug/l)	New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE (mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	23.5	23.5	3,380	Y(1,2)
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	31.3	30.0	9.80	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	5,475	4,000	59.0	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	0.663	0.160	ND	N
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	39.1	39.1	4.50	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)	78,214	400	61.1	N
Copper		1000	1000	1000					391	391	8.50	N
Lead		15	50	15	7.80	0.000	7.80	500		500	8.50	N
Manganese	300	50	600	50	167	0.000	167	20,000	391	391	167	N
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	23.5	20.0	0.160	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	1,564	1,564	19.2	N
Silver	50	100	100	50	0.128	0.023	0.165	200	391	200	6.30	N
Vanadium			250	250	17.9	0.000	17.9	600	548	548	39.3	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	23,464	20,000	17.9	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	1,564	1,564	13.3	N
Selenium	10	50	40	10	0.495	0.156	0.752		391	391	ND	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	5.48	5.48	0.740	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000

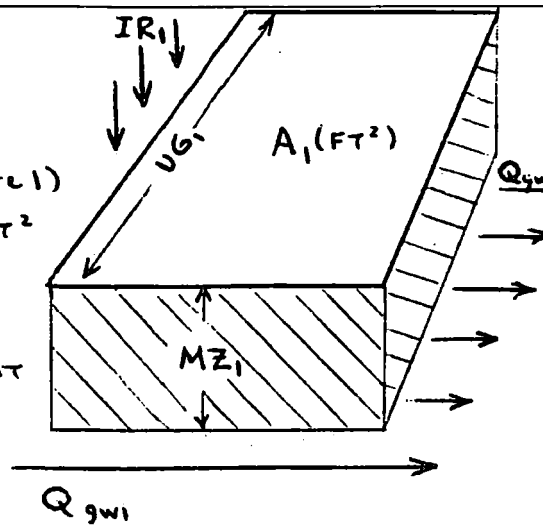
LK 01/30/95

SITE 1

SAMPLE CALCULATION OF SOIL ACTION LEVELS BASED ON LEACHING OF CONTAMINANTS TO GROUNDWATER

CLIENT NWIRP BETHPAGE	JOB NUMBER
SUBJECT SAMPLE CALCULATION OF SOIL ACTION LEVELS BASED ON LEACHING OF	
BASED ON	DRAWING NUMBER SOIL CONTAMINANTS TO GW
BY AND / CHECKED BY	APPROVED BY / DATE 4/6/93 LEK 8/25/93

SITE 1:



A_1 = AREA (Site 1)
A_1 = 65,000 FT²

Q_{gw} → IR_1 = INFILTRATION RATE
IR_1 = 13.65 IN/YR

UG_1 = UPPER GRADIENT
UG_1 = 220 FT.

MZ_1 = MIXING ZONE
MZ_1 = 50 FT

Q_{gw1} = GROUNDWATER FLOW

HYDRAULIC CONDUCTIVITY$_1$ = .02 $\frac{cm^3}{cm^2\text{-}sec}$
(measured at slope 1.0)

HYDRAULIC GRADIENT$_1$ = .0023

Q_{i1} = INFILTRATION FLOW RATE (SITE 1)

$Q_{i1} = IR_1 \times A_1$

$Q_{i1} = 13.65 \frac{IN}{YR} \times \frac{FT}{12\,IN} \times 65{,}000\ FT^2$

$Q_{i1} = 73{,}938\ FT^3/YR$

Q_{gw1} = GROUNDWATER FLOW RATE (SITE 1)

Q_{gw1} = (HYDRAULIC CONDUCTIVITY) × (HYDRAULIC GRADIENT) × (CROSS SECTION AREA)

CROSS SECTION AREA = $UG_1 \times MZ_1 = (220 \times 50)\ FT^2$
$= 11{,}000\ FT^2$

$Q_{gw1} = .02 \frac{cm^3}{cm^2\text{-}sec} \times .0023 \frac{FT}{FT} \times 11{,}000\ FT^2 \times 31{,}536{,}000 \frac{sec}{YR} \times \frac{929\ FT^3\ cm^2}{28{,}334\ cm^3\ FT^2}$

$Q_{gw1} = 523{,}197\ FT^3/YR$

GND 4/13/93

LEK 8/25/93
pg 2 of 4

(1) Use All TOC Data from all sites and combine together to get a total site average.

Site	Boring No.	Date	Time	TOC (mg/kg)
1	110	8/27/91	1735	620
1	115	8/27/91	0840	570
2	20A	8/29/91	0810	1100
2	20A*	8/29/91	0810	390*
2	215	8/29/91	1250	2500
3	316	8/28/91	1210	7900
3	328	8/30/91	0820	24,000

* Duplicate Analysis

Including Duplicate:

Mean = 5297

Median = 1100

Geometric Mean = 1842

Without Duplicate:

Mean = 6115

Median = 1800

Geometric Mean = 2385

Use duplicate result for conservative scenario, however, use geometric mean to reduce the great effect of the one large TOC result on the random set of samples.

Use TOC of 1842 mg/kg for all three sites.

CLIENT NWIRP BETHPAGE		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY	DATE 4/6/93 LEK 8/25/93

$$\text{DILUTION RATIO} = \frac{\overset{\text{g.w. flowrate}}{Q_{gw}} + \overset{\text{infiltration flowrate}}{Q_i}}{Q_i} = \frac{523,197 + 73,938}{73,938} \frac{\cancel{ft^3/yr}}{\cancel{ft^3/yr}}$$

DR_1 = DILUTION RATIO = 8.08 FOR SITE 1

FOR TRICHLOROETHENE (TCE):

$$K_d = F_{oc} \times K_{oc}$$

K_d = DISTRIBUTION COEFFICIENT ($\mu g/kg$ / $\mu g/l$)
F_{oc} = SOIL ORGANIC CARBON CONTENT (kg/kg)
K_{oc} = ORGANIC CARBON PARTITION COEFFICIENT (Chemical Specific)

AT SITE 1:

$$K_{dTCE1} = F_{oc1} \times K_{ocTCE}$$

$$TOC = \cancel{595}\ 1842\ mg/kg$$

$$F_{oc1} = \cancel{595}\ 1842 \frac{\cancel{mg}}{\cancel{kg}} \times \frac{\cancel{g}}{1000\ \cancel{mg}} \times \frac{kg}{1000\ \cancel{g}}$$

$$F_{oc1} = \cancel{.00595}\ .001842\ kg/kg$$

$$K_{ocTCE} = 126.2$$

$$K_{dTCE1} = \cancel{.00595}\ 0.001842 \times 126.2$$

$$K_{dTCE1} = \cancel{.0751}\ 0.232 \frac{\mu g/kg}{\mu g/l}$$

CLIENT NWIRP BETHPAGE		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY RND	CHECKED BY	APPROVED BY	DATE 4/6/93 LEK 8/25/93

FOR SITE 1 :

$$C_{gw1} = \frac{C_{L1}}{DR_1} \quad \text{OR} \quad C_{L1} = C_{gw1} \times DR_1$$

C_{gw1} = GROUNDWATER CONCENTRATION ($\mu g/l$)
C_{L1} = LEACHATE CONCENTRATION ($\mu g/l$)
DR_1 = DILUTION RATIO

ALSO

$$C_{L1} = \frac{C_{S1}}{K_{dTCE1}}$$

C_{S1} = SOIL CONCENTRATION ($\mu g/kg$)
K_{dTCE1} = DISTRIBUTION COEFFICIENT FOR TCE

THEREFORE,

$$\frac{C_{S1}}{K_{dTCE1}} = C_{gw1} \times DR_1$$

$$C_{S1} = C_{gw1} \times DR_1 \times K_{dTCE1}$$

TO LET C_{S1} BE THE SOIL ACTION LEVEL FOR TCE, SET C_{gw1} TO THE TRIGGER (OR STRICTEST MCL) GROUNDWATER CONCENTRATION, IE. $5 \mu g/l$

$$C_{S1} = \left(5 \frac{\mu g}{l}\right) \times (8.08) \times \left(\cancel{.0751} \; 0.232 \frac{\mu g}{kg} \cdot \frac{l}{\mu g}\right)$$

C_{S1} = SOIL ACTION LEVEL FOR TCE = ~~3.03 $\mu g/kg$~~ **9.3 $\mu g/kg$**

SITE 1

ANALYTICAL SUMMARIES AND MAPS

SITE 1 - FORMER DRUM MARSHALING AREA

ppb

CONDENSED SUMMARY OF ANALYTICAL DATA

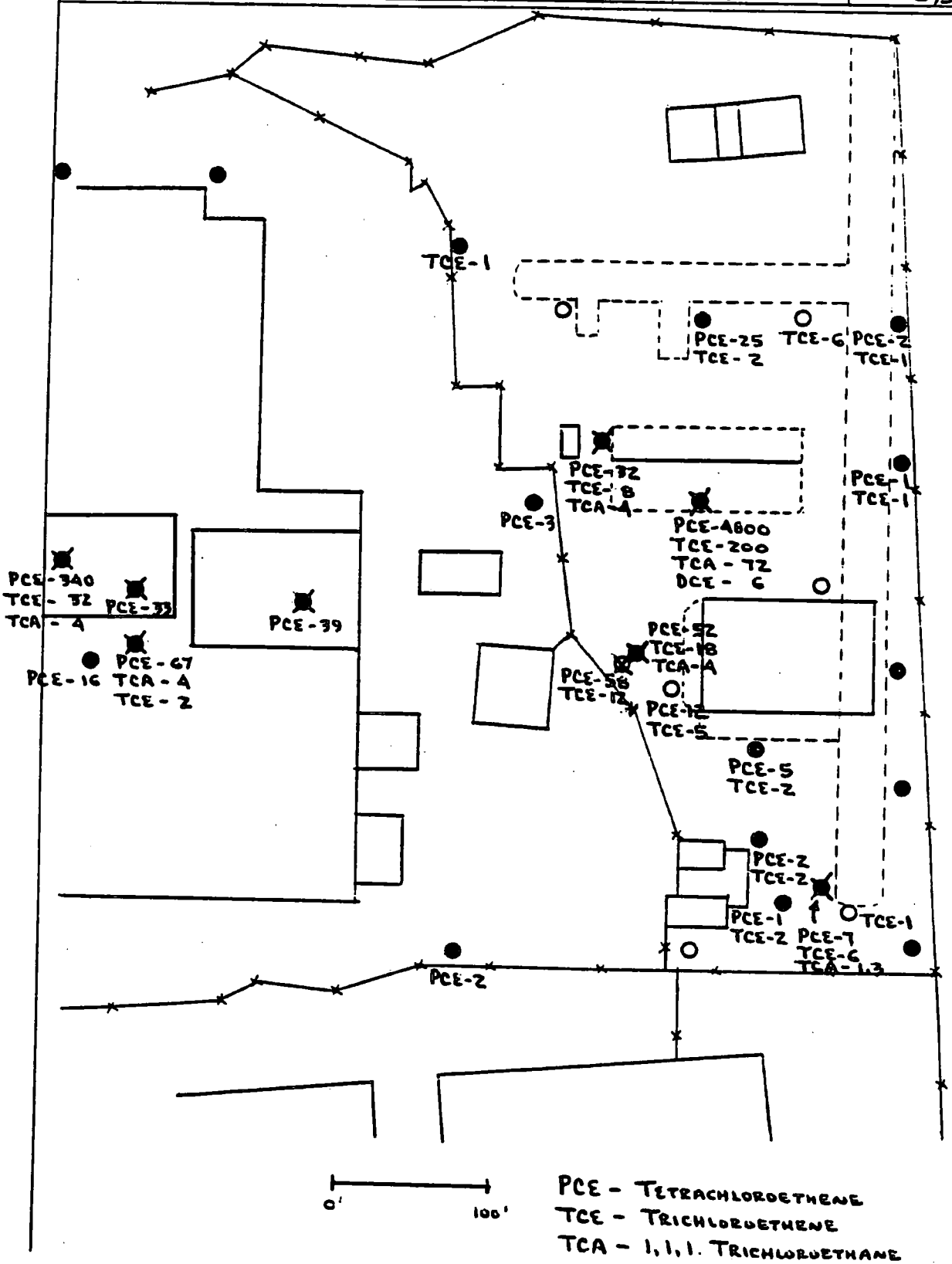
	SS100	SS200	SS300	SS400	SS500	SS600	SS2500	SB103	SB104	SB110	SB111	SB112	SB113	SB115	SB119	SB121	SB123
VOLATILES																	
Trichloroethene		1	12,11			6	5										
Tetrachloroethene			58,44				12	2 / ND	/ 2,2	2 /	ND / 5	3 / 3	25 / 2	2 / 3	200/ ND	2.2,ND/ND	
Trans-1,2-dichloroethene															4800/12	26,9 / 3	7 / 1
1,1,1-Trichloroethane															6 / ND		
ORGANIC ACIDS															72 / ND		
Benzoic Acid		170	99	130	64	120	370						35		140	84,72	
PHTHALATES																	
Bis(2-ethylhexyl) phthalate		80	105	130			72										
Butyl benzyl phthalate			120		180	120											
Di-n-butyl phthalate												16				130,ND	
PESTICIDES																	
DDT		170,37															
DDE		270,27															
Chlordane		240															
Endrin																	
PCB's																4.7	
Aroclor 1242					25000												
Aroclor 1248	25000	7900,1100	1300000	2500		1700	7500										
Aroclor 1254	5000	ND, 660	170000	530		400										1000	
PAH's																210	
Naphthalene						53											
2-Methylnaphthalene			55			160											
Acenaphthene	41	53		51													
Anthracene	43	66		66													
Fluoranthene	740	740	190	1100	260	260	340										
Pyrene	710	830	200	950	240	270	280										
Phenanthrene	400	600	140	700	140	200	210										
Benzo(a)anthracene	430	380	130	550	150	170	190										
Chrysene	420	470	190	580	170	170	200										
Benzo(b)fluoranthene	670	380	250	680	230	270	230										
Benzo(k)fluoranthene	350	460		620	180	240	250										
Benzo(a)pyrene	500	440	190	620	190	200	180										
Indeno(1,2,3-c)pyrene	350	290	110	430	150	190	140										
Dibenzo(a,h)anthracene	150	130															
Benzo(g,h,i)perylene	350	310	130	420	150	190	150										
Fluorene		42		44													
INORGANICS																	
Aluminum	4750	10800	7180	4090	3370	7550	4680	3070		5140	3040	2330	2010	1940	1010	5530,17300	7940
Antimony															9.8		
Arsenic	8.9	18.6	14.9	6.8	3.4	55.8	5.6	1.9		1.8	2	2.7		0.9	3380	1.8,1.5	2
Barium	10.8	44.8	35.8	28.7	16.4	59	20.1	6.2		13.9	6.3	4.1	5.7	5.5	7.9	15,46.5	18
Cadmium								4.5							1.3		
Calcium	243	4490	5580	3660	2870	6190	1960	251		277	77.2	72.5	68.6		291	216,636	212
Chromium	25	18.8	61.1	40.3	20.8	46.8	31.4	5		7.8	5.6	3.2	3.1	2.7	11.7	5.6,16.3	10.7
Cobalt			5			5.3										ND,6.3	
Copper												7.9		3.1		3,8.5	
Iron	7330	14100	15900	7270	7820	15400	9890	4050		7310	8600	4040	3820	3420	2210	11400,14400	6110
Lead								5.5		3.4	1.7	1.7	1.6	1	2.8	2.3,8.5	4.9
Magnesium	544	1740	2970	1790	1450	3100	1210	533		807	341	328	465	291	178	695,2380	1330
Manganese								145		93.4	167	92.7	99.3	60.1	15.1	82.6,101	54.3
Mercury																ND,0.16	
Nickel	6.5	9.1	13.9	9.2	15.8	19.2	10.7									ND,9.4	5.3
Potassium	368	600	550	460	424	648	443	138		276	173	163	120	164		154,596	485
Silver	1.9		0.63	0.38	0.4	0.56	6.3										
Sodium	204	244	692	283	286	419	272	174		175	158	145	214	132	151	153,195	169
Thallium																ND,0.74	
Vanadium	16.5	22.8	39.3	13.7	16.4	27.5	20.1	5.9		11.2	7	4.4	4.3			12.2,23.6	13.6
Zinc								9.3		10.5	8.8		8.9		9.1		17.9
Cyanide						5.4		5.1							13.3		

SOIL GAS ANALYSES	SG103	SG104	SG105	SG106	SG110	SG111	SG112	SG113	SG115	SG117	SG119	SG120	SG121	SG122	SG123	SG124
1,1-Dichloroethene	44/192	ND/7.4	187/244	6.1/ND	ND/3.6	125/59	61/85	131/174	20/80	7.4/14	626/165	832/728	568/558	8.6/46	4.9/11	2.7/11
1,1-Dichloroethane	ND/2.7	ND/3.7					ND/1.7		ND/2.4		6.9/3.1	30/18	21/19		ND/3.9	
Cis-1,2-dichloroethene	3.6/1.6								ND/4.4		37/26	48/16	48/50			
1,1,1-Trichloroethane	5.6/18	.31/89	9.9/14	1.6/.22	ND/.11	8.8/6.4	9.4/9.0	8.3/15	9.5/8.8	10/26	70/24	122/107	125/101	6.4/19	39/78	2.4/13
Trichloroethene	13/15	.68/143	7.7/9.7	3.5/1.3		7.8/6.7	3.7/4.9	15/11	14/18	18/40	63/21	68/45	159/96	17/19	56/139	1.2/16
Tetrachloroethene	9.6/11	ND/5.7	19/27	3.5/.13	.65/.78	1.9/3.6	9.4/6.7	12/16	70/ND	14/21	138/70	479/174	765/617	35/77	14/19	4.8/20

CALCULATION WORKSHEET

Order No. 19116 (01-01)

CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER:
SUBJECT: SITE 1 AREA MAP - VOA ANALYSES	
BASED ON: SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER:
BY: GND / CHECKED BY:	APPROVED BY: LEK / DATE: 8/30/93



0' 100'

PCE - TETRACHLOROETHENE
TCE - TRICHLOROETHENE
TCA - 1,1,1. TRICHLOROETHANE
DCE - TRANS 1,2 DICHLOROETHENE
(ND = 05 FOR ALL COMPOUNDS)

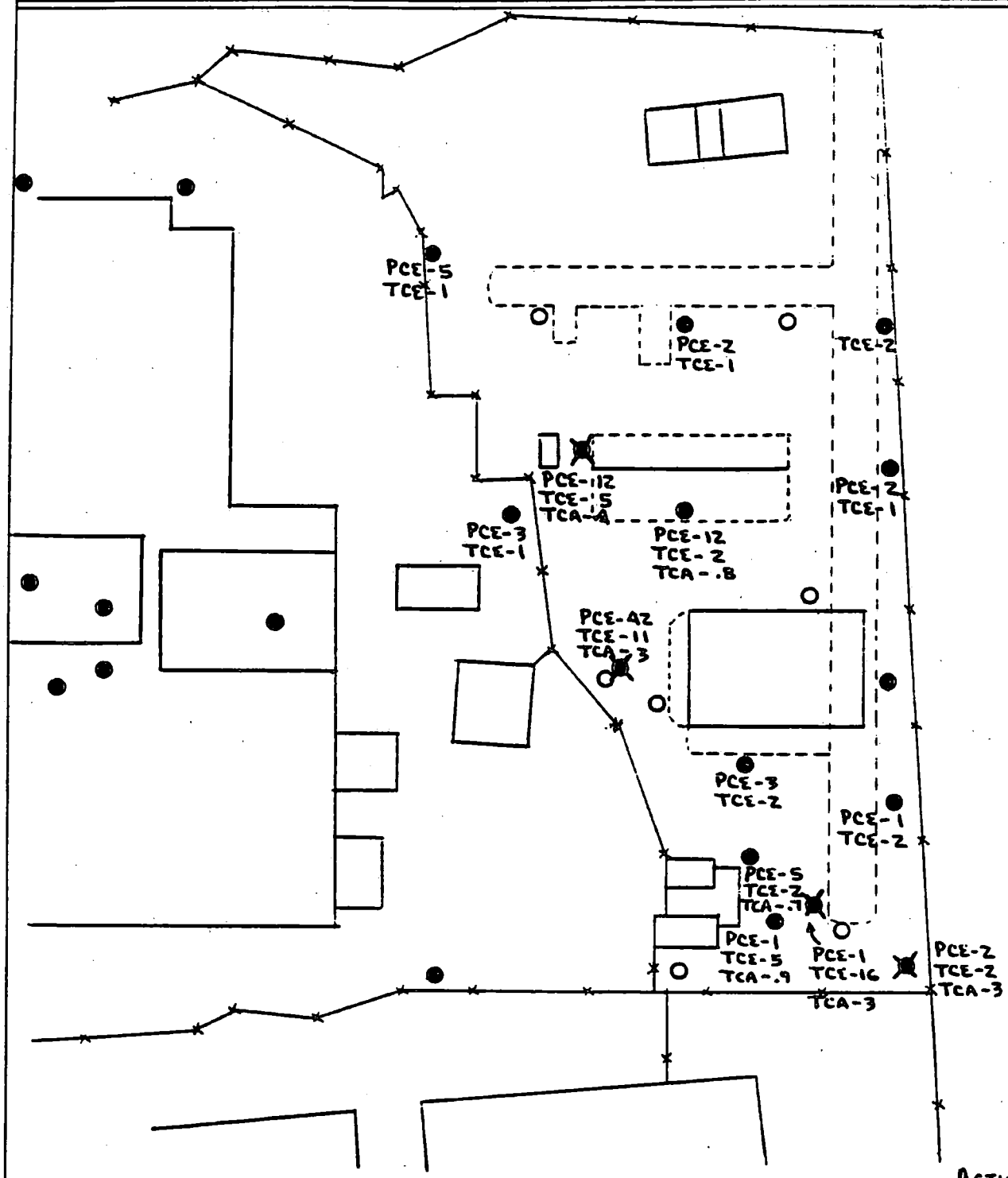
ACTION LEVEL
26.8
9.3
1.12
4.35

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA ANALYSES	
BASED ON DEEP SUB-SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



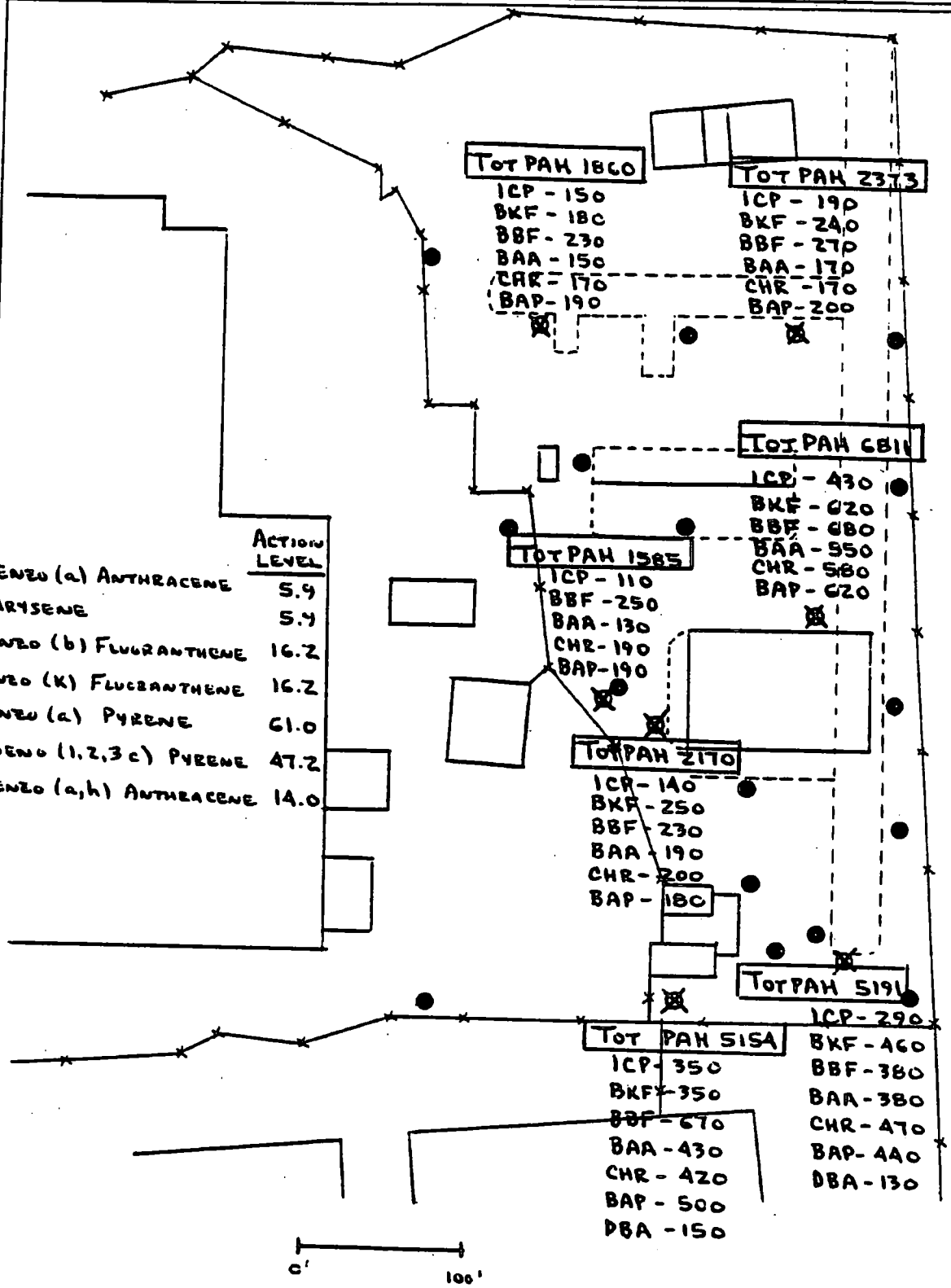
		Action Level
PCE	- TETRACHLOROETHENE	26.8
TCE	- TRICHLOROETHENE	9.3
TCA	- 1,1,1 TRICHLOROETHANE	1.12
DCE	- TRANS 1,2 DICHLOROETHENE	4.35

(ND = 0.5 FOR ALL COMPOUNDS)

CALCULATION WORKSHEET

Order No. 19115 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PAH ANALYSES	
BASED ON SURFACE SOIL SAMPLES	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY ZEK / DATE 8/30/93



	Action Level
BAA - Benzo (a) Anthracene	5.4
CHR - Chrysene	5.4
BBF - Benzo (b) Fluoranthene	16.2
BKF - Benzo (k) Fluoranthene	16.2
BAP - Benzo (a) Pyrene	61.0
ICP - Indeno (1,2,3 c) Pyrene	47.2
DBA - Dibenzo (a,h) Anthracene	14.0

CALCULATION WORKSHEET

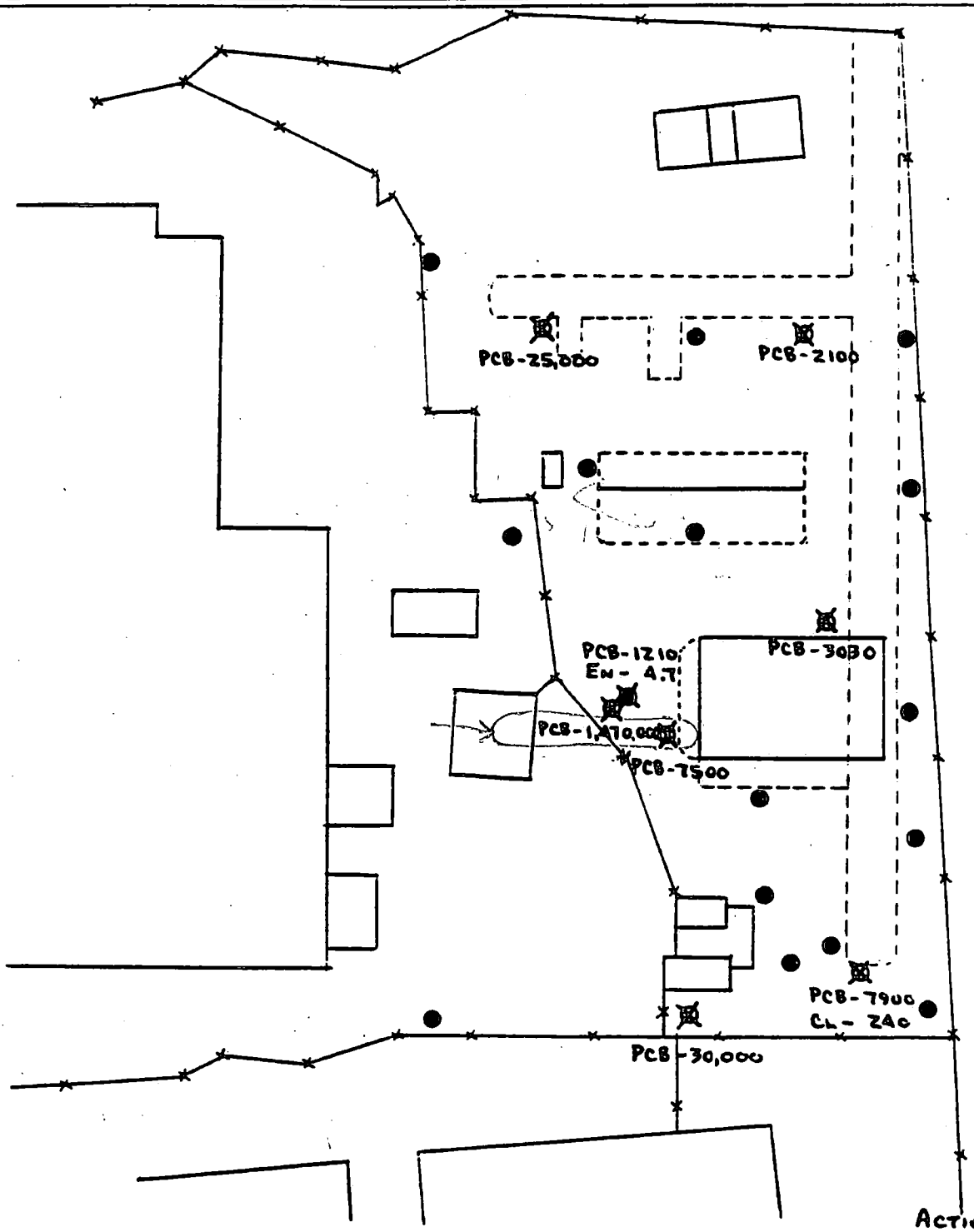
Order No. 19116 (01-91)

CLIENT	JOB NUMBER
NWIRP - BETHPAGE, NY	

SUBJECT: SITE 1 AREA MAP - PESTICIDE / PCB ANALYSES

BASED ON	DRAWING NUMBER
SURFACE SOIL / SHALLOW SUB-SOIL	

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

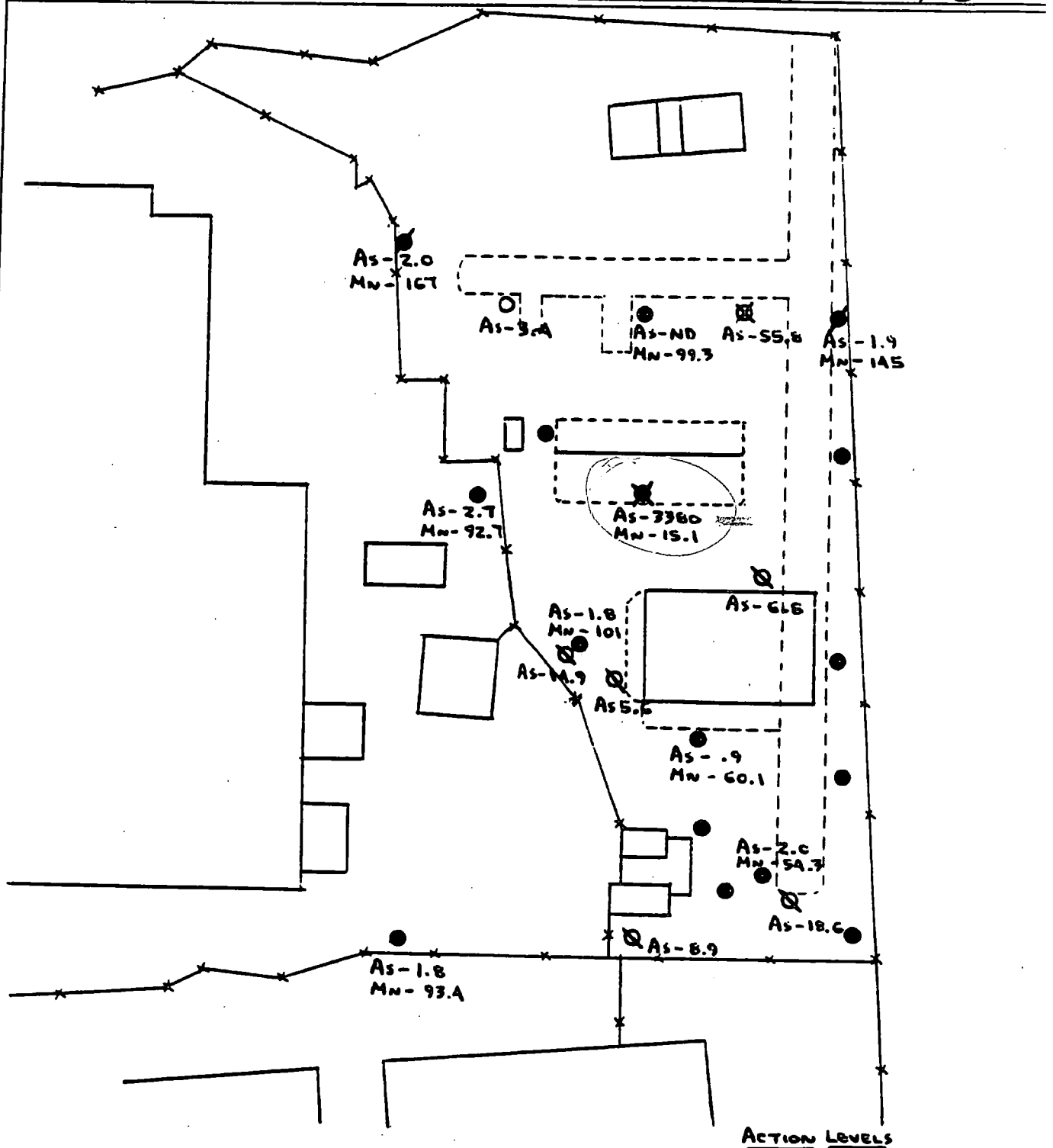


CL - CHLORDANE
EN - ENDRIN
TOTAL PCB'S
INCINERATION
CURRENT
FUTURE

ACTION LEVELS	
CL	206
EN	0.251
TOTAL PCB'S	
INCINERATION	50,000
CURRENT	10,000
FUTURE	1,000

CALCULATION WORKSHEET Order No. 19115 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - ARSENIC / MANGANESE ANALYSES	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



ACTION LEVELS

	CURRENT	FUTURE	ND = ½ IDL
As - ARSENIC	5.38	23.5	0.24
Mn - MANGANESE	142	391	0.30

SITE 1

SOIL GAS VS. VOC CORRELATION

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SOIL GAS VS. VOA CORRELLATION	
BASED ON SITE 1	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

TETRACHLORDETHENE	VOA ANALYSIS	SOIL-GAS ANALYSIS
103-S	2	9.6
103-D	ND	11
104-S	--	ND
104-D	2	5.7
110-S	2	.65
110-D	--	.78
111-S	ND	1.9
111-D	5	3.6
112-S	3	9.4
112-D	3	6.7
113-S	25	12
113-D	2	16
115-S	2	70
115-D	3	ND
~~119-S~~	~~4800~~	~~138~~
119-D	12	70
121-S	26, ~~9~~	765
121-D	3	617
123-S	7	14
123-D	1	19

TRICHLORDETHENE		
~~119-S~~	~~200~~	~~63~~
~~119-D~~	~~ND~~	~~21~~
121-S	2.2, ND	159
~~121-D~~	~~ND~~	~~96~~

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

1,1,1 TRICHLOROETHANE

	VOA ANALYSIS	SOIL-GAS ANALYSIS
~~119-S~~	~~72~~	~~70~~
~~119-D~~	~~ND~~	~~24~~

1,2 DICHLOROETHENE

~~119-S~~	~~6~~	~~37~~
~~119-D~~	~~ND~~	~~26~~

NOTE: 119-S Bad Sample, Oily Matrix

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, N.Y.		JOB NUMBER	
SUBJECT SOIL GAS TO VOLATILE ANALYSIS CORRELLATION			
BASED ON SITE 1		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

BASED ON 17 OBSERVATIONS :

TETRACHLOROETHENE (PCE) χ COEFFICIENT = $\boxed{14.76}$

INADEQUATE DATA FOR TCE & 1,1,1-TCA. THEREFORE DEVELOP BASED ON PCE DATA

HENRY'S LAW CONSTANTS	H
TETRACHLOROETHENE	.0153
TRICHLOROETHENE	.0091
1,1,1 TRICHLOROETHANE	.0300

FOR

TRICHLOROETHENE

$$\chi \text{ COEFFICIENT} = 14.76 \times \frac{.0091}{.0153} = \boxed{8.78}$$

1,1,1 TRICHLOROETHANE

$$\chi \text{ COEFFICIENT} = 14.76 \times \frac{.0300}{.0153} = \boxed{28.94}$$

LEK 8/30/93
pg 4 of 4

SITE 1
Tetrachloroethene
Shallow Samples Only

VOA	Soil–Gas
2	9.6
2	0.65
1	1.9
3	9.4
25	12
2	70
26	765
7	14
4800	138

Regression Output:

Constant	0
Std Err of Y Est	201.7722
R Squared	0.422276
No. of Observations	8
Degrees of Freedom	7
X Coefficient(s)	14.92609
Std Err of Coef.	5.447337

SITE 1
Tetrachloroethene
Shallow and Deep Samples

VOA	Soil–Gas
2	9.6
1	11
2	5.7
2	0.65
1	1.9
5	3.6
3	9.4
3	6.7
25	12
2	16
2	70
3	1
12	70
26	765
3	617
7	14
1	19
4800	138

Regression Output:

Constant	0
Std Err of Y Est	198.9819
R Squared	0.227712
No. of Observations	17
Degrees of Freedom	16
X Coefficient(s)	14.75545
Std Err of Coef.	5.009103

SITE 1

AREA OF CONTAMINATION
(FOR CAPPING ALTERNATIVES)

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT AREA REQUIRED FOR CAPPING			
BASED ON SITE 1 - CURRENT / FUTURE		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

CURRENT SCENARIO :

AREA = 104.4 + 6.3 + .5 = 111.2 BLOCKS

1 BLOCK = 25 FT × 25 FT = 625 FT^2

AREA = 111.2 × 625 FT^2 = **69,500 FT^2**

FUTURE SCENARIO :

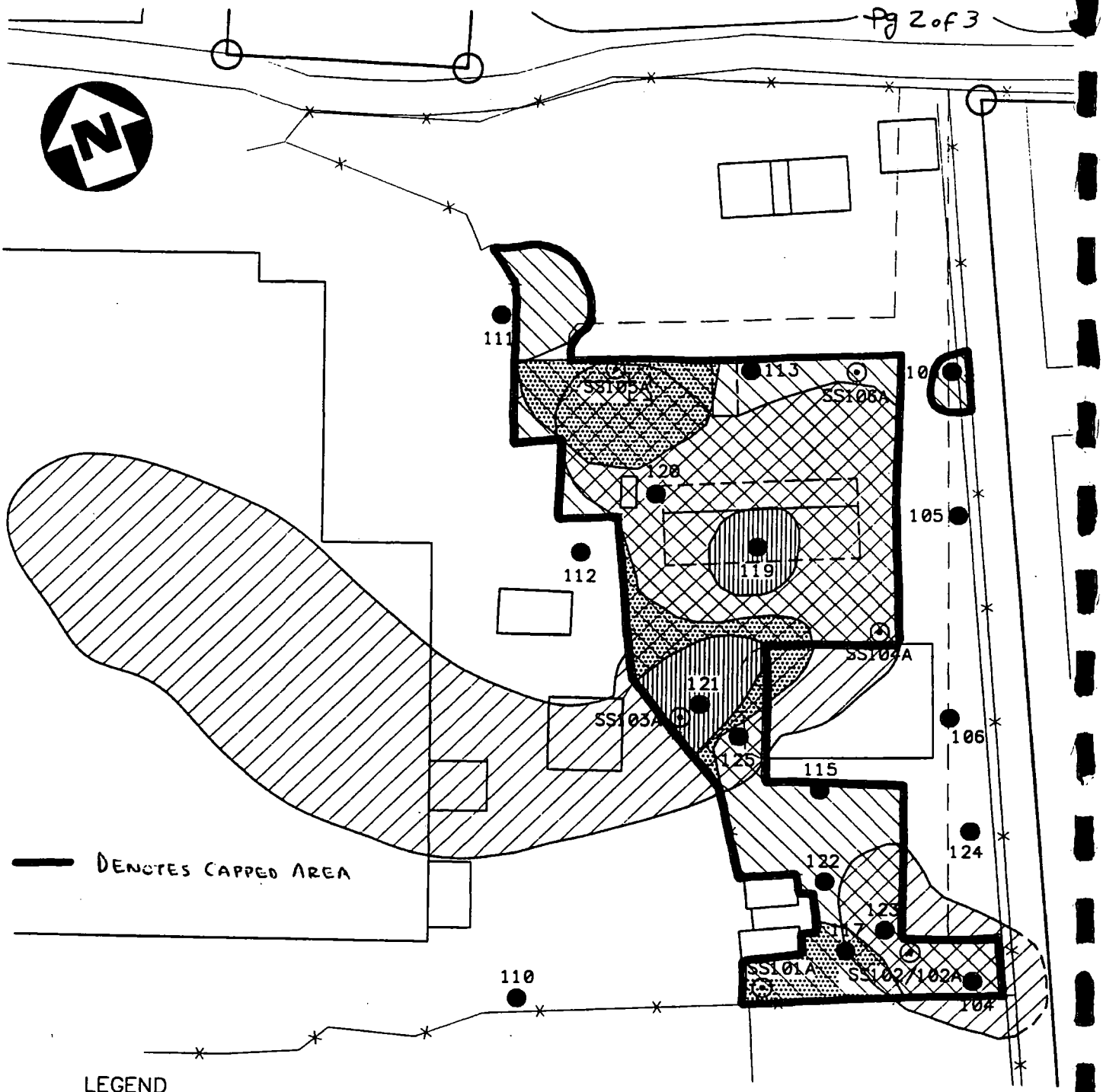
AREA = 104.4 BLOCKS

1 BLOCK = 25 FT × 25 FT = 625 FT^2

AREA = 104.4 × 625 FT^2 = **65,250 FT^2**

NOTE : CONCRETE AND BUILDING AREAS NOT CAPPED

LEK 8/30/93
Pg 2 of 3



LEGEND

- PCBs > 50 ppm (LOCATION 121); 0-2 FT. DEPTH OR METALS > HAZARDOUS WASTE CRITERIA (LOCATION 119) 1-7 FT. DEPTH
- VOAs > ACTION LEVELS; RANGES TO 50 FT. DEPTH
- OTHER METALS AND ORGANICS > ACTION LEVELS; RANGES TO 7 FT. DEPTH
- PCBs > 10 ppm < 50 ppm; 0-2 FT. DEPTH

0 100 200
SCALE IN FEET

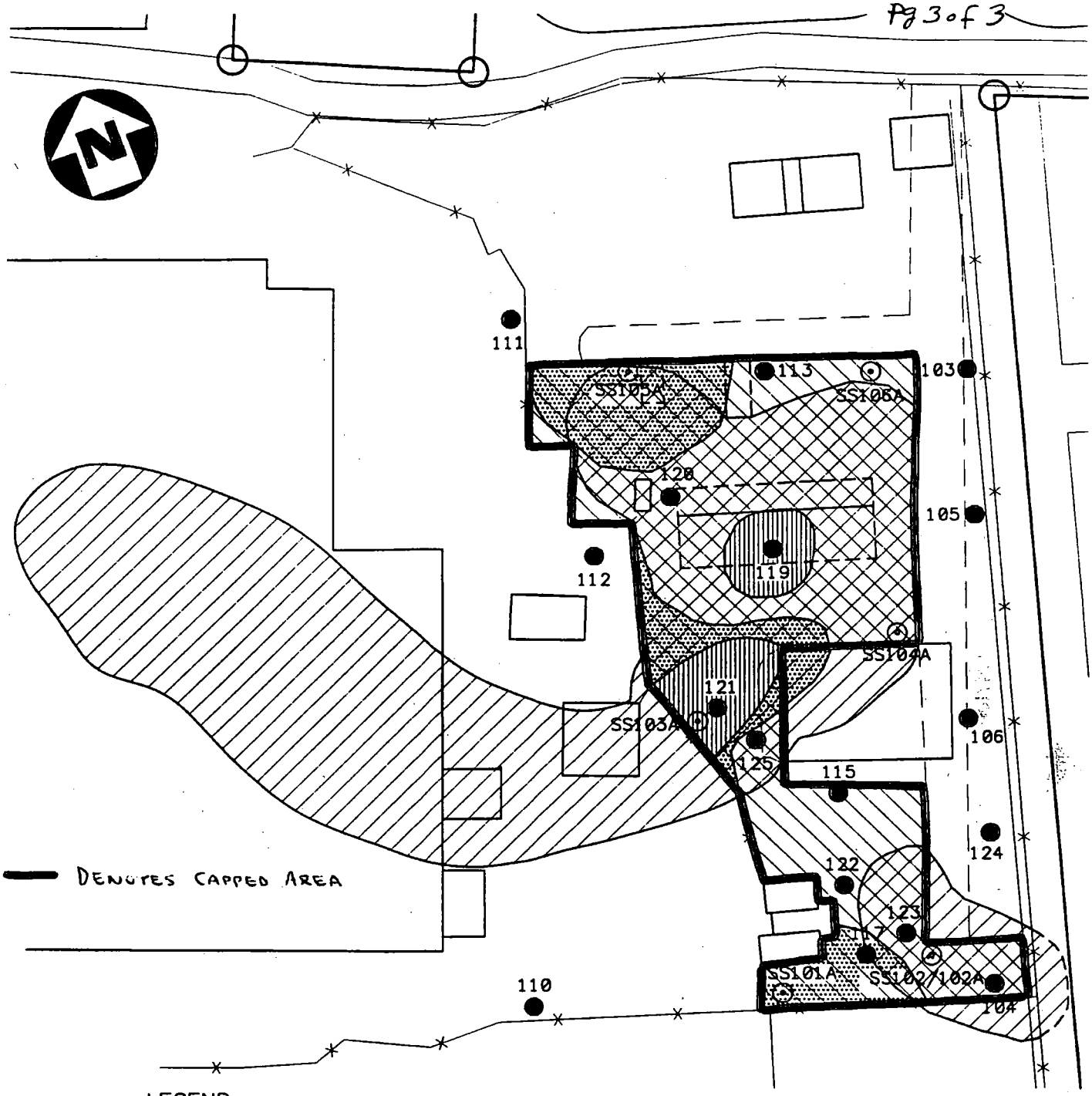
FIGURE 2-1

SITE 1 - CURRENT INDUSTRIAL USE SCENARIO
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953\SITE1.DWG 7/20/93 MB PLOT2

LEK 8/30/93
Pg 3 of 3



LEGEND

- PCBs > 50 ppm (LOCATION 121); 0-2 FT. DEPTH OR METALS > HAZARDOUS WASTE CRITERIA (LOCATION 119) 1-7 FT. DEPTH
- VOAs > ACTION LEVELS; RANGES TO 50 FT. DEPTH
- OTHER METALS AND ORGANICS > ACTION LEVELS; RANGES TO 7 FT. DEPTH
- PCBs > 10 ppm < 50 ppm; 0-2 FT. DEPTH

0 100 200
SCALE IN FEET

FIGURE 2-2

SITE 1 - FUTURE RESIDENTIAL USE SCENARIO
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953\SITE1.DWG 7/21/93 MB (PLOT1)

SITE 1

SOIL VOLUME CALCULATIONS

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 1 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON Hi PCB / As. (CURRENT & FUTURE SCENARIOS)		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① FOR PCB's > 50,000 μg/kg : 0 - 2 FT. DEPTH

$$\text{Area} = 6.3 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 437.5\ YD^2$$

$$\text{Volume} = 437.5\ YD^2 \times 2\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{292\ CY}$$

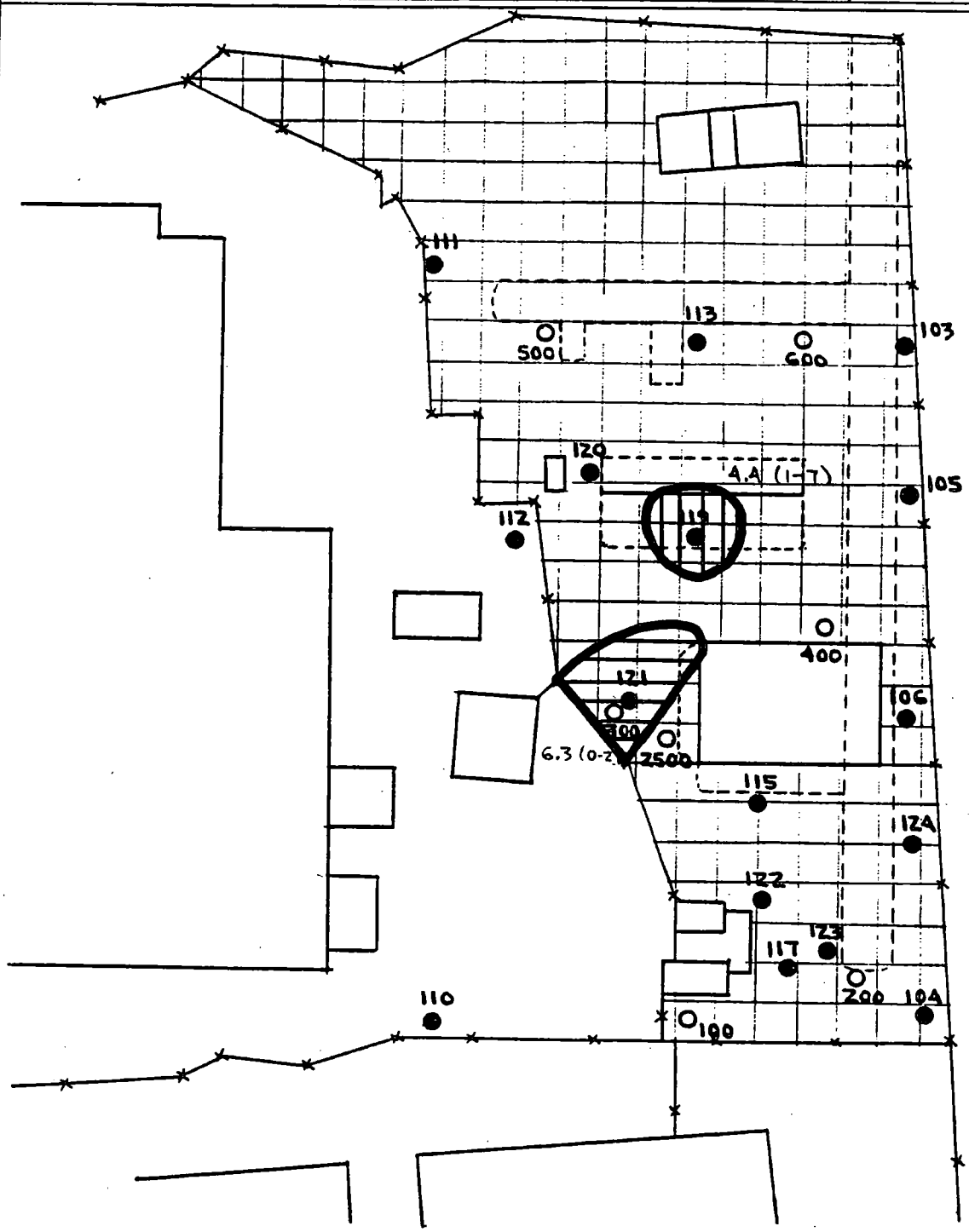
② FOR ARSENIC > 1000 mg/kg : 1 - 7 FT. DEPTH

$$\text{Area} = 4.4 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 305.6\ YD^2$$

$$\text{Volume} = 305.6\ YD^2 \times (7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{611\ CY}$$

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PCB's / ARSENIC (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



0' 100'

	VOLUME
SURFACE SOILS (0'-2') PCB's > 50,000 µg/kg	292 CY
SHALLOW SUB-SOILS (1'-7') ARSENIC > 1000 µg/kg	611 CY

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 1 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON VOA's (CURRENT & FUTURE SCENARIO)		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① FOR SHALLOW SUB-SOILS : 0 TO 7 FT. DEEP. (EXCLUDING PLANT 3 AREA)
BASED ON 1,1,1 TRICHLOROETHANE CONTAMINATION

$$\text{Area} = (60.4 + 1.1) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 4270.8\ YD^2$$

$$\text{Volume} = 4271\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{9965\ CY}$$

FOR SHALLOW SUB-SOILS: 0 TO 7 FT DEEP (INCLUDING PLANT 3 AREA)

$$\frac{(155.4+1.1)(625)(7)}{27} = \boxed{25{,}360\ CY}$$

② FOR DEEP SUB-SOILS : TO 50 FEET DEPTH. (EXCLUDING PLANT 3 AREA)
BASED ON 1,1,1 TRICHLOROETHANE CONTAMINATION.

$$\text{Area} = (19.7 + 19.3 + 17.2) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 3902.8\ YD^2$$

$$\text{Volume} = ((19.7 - 3.1) + (1.1) + (19.3 - 5.4)) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} \times (50-7)\frac{\cancel{FT}}{3\ \cancel{FT}}$$

$$+ ((3.1 + (17.2 - 1.1) + 5.4) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} \times 50\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}}$$

$$\text{Volume} = (31.6)(625)\frac{(43)}{27} + (24.6)(625)\frac{(50)}{27}\ CY$$

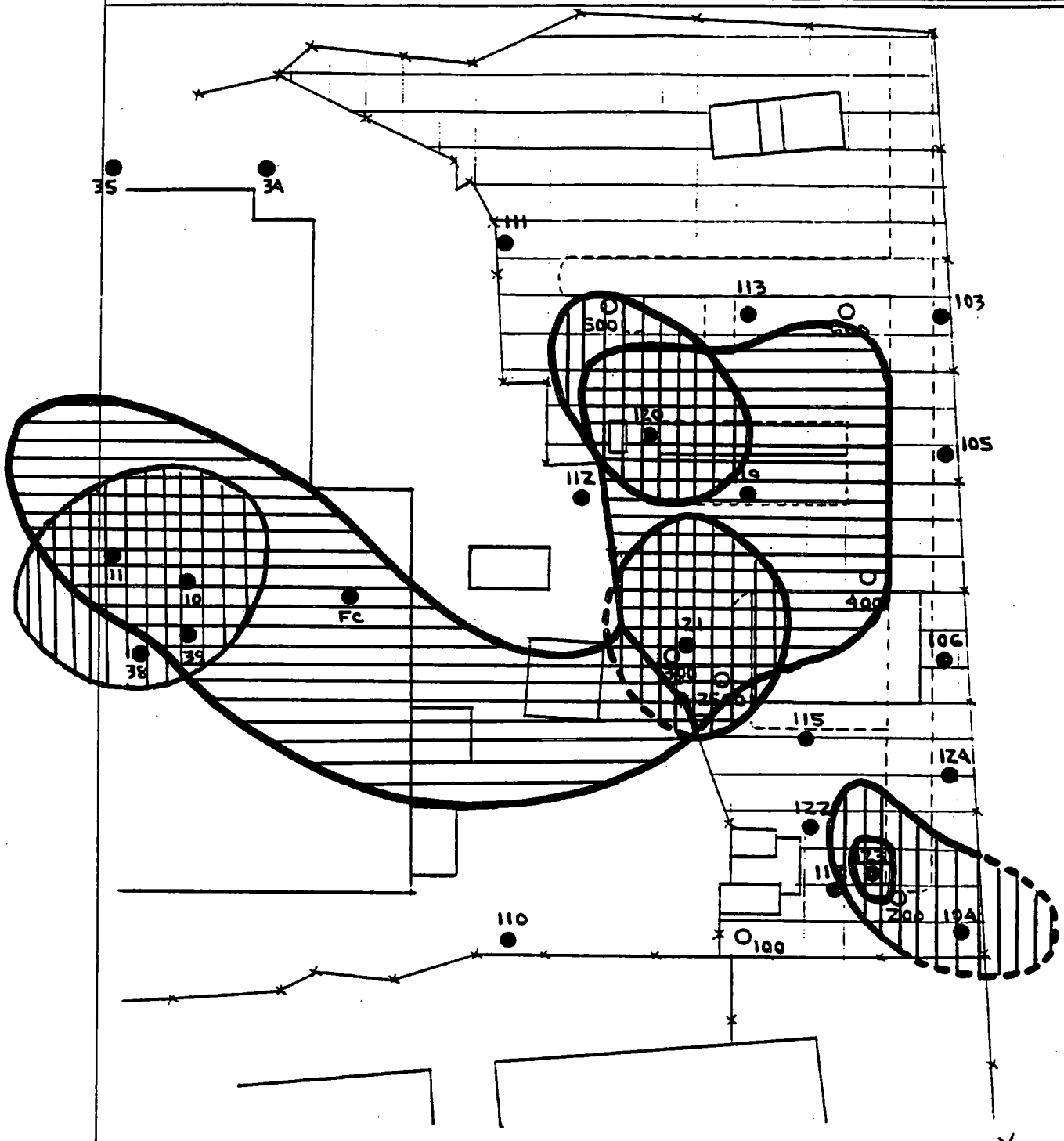
$$\text{Volume} = 31{,}454 + 28{,}472 = \boxed{59{,}926\ CY}$$

FOR DEEP SUBSOILS: TO 50 FT (INCLUDING PLANT 3 AREA)

$$59{,}926 + [(22.5)(50-7) + (8)(50)]\left(\frac{625}{27}\right) = 59{,}926 + 31{,}700 = \boxed{91{,}600\ CY}$$

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW & DEEP SUB-SOILS (INCLUDES PLANT 3 DATA)	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND	LEK	LEK	8/30/93



SHALLOW SUB-SOILS (0-7' DEEP)

DEEP SUB-SOILS (7-50' DEEP)

VOLUME

25,360 CY (INCLUDING PLANT 3 AREA)

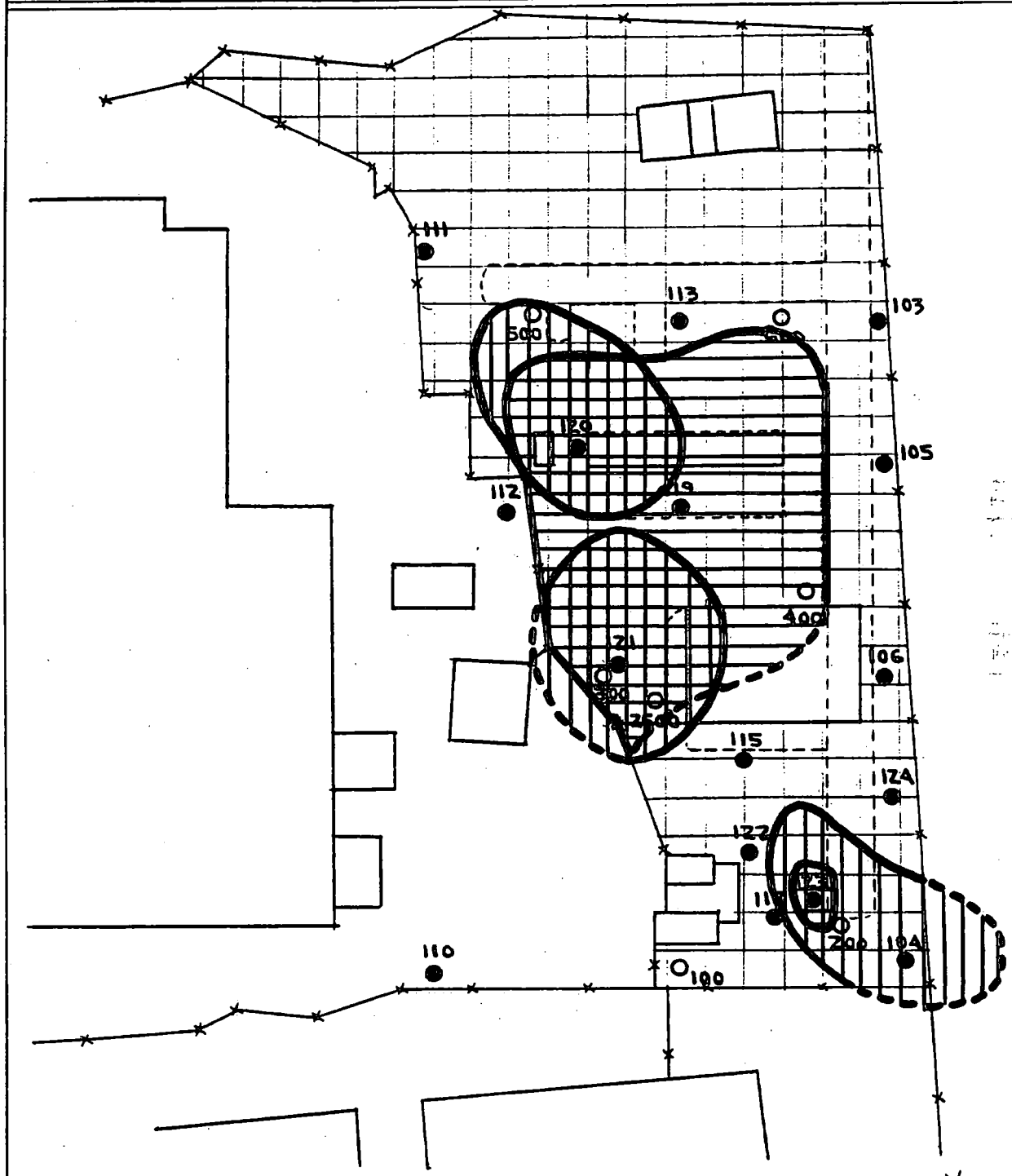
~~59,926~~ CY

91,600 CY (INCLUDING PLANT 3 AREA)

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW & DEEP SUB-SOILS (EXCLUDES PLANT 3 DATA)	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



0' 100'

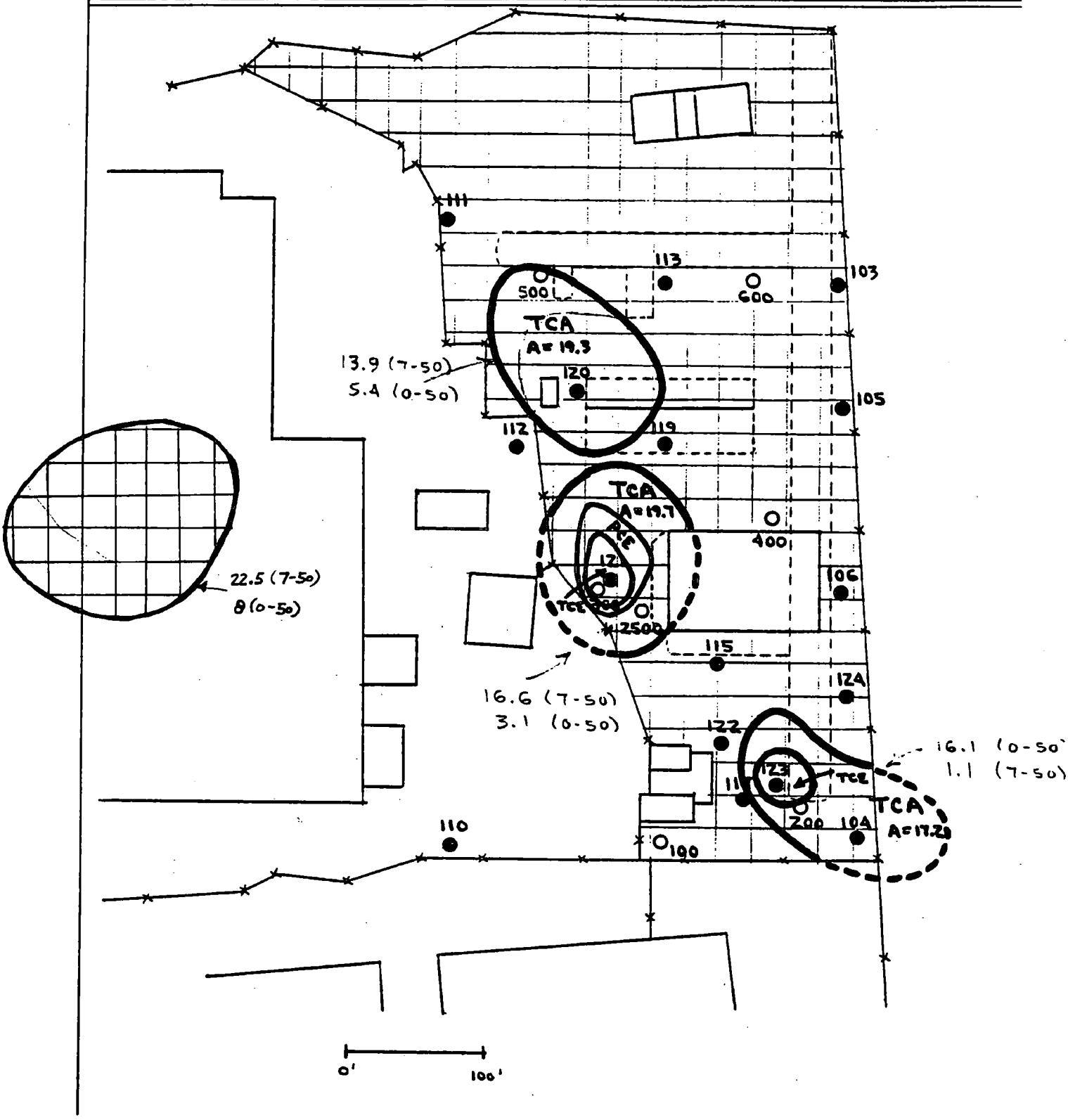
SHALLOW SUB-SOILS (0-7' DEEP) — VOLUME 9965 CY (EXCLUDING PLANT 3 AREA)

DEEP SUB-SOILS (TO 50' DEEP) — 59,926 CY (EXCLUDING PLANT 3 AREA)

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON DEEP SUB-SOILS (INCLUDES PLANT 3 DATA)	DRAWING NUMBER

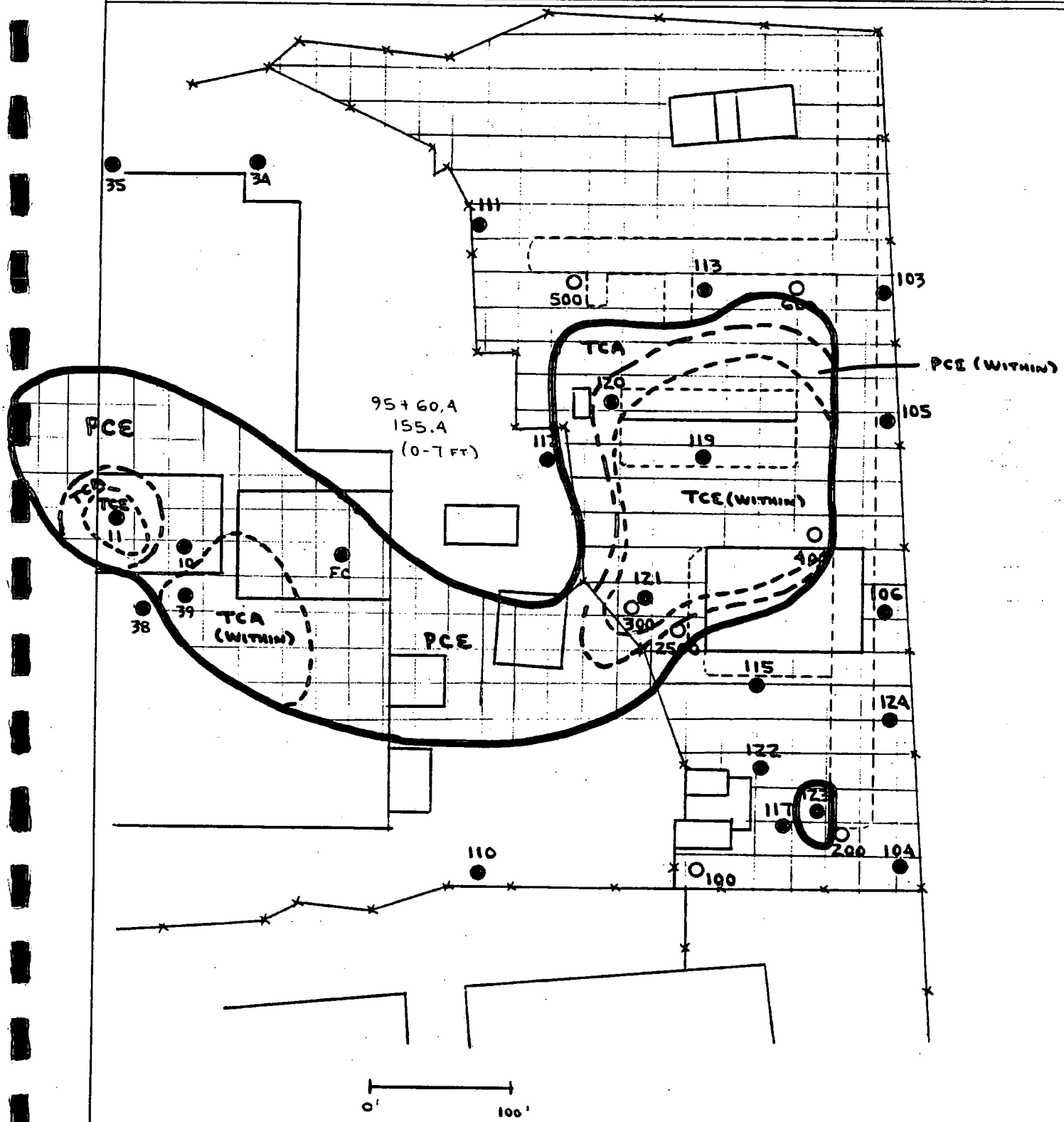
BY	CHECKED BY	APPROVED BY	DATE
GND	LEK	LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

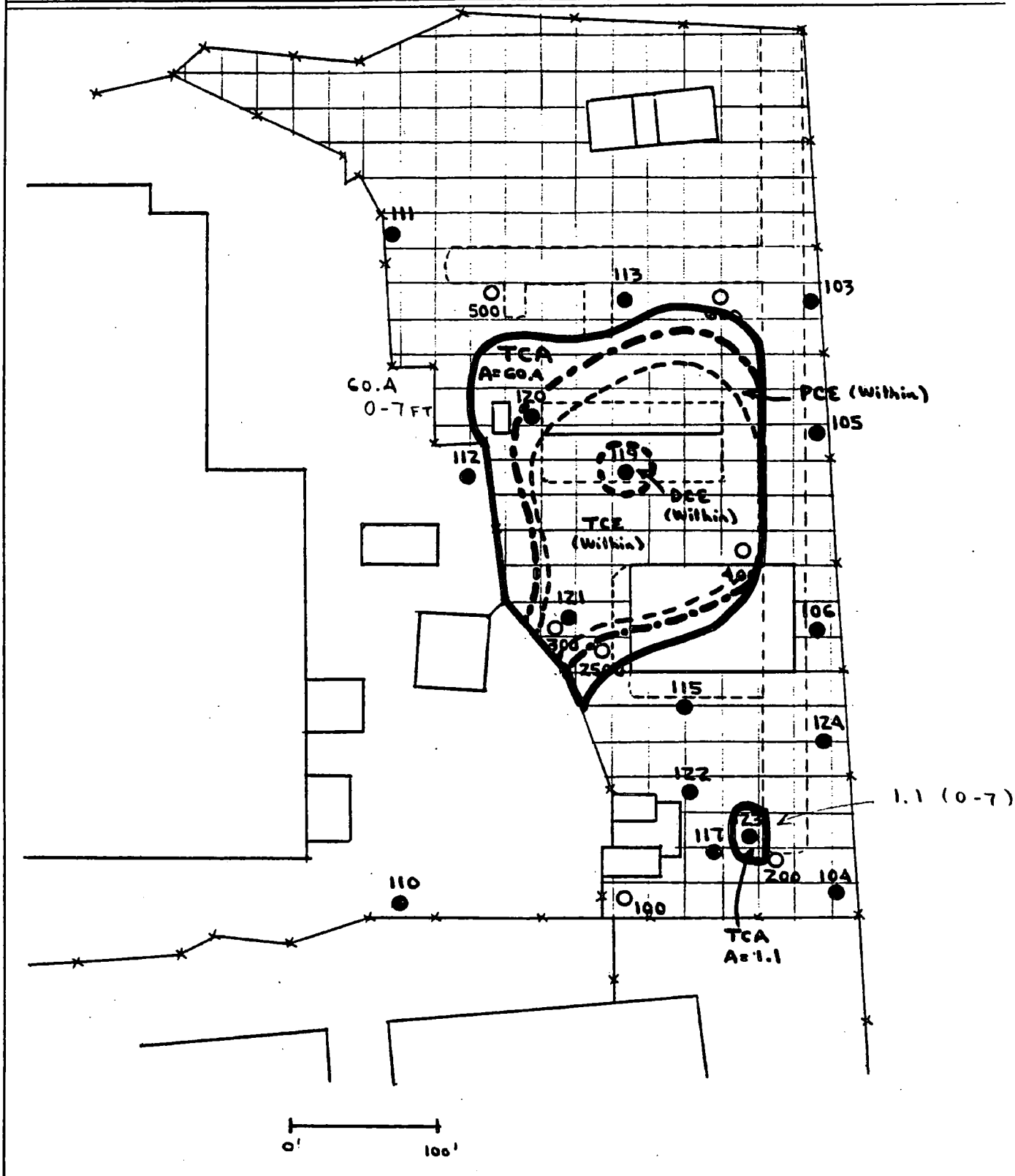
CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER:
SUBJECT: SITE 1 AREA MAP - VOAs (CURRENT & FUTURE SCENARIOS)	
BASED ON: SHALLOW SUB-SOILS (INCLUDES	DRAWING NUMBER: PLANT 3 DATA)
BY: GND / CHECKED BY:	APPROVED BY: LEK / DATE: 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW SUB-SOILS (EXCLUDES PLANT 3 DATA)	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

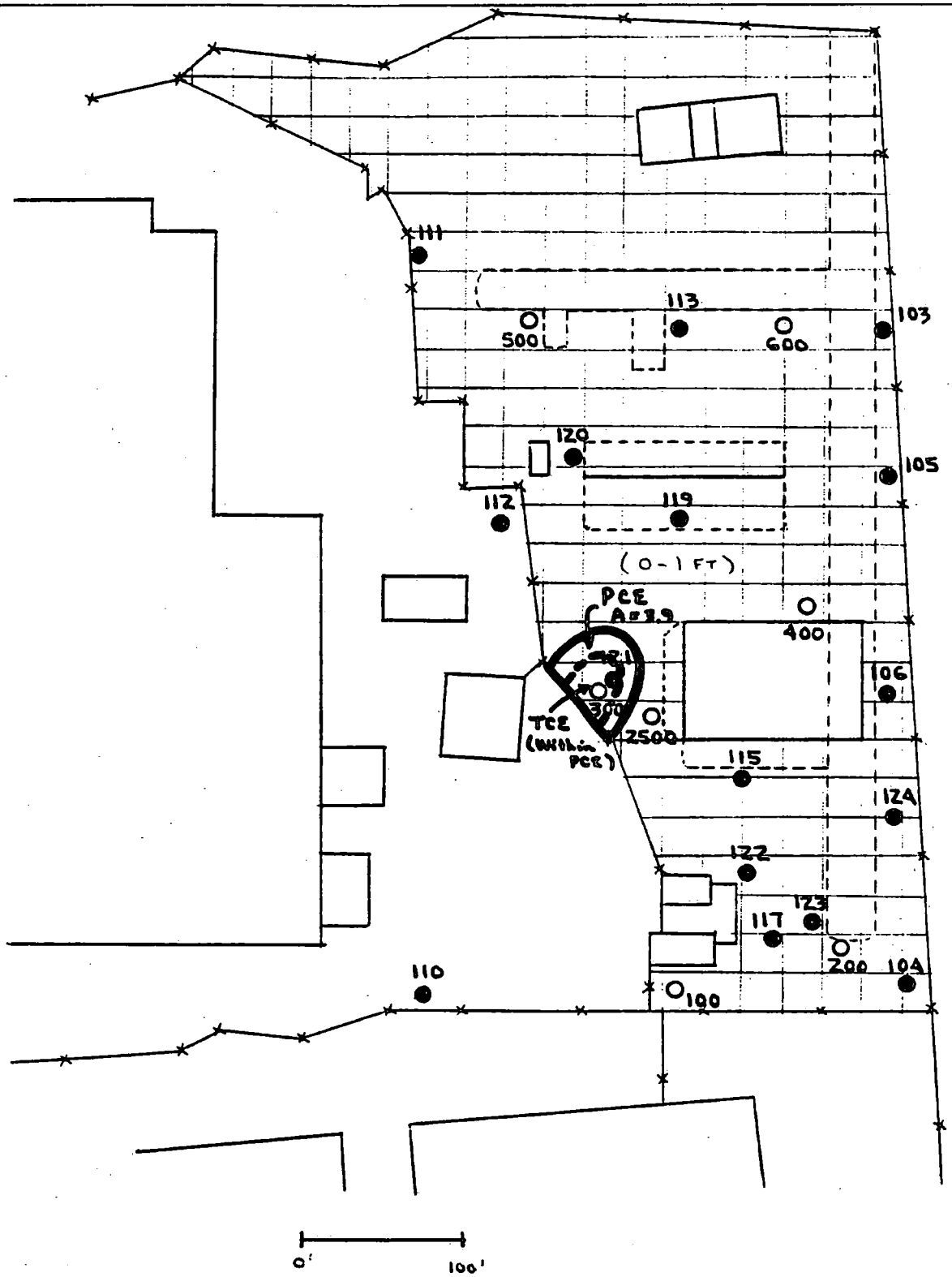


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 - CONTAMINATED SOIL VOLUME CALCULATIONS	
BASED ON CURRENT SCENARIO EXCEPT VOA's.	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

① SURFACE SOILS : FOR ARSENIC, CHLORDANE, PAH & PCB REMOVAL

DEPTH : 0 TO 1 FT.

AREA = $(100.0 + 4.4 - 6.3) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 6812.5\ YD^2$

VOLUME = $6813\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{2271\ CY}$

② SURFACE SOIL / SHALLOW SUB-SOIL : FOR MANGANSE REMOVAL

DEPTH : 0 TO 7 FT.

AREA = $(6.3 + 0.5) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 472.2\ YD^2$

VOLUME = $472\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{1102\ CY}$

③ SHALLOW SUB-SOIL : ENDRIN REMOVAL

DEPTHS : 1 TO ~~5~~ 7 FT AND 2 TO ~~5~~ 7 FT.

AREA 1 = $\overset{(1.1+3.3)}{4.4} \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 306.\ YD^2$

AREA 2 = $3.1 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 215\ YD^2$

VOLUME = $306\ YD^2 \times \overset{7-1}{(5-1)}\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} + 215\ YD^2 \times \overset{7-2}{(5-2)}\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}}$

VOLUME = $\overset{612}{\cancel{408}}\ CY + \overset{358}{\cancel{215}}\ CY = \boxed{970\ CY}$ $\boxed{\cancel{625}\ CY}$

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 1 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON CURRENT SCENARIO EXCEPT VOA's.		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

(4) SHALLOW SUB-SOIL : FOR ARSENIC REMOVAL

DEPTH : 1 TO 7 FT. AND 2 TO 7 FT.

$$\text{AREA}_1 = (66.8 - 4.4 - 5.8 - 3.2) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 3708\ YD^2$$

$$\text{AREA}_2 = 3.2 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 222\ YD^2$$

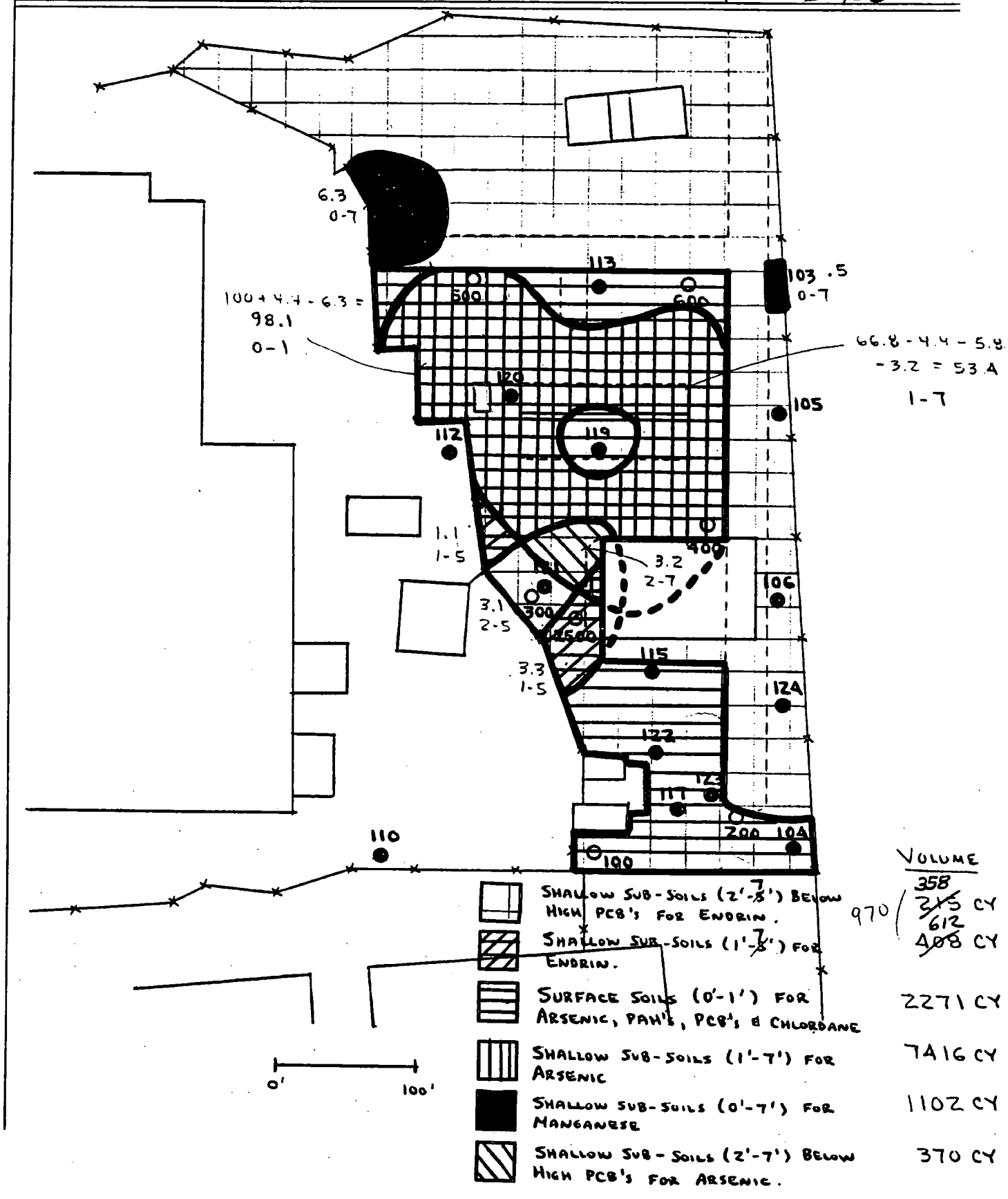
$$\text{VOLUME} = 3708\ YD^2 \times (7-1)\cancel{FT} \times \frac{YD}{3\cancel{FT}} + 222\ YD^2 \times (7-2)\cancel{FT} \times \frac{YD}{3\cancel{FT}}$$

$$\text{VOLUME} = 7416\ CY + 370\ CY = \boxed{7786\ CY}$$

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - ARSENIC, MANGANESE, PCB's, PAH's, ENDRIN (CURRENT)	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



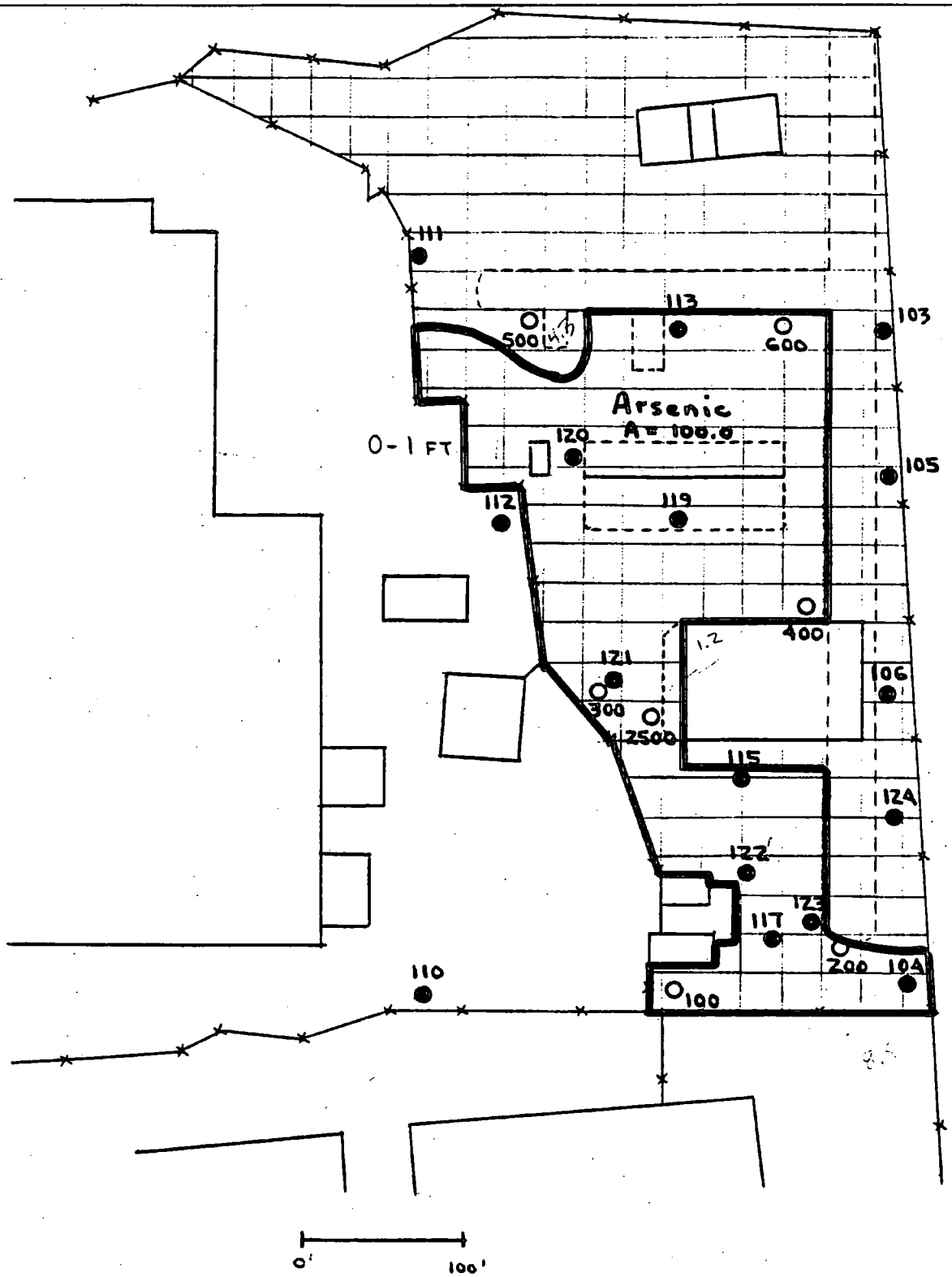
	VOLUME
SHALLOW SUB-SOILS (2'-~~5~~ 7') BELOW HIGH PCB's FOR ENDRIN.	970 (~~215~~ 358 CY
SHALLOW SUB-SOILS (1'-~~5~~ 7') FOR ENDRIN.	~~408~~ 612 CY
SURFACE SOILS (0'-1') FOR ARSENIC, PAH's, PCB's & CHLORDANE	2271 CY
SHALLOW SUB-SOILS (1'-7') FOR ARSENIC	7416 CY
SHALLOW SUB-SOILS (0'-7') FOR MANGANESE	1102 CY
SHALLOW SUB-SOILS (2'-7') BELOW HIGH PCB's FOR ARSENIC.	370 CY

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - INORGANICS (CURRENT SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

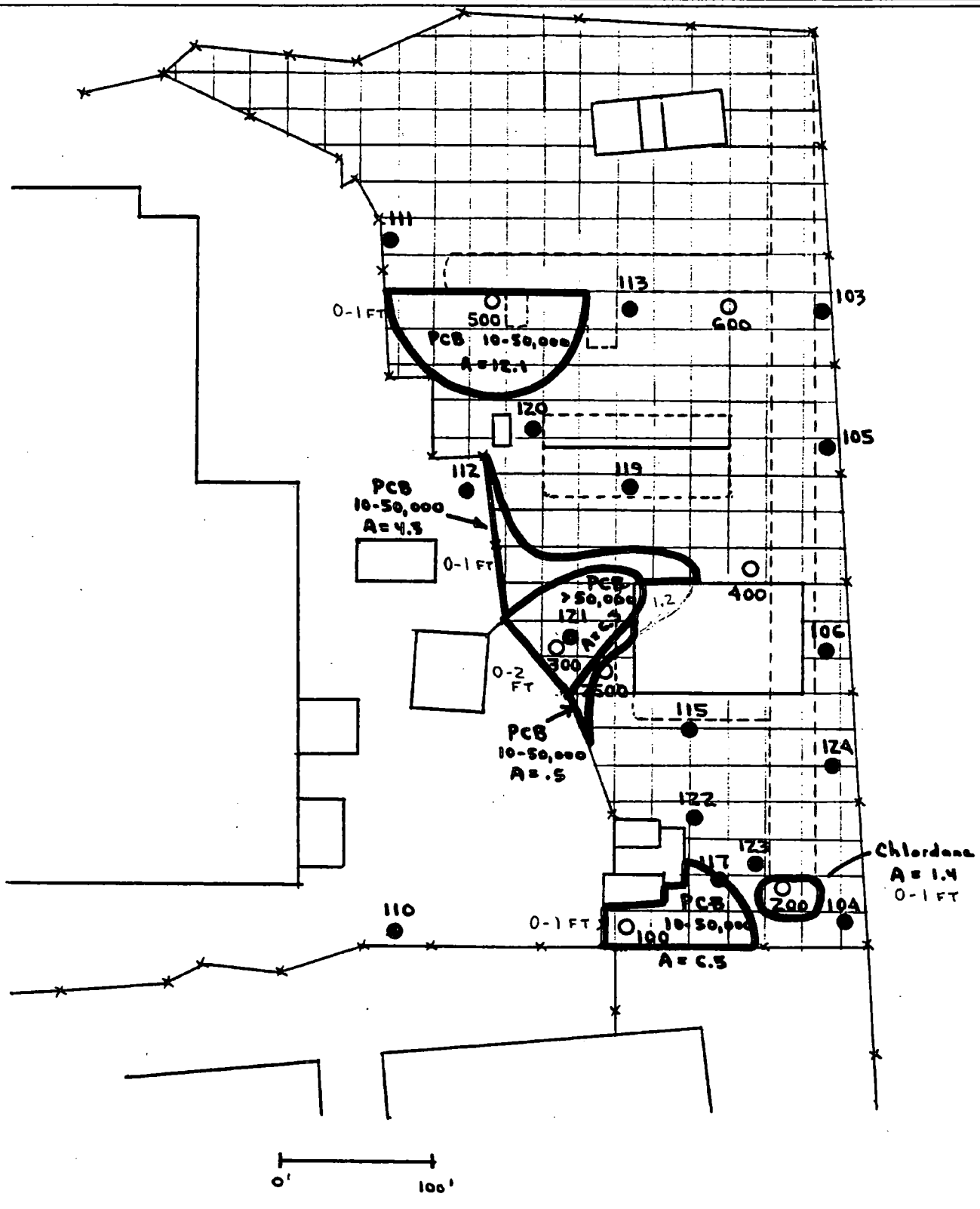


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PESTICIDES / PCB's (CURRENT SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

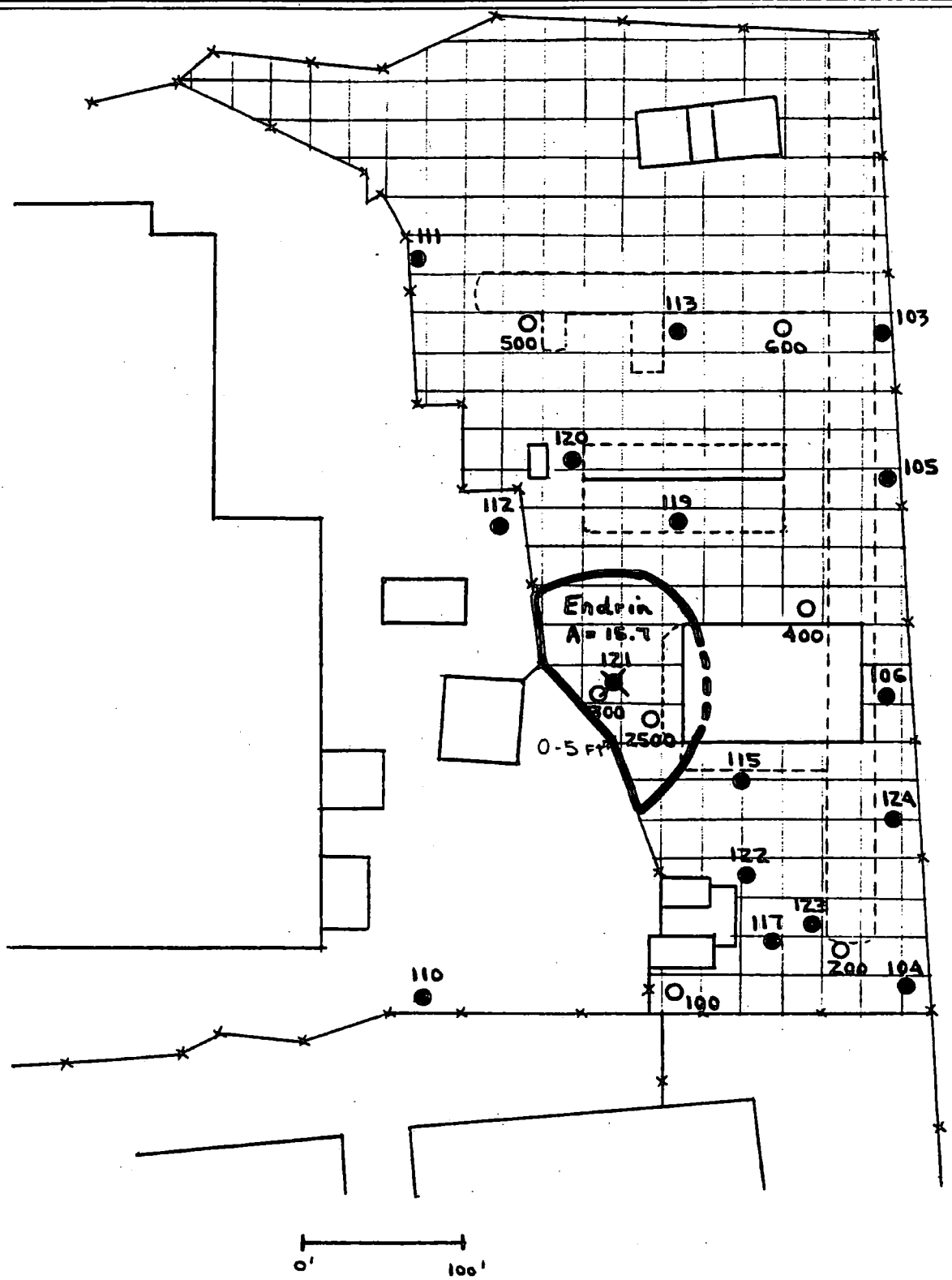


CALCULATION WORKSHEET

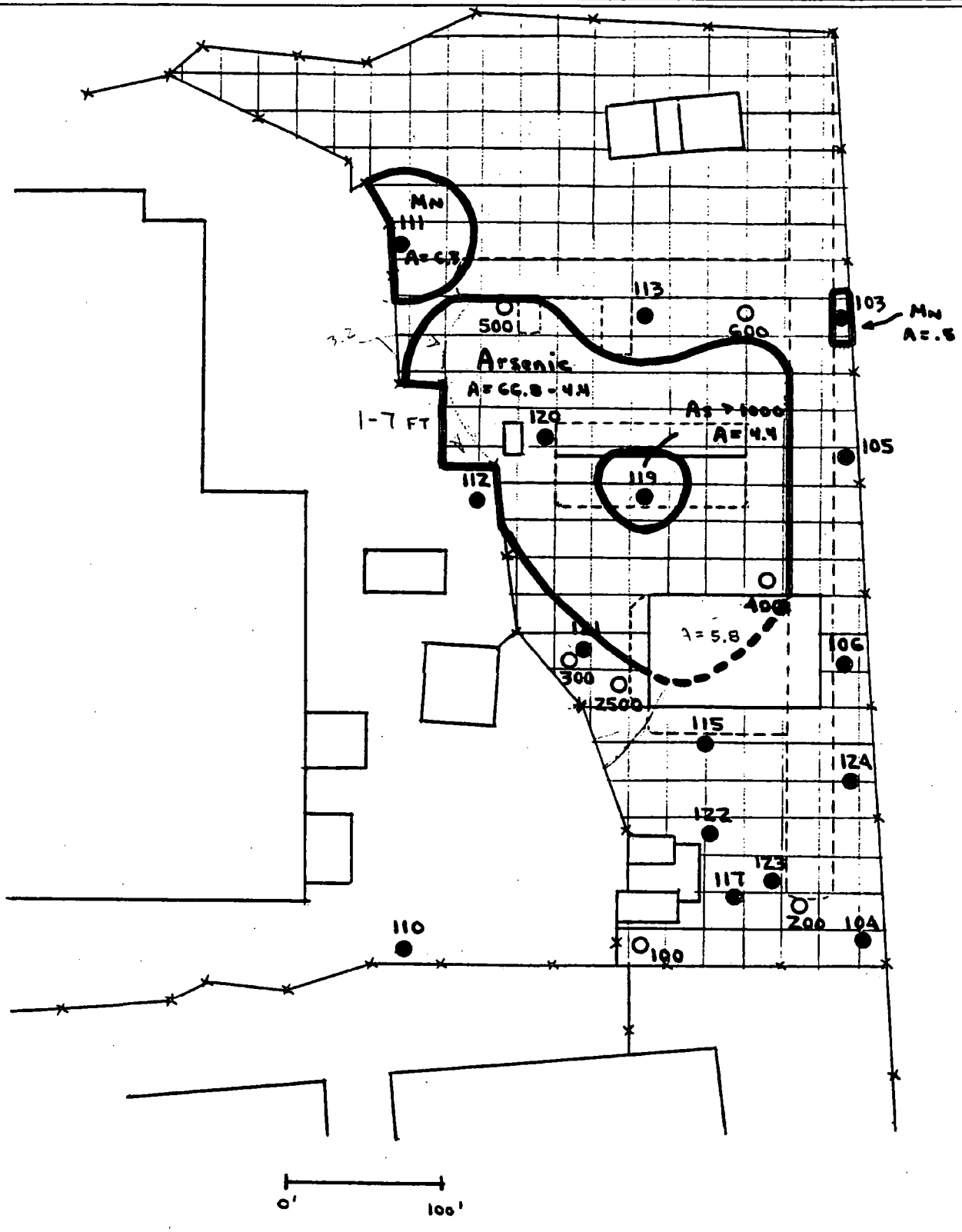
Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PESTICIDES / PCB'S (CURRENT SCENARIO)	
BASED ON SHALLOW SUB - SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



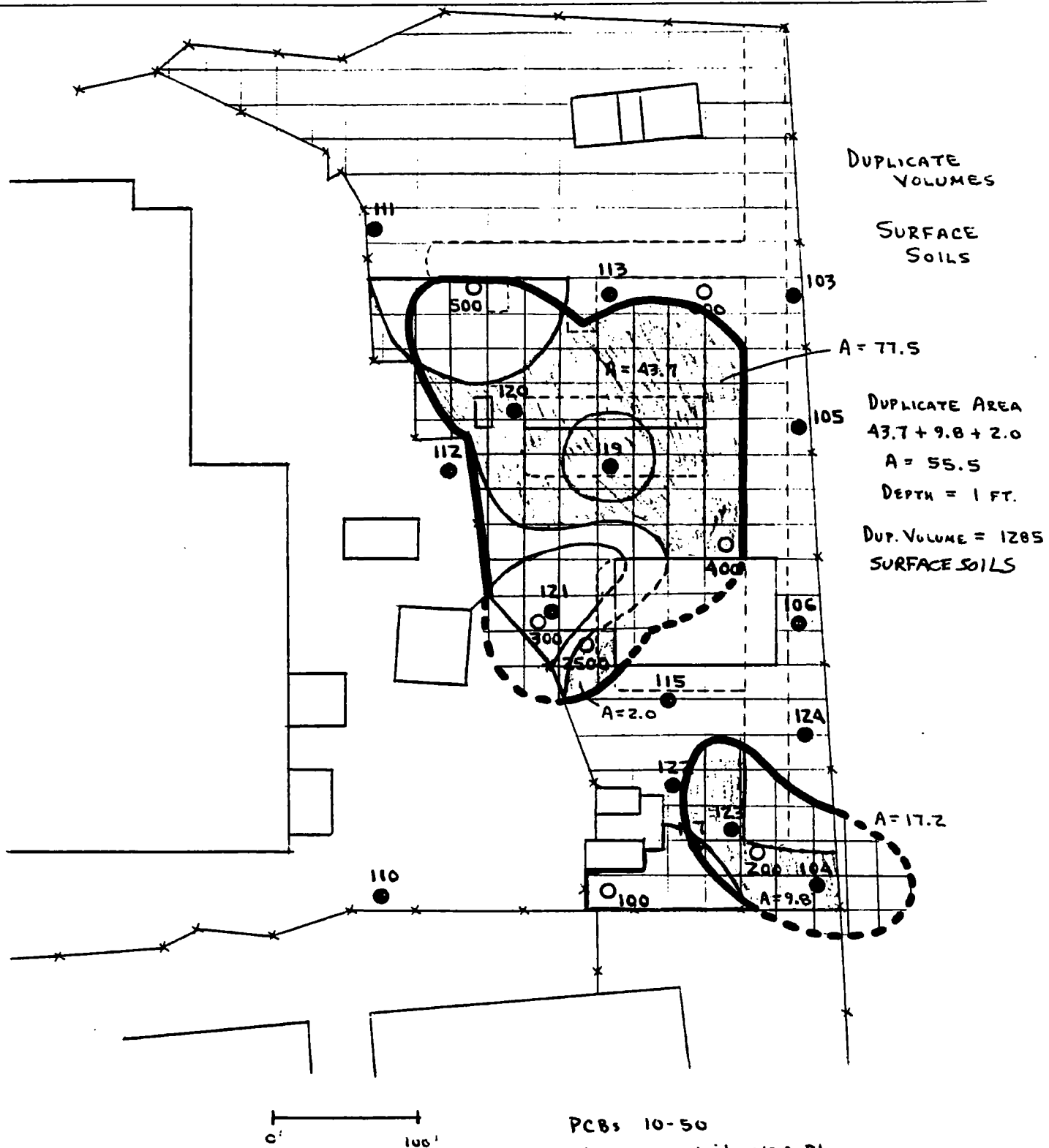
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - INORGANICS (CURRENT SCENARIO)	
BASED ON SHALLOW SUB - SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT		JOB NUMBER	
SUBJECT SITE 1 VOA OVERLAP W/ METALS & OTHER ORGANICS (SURFACE SOILS)			
BASED ON CURRENT SCENARIO		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

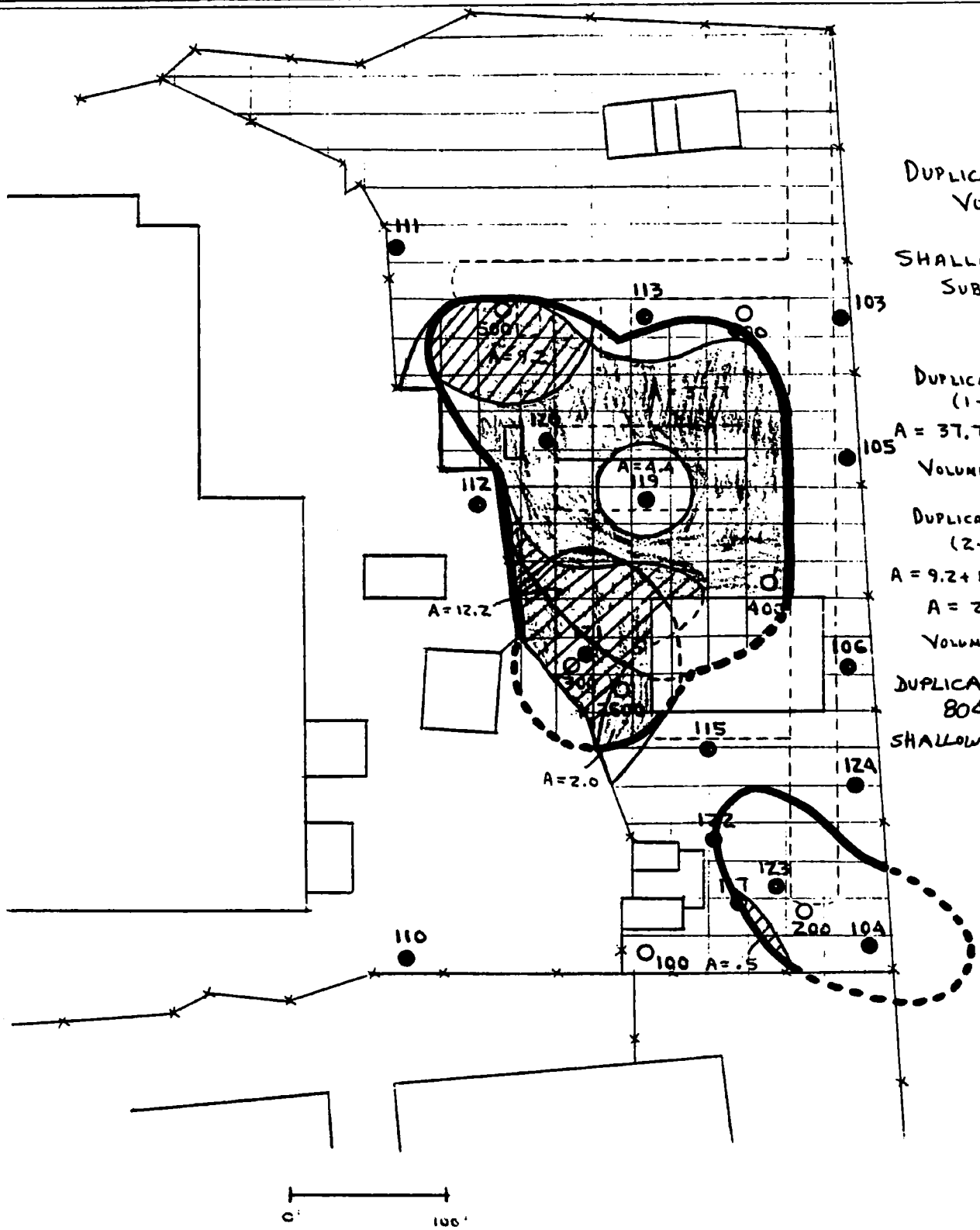


PCBs 10-50
A = 7.7 outside VOA Plume
Vol. = 360 CY outside Plume

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT	JOB NUMBER
SUBJECT: SITE 1 VOA OVERLAP W/ METALS & OTHER ORGANICS	
BASED ON: CURRENT SCENARIO	DRAWING NUMBER: (SHALLOW SUBSOILS)
BY	CHECKED BY	APPROVED BY: LEK	DATE: 8/30/93



DUPLICATE VOLUMES

SHALLOW SUB-SOILS

DUPLICATE AREA (1-7 FT)

A = 37.7 + 2.0 = 39.7

VOLUME = 5514

DUPLICATE AREA (2-7 FT)

A = 9.2 + 12.2 + .5

A = 21.9

VOLUME = 2535

DUPLICATE VOLUME 8049 CY SHALLOW SUBSOILS

NOTE: VOLUME DUPLICATED UNDER SLAB & BERM = 8950 CY

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 - CONTAMINATED SOIL VOLUME CALCULATIONS	
BASED ON FUTURE SCENARIO EXCEPT VOA's.	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

① SURFACE SOILS : FOR ARSENIC, CHLORDANE, PAH & PCB REMOVAL

DEPTH : 0 TO 1 FT.

$$\text{AREA} = (100 + 4.4 - 6.3) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 6812.5\ YD^2$$

$$\text{VOLUME} = 6813\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{2271\ CY}$$

② SHALLOW SUB-SOIL : FOR ENDRIN & PCB REMOVAL

DEPTHS : 1 TO 5 FT AND 2 TO 7 FT.

$$\text{AREA}_1 = (3.6 + 2.5) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 423.6\ YD^2$$

$$\text{AREA}_2 = 5.7 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 395.8\ YD^2$$

$$\text{VOLUME} = 424\ YD^2 \times (\overset{7-1}{\cancel{5}-1})\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} + 396\ YD^2 \times (\overset{7}{\cancel{5}}-2)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}}$$

$$\text{VOLUME} = \overset{848}{\cancel{565}}\ CY + \overset{660}{\cancel{396}}\ CY = \boxed{\cancel{961}\ CY}\ 1508$$

③ SHALLOW SUB-SOIL : FOR ARSENIC REMOVAL

DEPTHS : 1 TO 7 FT AND 2 TO 7 FT.

$$\text{AREA}_1 = (41.7 - 4.4 - 20 - .7) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 2403\ YD^2$$

$$\text{AREA}_2 = (0.7) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 48.6\ YD^2$$

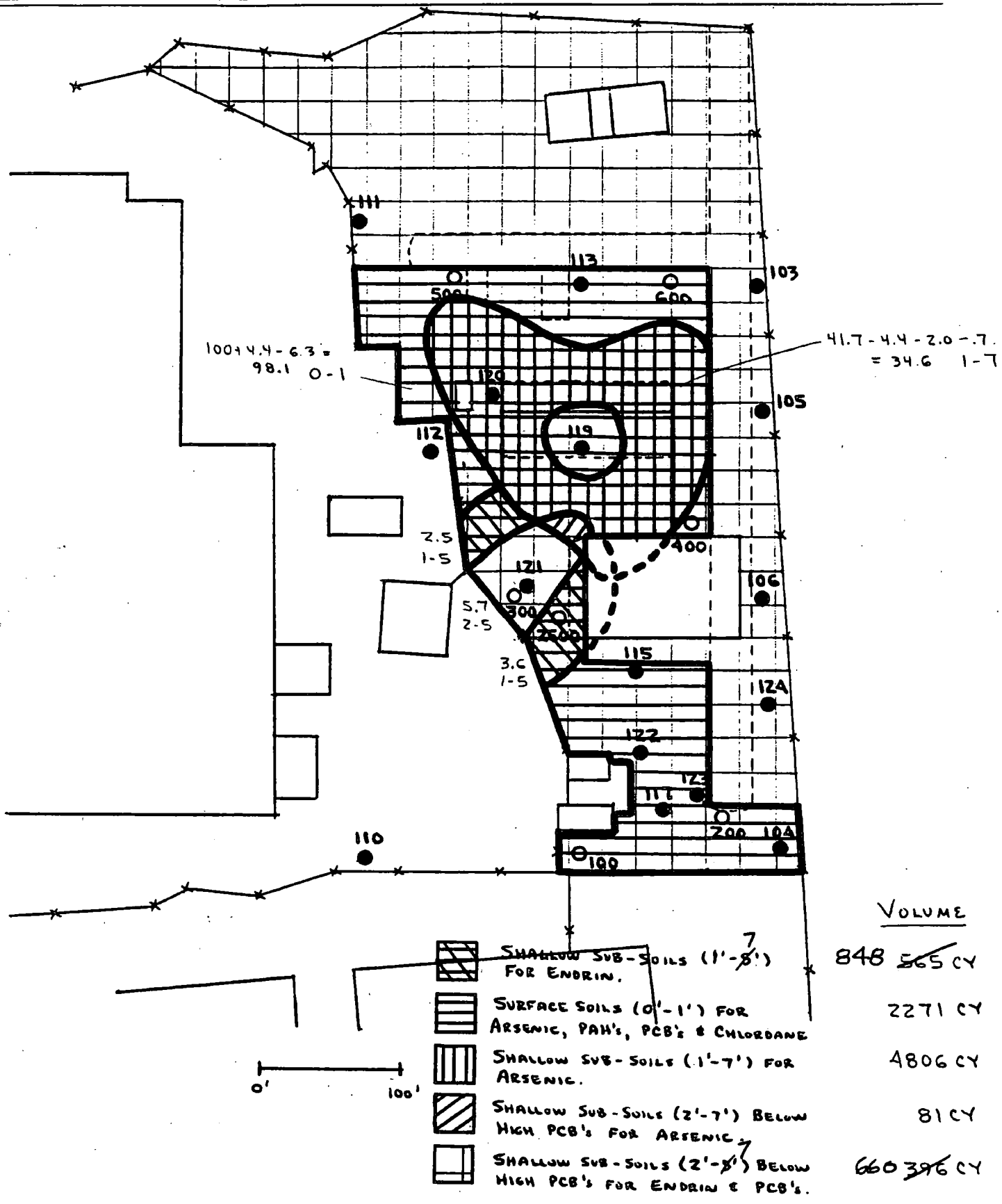
$$\text{VOLUME} = 2403\ YD^2 \times (7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} + 48.6\ YD^2 \times (7-2)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}}$$

$$\text{VOLUME} = 4806\ CY + 81\ CY = \boxed{4887\ CY}$$

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - ARSENIC, PCB'S, PAH'S & ENDRIN (FUTURE)	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

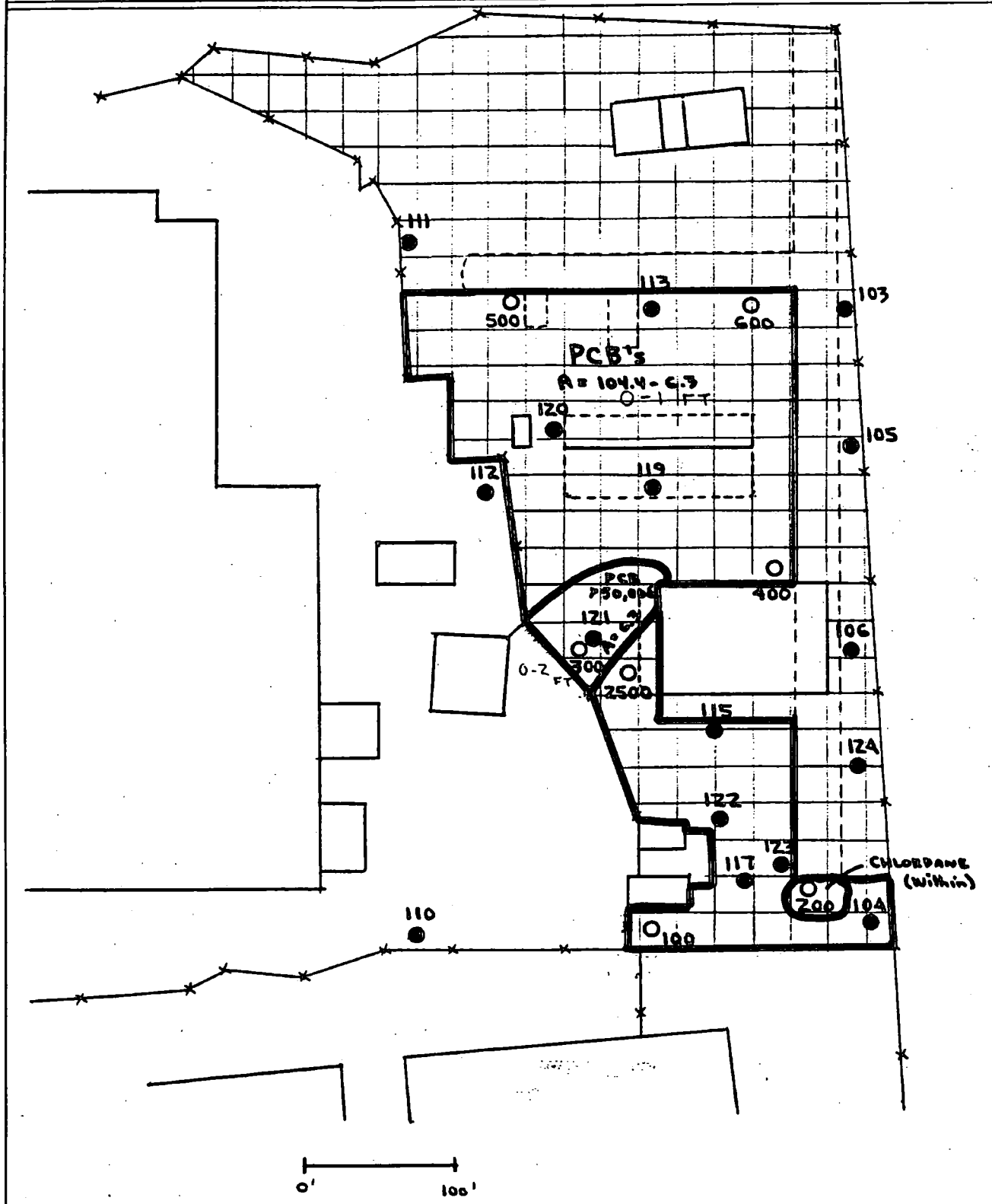


	VOLUME
SHALLOW SUB-SOILS (1'-~~8'~~ 7') FOR ENDRIN.	848 ~~565~~ CY
SURFACE SOILS (0'-1') FOR ARSENIC, PAH'S, PCB'S & CHLORDANE	2271 CY
SHALLOW SUB-SOILS (1'-7') FOR ARSENIC.	4806 CY
SHALLOW SUB-SOILS (2'-7') BELOW HIGH PCB'S FOR ARSENIC.	81 CY
SHALLOW SUB-SOILS (2'-~~8'~~ 7') BELOW HIGH PCB'S FOR ENDRIN & PCB'S.	660 ~~396~~ CY

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

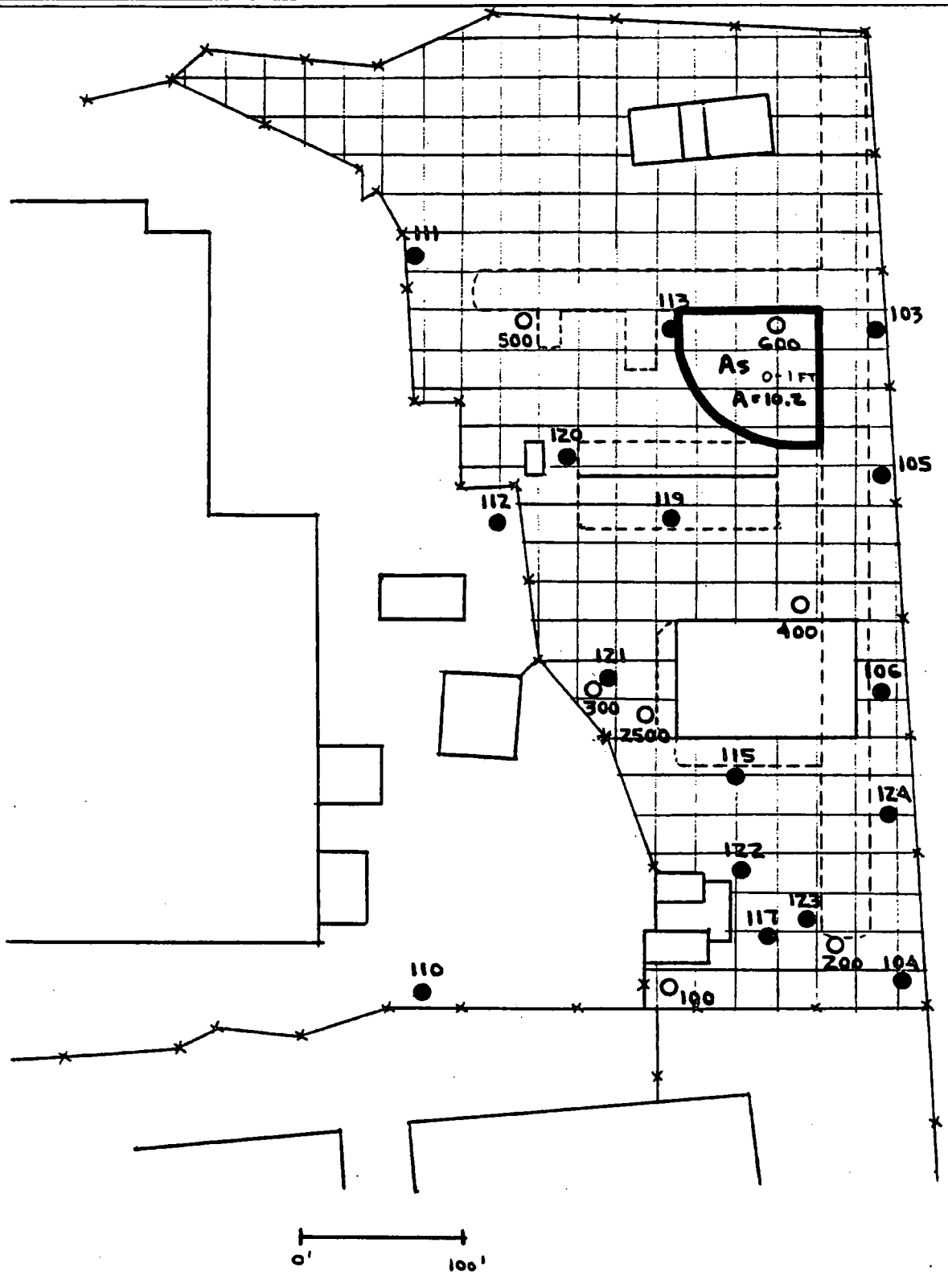


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - INORGANICS (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

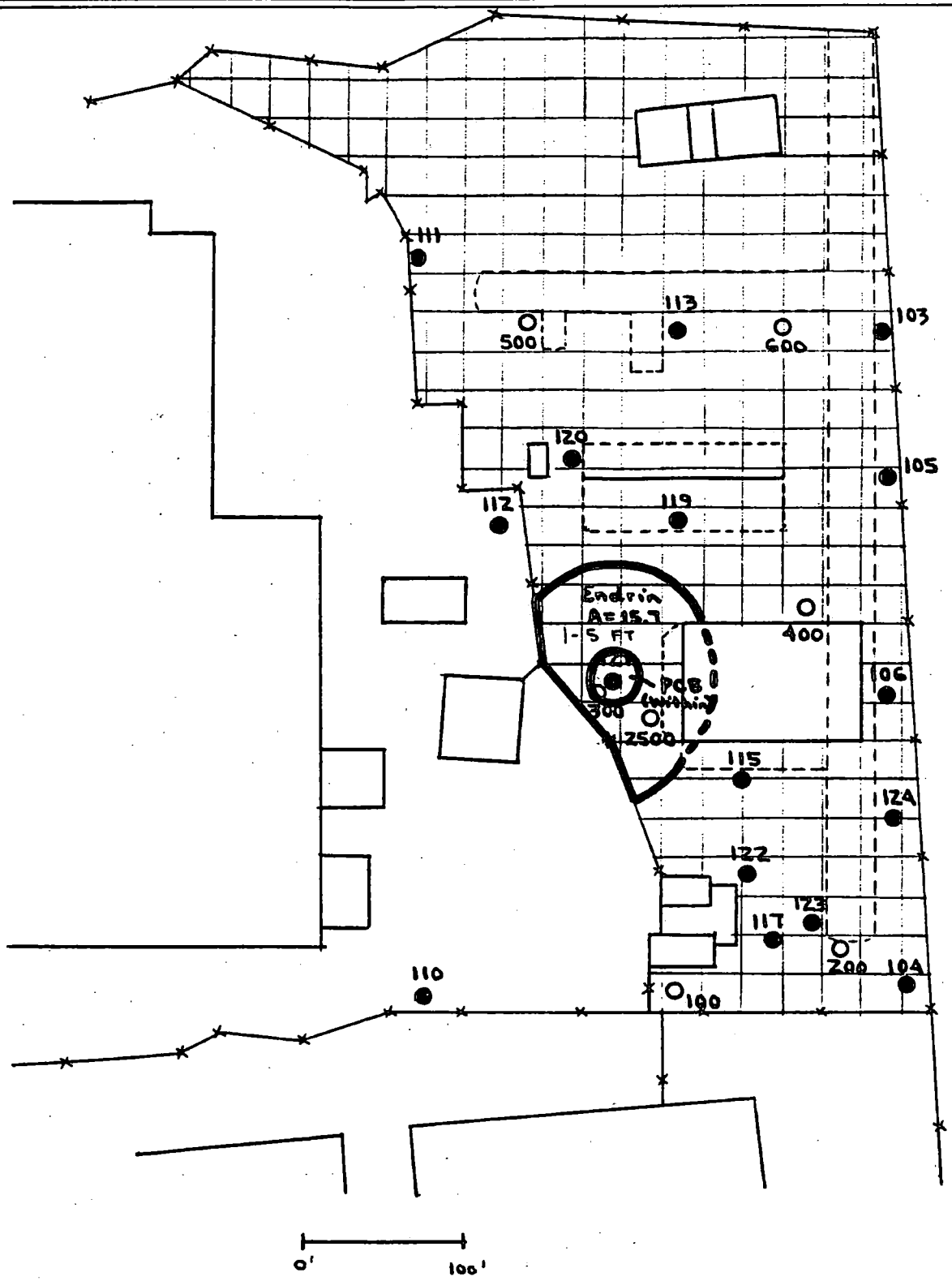


CALCULATION WORKSHEET

Order No. 19118 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SHALLOW SUB - SOILS	DRAWING NUMBER

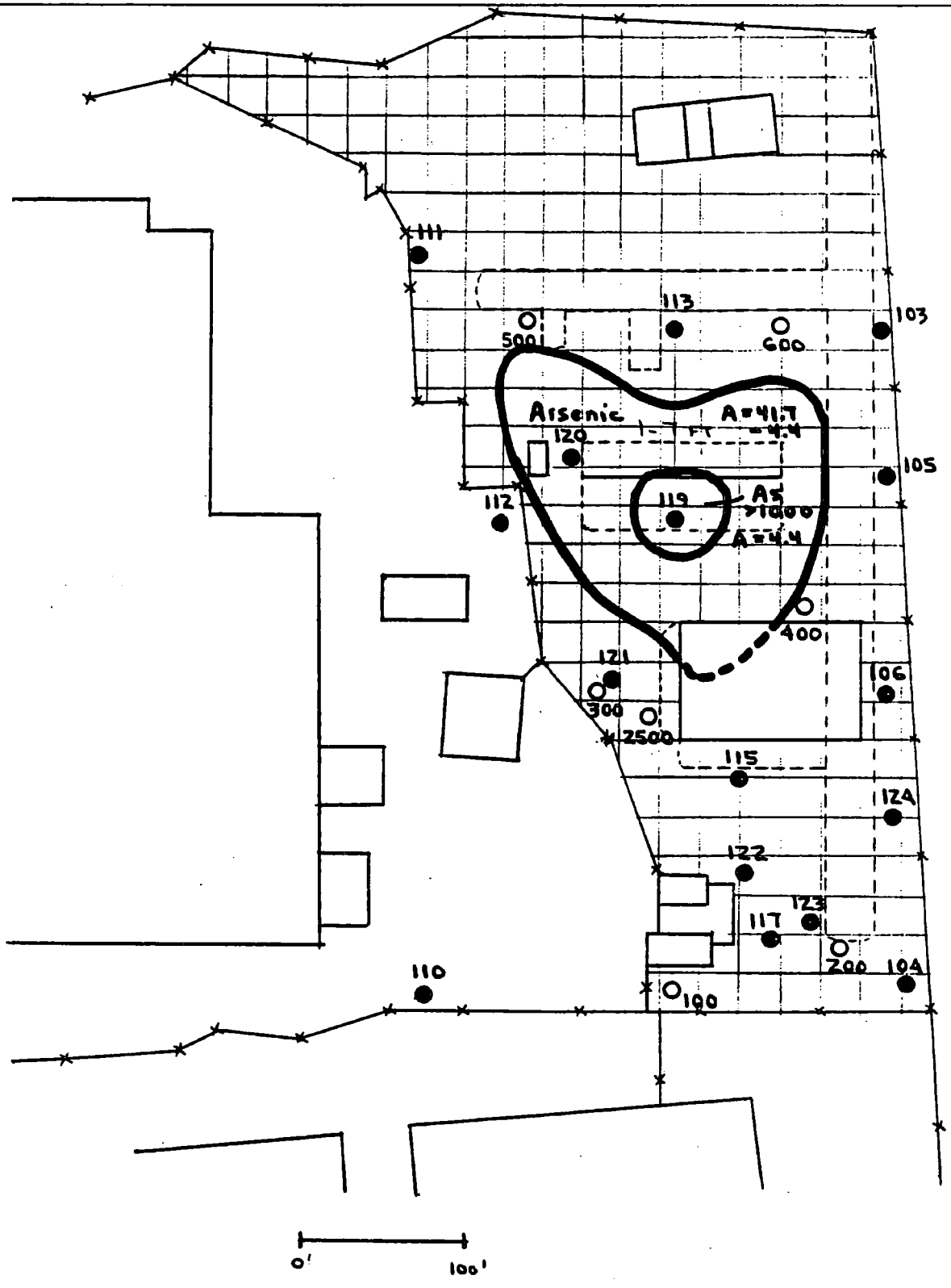
BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

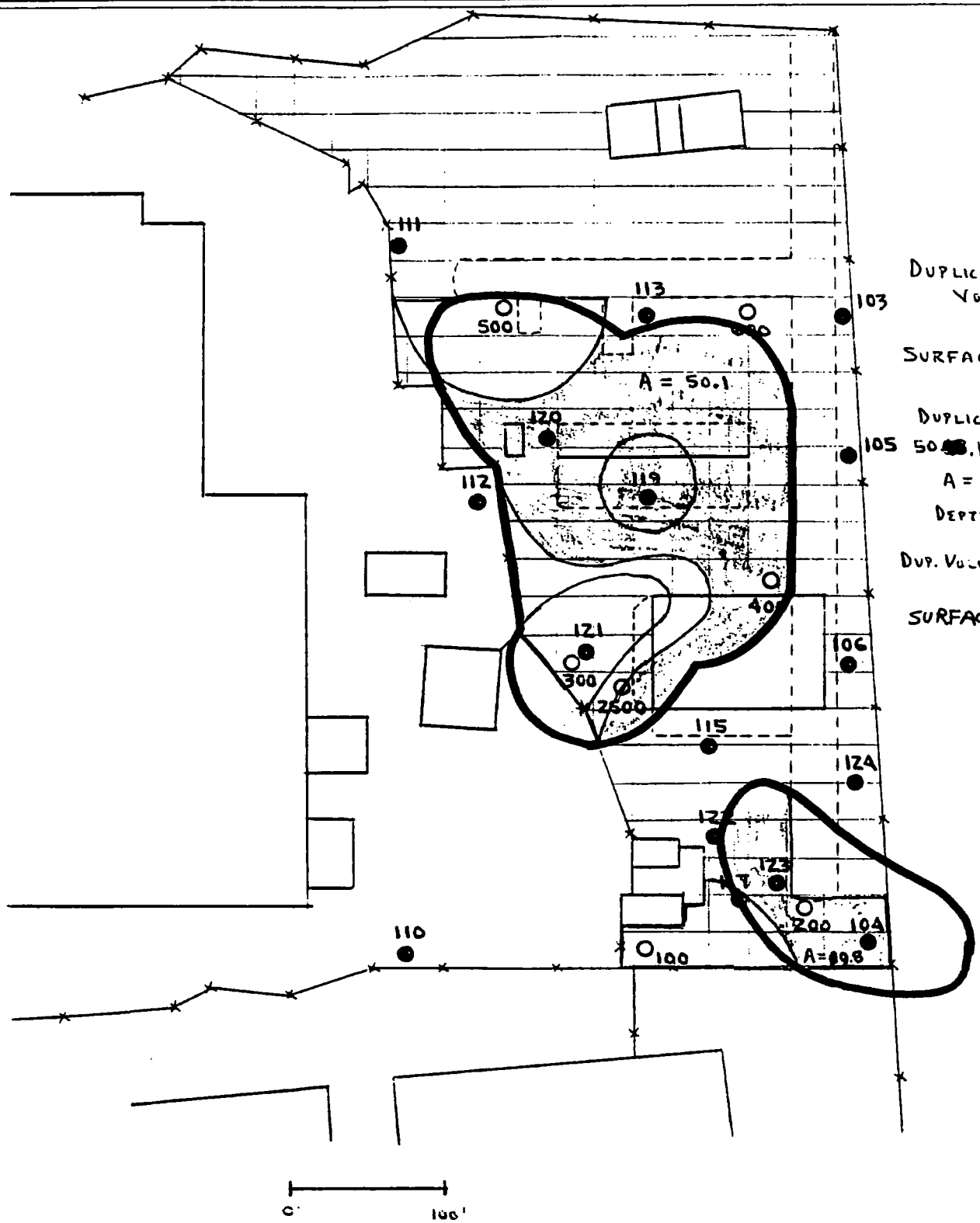
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 1 AREA MAP - INORGANICS (FUTURE SCENARIO)	
BASED ON SHALLOW SUB - SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT		JOB NUMBER	
SUBJECT SITE 1 - VOA OVERLAP W/ METALS & OTHER ORGANICS (SURFACE SOILS)			
BASED ON FUTURE SCENARIO		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY LEK	DATE 8/30/93



DUPLICATE VOLUMES

SURFACE SOILS

DUPLICATE AREA

50.1 + 89.8

A = 57.9

DEPTH = 1 FT.

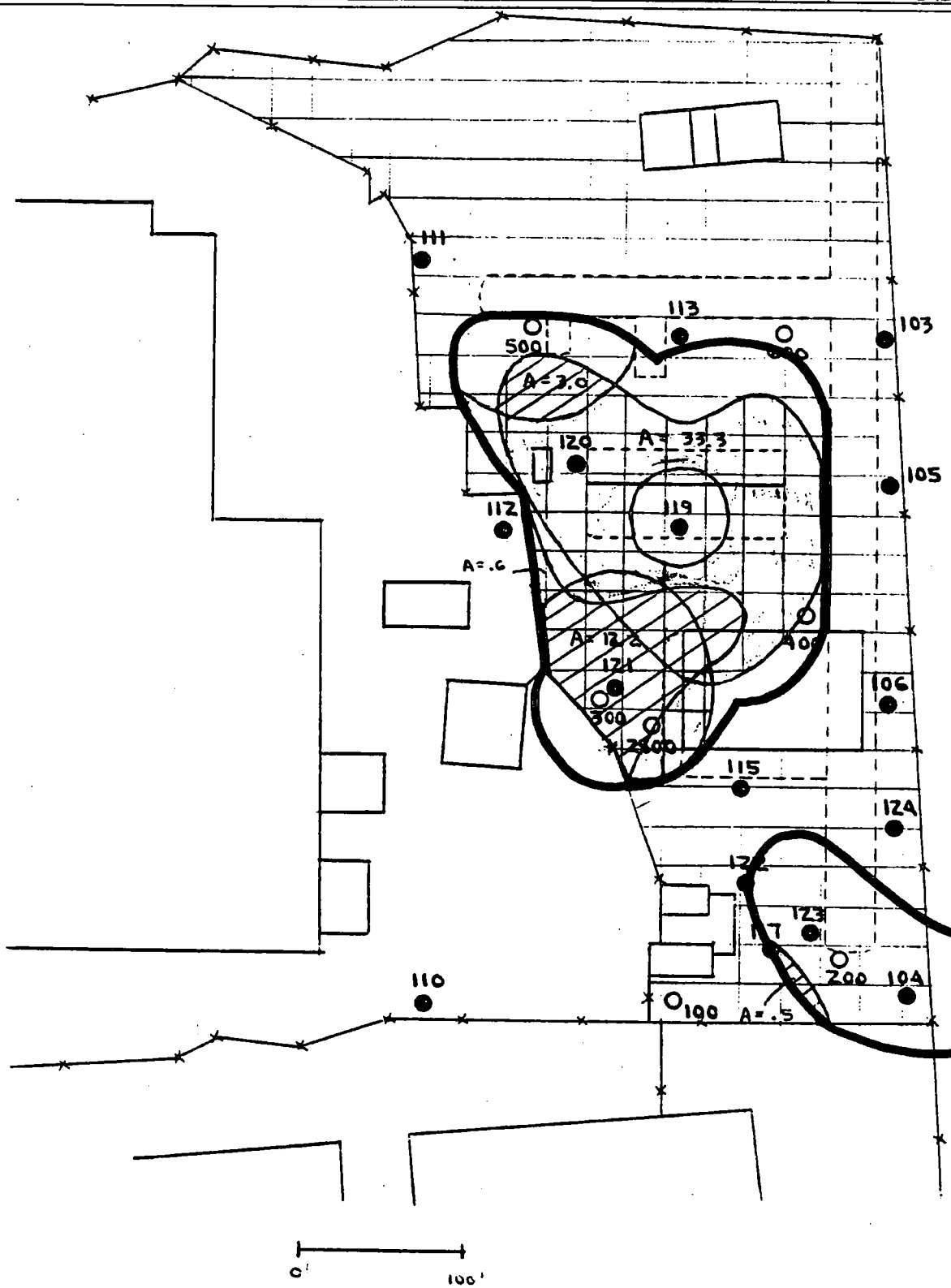
DUP. VOLUME = 1387

SURFACE SOILS

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT		JOB NUMBER	
SUBJECT SITE 1 - VOA OVERLAP W/ METALS & OTHER ORGANICS			
BASED ON FUTURE SCENARIO		DRAWING NUMBER (SHALLOW SUBSOILS	
BY	CHECKED BY	APPROVED BY LEK	DATE 8/30/93



DUPLICATE VOLUMES

SHALLOW SUB-SOILS

DUPLICATE AREA (1-7 FT)

A = 33.3

VOLUME = ~~5396~~ 4625

DUPLICATE AREA (2-7 FT)

A = 13.2 + .5 + 3.0 - .6

A = ~~16.7~~ 16.1

VOLUME = ~~1747~~ ~~1973~~ 1863

TOTAL DUP. VOLUME

~~7329~~ 6488

SHALLOW SUBSOILS

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 1 - PCB CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① PCBs GREATER THAN 50,000 μg/kg

Ⓐ SURFACE SOILS (0-2 FT DEPTH)

$$\text{AREA} = 6.3 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = \underline{437\ YD^2}$$

$$\text{VOLUME} = 437\ YD^2 \times 2\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{292\ CY}$$

② PCBs BETWEEN 10,000 μg/kg AND 50,000 μg/kg

Ⓐ SURFACE SOILS (0-2 FT DEPTH)

$$\text{AREA} = (12.1 + 6.0 + 6.5) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = \underline{1708\ YD^2}$$

$$\text{VOLUME} = 1708\ YD^2 \times 2\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{\cancel{570}\ 1140\ CY}$$

③ PCBs BETWEEN 1000 μg/kg AND 10,000 μg/kg

Ⓐ SHALLOW SUB SOILS (~~0~~ 2 - 7 FT DEPTH)*

$$\text{AREA} = 1.0 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = \underline{70\ YD^2}$$

$$\text{VOLUME} = 70\ YD^2 \times \overset{(7-2)}{5}\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{116\ CY}$$

Ⓑ SURFACE SOILS (0-1 FT DEPTH)

$$\text{AREA} = (105.6 - 12.1 - 6.0 - 6.5 - 6.3) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = \underline{5188\ YD^2}$$

$$\text{VOLUME} = 5188\ YD^2 \times 1\ FT \times \frac{YD}{3\ FT} = \boxed{1729\ CY}$$

* Completely within area of > 50,000 μg/kg Surface Soil Plume.

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 1 - PCB CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON SURFACE SOIL / SHALLOW SUB SOIL		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

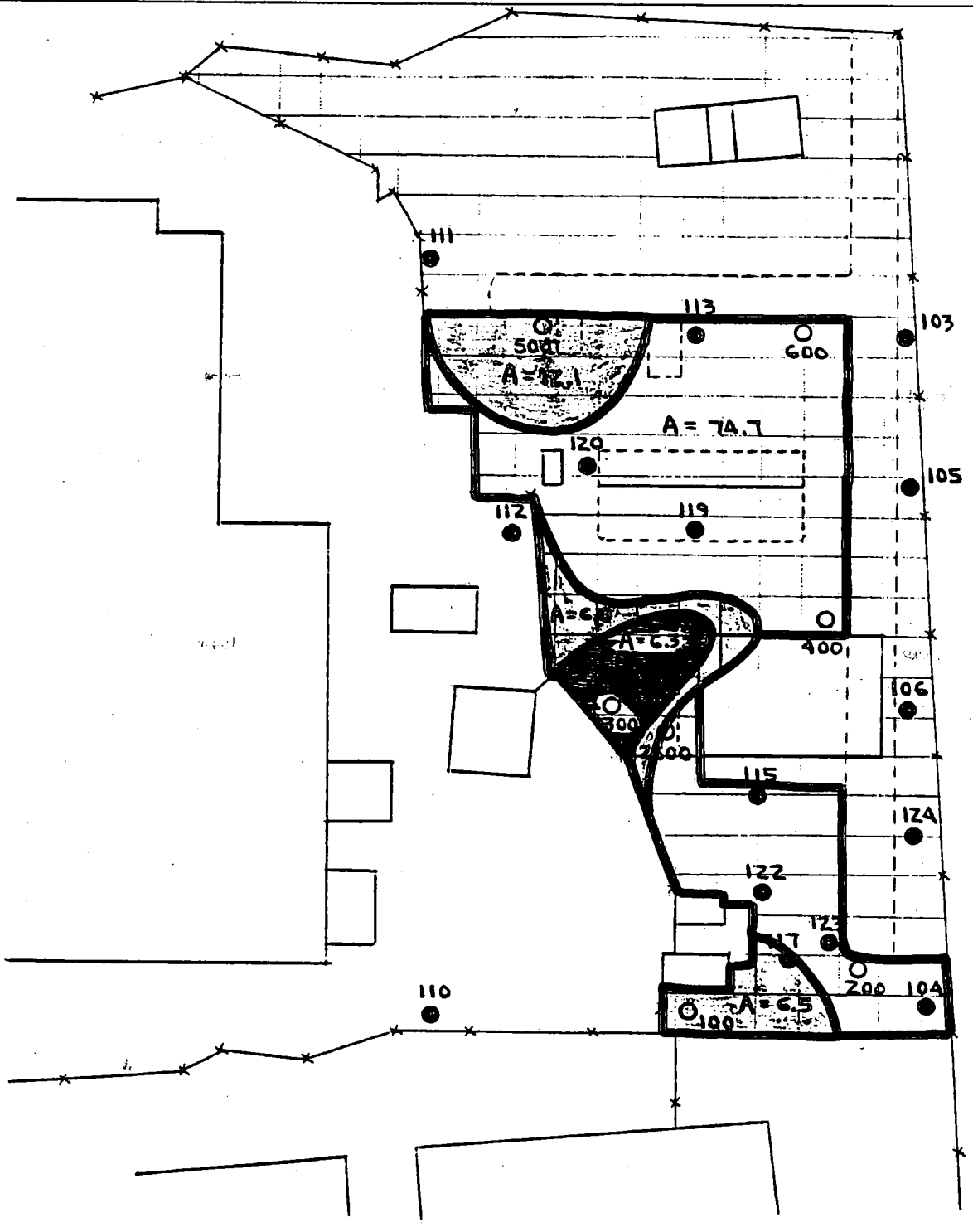
TOTAL VOLUME OF PCB CONTAMINATED SOIL BETWEEN 1000 µg/kg AND 10,000 µg/kg :

$$V = 116 \text{ CY} + 1729 \text{ CY} = \underline{\underline{1845 \text{ CY}}}$$

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT: SITE 1 AREA MAP - PCB's CONTAMINATION	
BASED ON: SURFACE SOILS / SHALLOW SUB SOILS	DRAWING NUMBER
BY: GND / CHECKED BY	APPROVED BY: LEK / DATE: 8/30/93



A = 105.6 - 12.1 - 6.3 - 6.0 - 6.5
A = 74.7

0' 100'

SURFACE SOILS (1-10)	A = 74.7
SURFACE SOILS (10-50)	A = 24.6
SURFACE SOILS (>50)	A = 6.3

NOTE: SHALLOW SUB SOILS (1-10) WITHIN >50 SURFACE SOIL PLUME
A = 1.0

SITE 2

SOIL CALCULATIONS

SITE 2

SOIL ACTION LEVELS

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 2 - RECHARGE BASINS
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 2**
SITE AREA (SF)	50,000
INFILTRATION FLOW RATE (CFY)	57,500
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	10.10
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcinogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 2						
	--DRINKING WATER LAWS-- New York MCL (ug/l)	NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	11.74	64,000	527,000	11.74	32.0	Y (2)
Tetrachloroethene	5	5	5	5	364.0	0.67049	33.9	14,000	112,000	33.9	8.00	N
Chloroform	50		7	7	44.00	0.08105	5.73	110,000	29.0	5.73	1.00	N
Toluene	5	1000	5	5	300.0	0.55260	27.9	20,000,000	3,435,000	27.9	6.00	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.452	4,000,000	102,000,000	0.452	75.0	Y (1)
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.259	640	24.0	0.259	ND	N
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	7,259	2,100	14,000	2,100	620	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,433	2,900	24,200	1,433	6.3	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	4,095	2,100	17,100	2,100	130	N
Chlordane	2	2	0.1	0.1	140,000	257.9	261	540	3,650	261	ND	N
Total PCB's	0.5	0.5	0.1	0.1				10,000	753 **	10,000	36,600	Y (2)
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	148,899,671		414,000	414,000	310	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	158,206	20,000,000	408,000,000	158,206	890	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	2,436,371	8,000,000	204,000,000	2,436,371	102	N
Dimethyl phthalate	50		50	50	17.40	0.03205	16.2	80,000,000	1,000,000,000 *	16.2	ND	N
Naphthalene	50		10	10	940.0	1.731	175	300,000	81,600,000	175	210	Y (1)
2-Methylnephthalene	50			50	5,800	10.68			40,800,000	40,800,000	107	N
Acenaphthene	50		20	20	4,600	8.473	1,712	5,000,000	122,400,000	1,712	610	N
Acenaphthylene	50			50	2,500	4.605					ND	N
Anthracene	50		50	50	14,000	25.79	13,029	20,000,000	612,000,000	13,029	760	N
Fluoranthene	50		50	50	38,000	70.00	35,364	3,000,000	81,600,000	35,364	3,500	N
Pyrene	50		50	50	38,000	70.00	35,364	2,000,000	61,200,000	35,364	2,500	N
Phenanthrene	50		50	50	14,000	25.79	13,029			13,029	3,700	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	7.44	220		7.44	1,200	Y(1,2)
Chrysene	50		0.002	0.002	200,000	368.4	7.44			7.44	1,100	Y(1,2)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	20.5	220		20.5	980	Y(1,2)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	20.5	220		20.5	1,200	Y(1,2)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	2,047	61.0	670	61.0	1,200	Y(1,2)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	59.6			59.6	690	Y(1,2)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	43.0	14.0		14.0	310	Y (1)
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,488,997			1,488,997	630	N
Fluorene	50		50	50	7,300	13.45	6,794	3,000,000	81,600,000	6,794	560	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	5.49	2,000,000	40,800,000	5.49	ND	N
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.41	7,000,000	37,000	1.41	ND	N
Carbon disulfide	50		3500	50	14.20	0.02616	13.2	8,000,000	310	13.2	ND	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.79	8,000,000	204,000,000	2.79	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	6.05	12,000	9,070	6.05	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	40.9	5,400	56.0	40.9	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	102.4	8,000,000	218,000	102.4	ND	N
Xylenes	50	10,000		50	248.0	0.45682	230.8	200,000,000	30,400	230.8	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	40,800,000	2,000,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.912	4,000,000	102,000,000	0.912	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	3.57	2,000,000	40,800,000	3.57	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	8.93	160	1050	8.93	ND	N
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.082	77.0	522	0.082	12.0	Y (1)
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.316	44.0	297	0.316	7.90	Y (1)
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.316	200,000	612,000	0.316	ND	N

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 2 - RECHARGE BASINS
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 2**
SITE AREA (SF)	50,000
INFILTRATION FLOW RATE (CFY)	57,500
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	10.10
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 2					
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	5.38	5.38	13.4	Y(1,2)
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	816	30.0	ND	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	142	142	51.6	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	1.46	0.160	0.880	Y (1)
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	4.79	4.79	ND	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)		400	98.2	N
Copper		1000	1000	1000					75,480	75,480	141	N
Lead		15	50	15	7.80	0.000	7.80	500		500	23.2	N
Manganese	300	50	600	50	167	0.000	167	20,000	142	142	74.7	N
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	127	20.0	0.320	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	34.5	34.5	10.1	N
Silver	50	100	100	50	0.128	0.023	0.165	200	10,200	200	2.80	N
Vanadium			250	250	17.9	0.000	17.9	600	14,280	600	87.7	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	612,000	20,000	19.2	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	40,800	2,000	3.10	N
Selenium	10	50	40	10	0.495	0.156	0.752		10,200	10,200	ND	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	143	6.00	ND	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 2 - RECHARGE BASINS
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 2**
SITE AREA (SF)	50,000
INFILTRATION FLOW RATE (CFY)	57,500
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	10.10
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcinogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 2						
	DRINKING WATER LAWS- New York MCL (ug/l)	NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	11.74	64,000	58,100	11.74	32.0	Y (2)
Tetrachloroethene	5	5	5	5	364.0	0.67049	33.9	14,000	12,300	33.9	8.00	N
Chloroform	50		7	7	44.00	0.08105	5.73	110,000	105,000	5.73	1.00	N
Toluene	5	1000	5	5	300.0	0.55260	27.9	20,000,000	15,643,000	27.9	6.00	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.452	4,000,000	3,911,000	0.452	75.0	Y (1)
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.259	640	581	0.259	ND	N
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	7,259	2,100	1,880	1,880	620	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,433	2,900	2,660	1,433	6.3	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	4,095	2,100	1,880	1,880	130	N
Chlordane	2	2	0.1	0.1	140,000	257.9	261	540	491	261	ND	N
Total PCB's	0.5	0.5	0.1	0.1				1,000	83.0 **	1,000	36,600	Y(1,2)
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	148,899,671		45,600	45,600	310	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	158,206	20,000,000	15,643,000	158,206	890	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	2,436,371	8,000,000	7,821,000	2,436,371	102	N
Dimethyl phthalate	50		50	50	17.40	0.03205	16.2	80,000,000	782,143,000	16.2	ND	N
Naphthalene	50		10	10	940.0	1.731	175	300,000	3,129,000	175	210	Y (1)
2-Methylnaphthalene	50			50	5,800	10.68			1,564,000	1,564,000	107	N
Acenaphthene	50		20	20	4,600	8.473	1,712	5,000,000	4,693,000	1,712	610	N
Acenaphthylene	50			50	2,500	4.605					ND	N
Anthracene	50		50	50	14,000	25.79	13,029	20,000,000	23,464,000	13,029	760	N
Fluoranthene	50		50	50	38,000	70.00	35,364	3,000,000	3,129,000	35,364	3,500	N
Pyrene	50		50	50	38,000	70.00	35,364	2,000,000	2,346,000	35,364	2,500	N
Phenanthrene	50		50	50	14,000	25.79	13,029			13,029	3,700	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	7.44	220		7.44	1,200	Y(1,2)
Chrysene	50		0.002	0.002	200,000	368.4	7.44			7.44	1,100	Y(1,2)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	20.5	220		20.5	980	Y(1,2)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	20.5	220		20.5	1,200	Y(1,2)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	2,047	61.0	87.5	61.0	1,200	Y(1,2)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	59.6			59.6	690	Y(1,2)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	43.0	14.0		14.0	310	Y (1)
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,488,997			1,488,997	630	N
Fluorene	50		50	50	7,300	13.45	6,794	3,000,000	3,129,000	6,794	560	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	5.49	2,000,000	1,564,000	5.49	ND	N
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.41	7,000,000	70,393,000	1.41	ND	N
Carbon disulfide	50		3500	50	14.20	0.02616	13.2	8,000,000	7,821,000	13.2	ND	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.79	8,000,000	7,821,000	2.79	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	6.05	12,000	1,060	6.05	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	40.9	5,400	54,800	40.9	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	102.4	8,000,000	7,821,000	102.4	ND	N
Xylenes	50	10,000		50	248.0	0.45682	230.8	200,000,000	156,429,000	230.8	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	1,564,000	1,564,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.912	4,000,000	3,911,000	0.912	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	3.57	2,000,000	1,564,000	3.57	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	8.93	160	142	8.93	ND	N
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.082	77.0	70.2	0.082	12.0	Y (1)
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.316	44.0	39.9	0.316	7.90	Y (1)
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.316	200,000	23,500	0.316	ND	N

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 2 - RECHARGE BASINS
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 2**
SITE AREA (SF)	50,000
INFILTRATION FLOW RATE (CFY)	57,500
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	10.10
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 2					
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	23.5	23.5	13.4	N
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	31.3	30.0	ND	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	5,475	4,000	51.6	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	0.663	0.160	0.880	Y (1)
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	39.1	39.1	ND	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)	78,214	400	98.2	N
Copper		1000	1000	1000					391	391	141	N
Lead		15	50	15	7.80	0.000	7.80	500		500	23.2	N
Manganese	300	50	600	50	167	0.000	167	20,000	391	391	74.7	N
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	23.5	20.0	0.320	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	1,564	1,564	10.1	N
Silver	50	100	100	50	0.128	0.023	0.165	200	391	200	2.80	N
Vanadium			250	250	17.9	0.000	17.9	600	548	548	87.7	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	23,464	20,000	19.2	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	1,564	1,564	3.10	N
Selenium	10	50	40	10	0.495	0.156	0.752		391	391	ND	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	5.48	5.48	ND	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000

LEK 8/30/93

SITE 2

ANALYTICAL SUMMARIES AND MAPS

SITE 2 - RECHARGE BASINS

CONDENSED SUMMARY OF ANALYTICAL DATA

	SS700	SS800	SS900	SS1000	SS1100	SS1200	SS1300	SS1400	SS1500	SS1600	SS1700	SS1800	SS2600	SB202	SB204	SB205	SB206	SB209	SB215	SB217	SB218	SB219	SB225	SB227	SB229
VOLATILES																									
Trichloroethene																									
Tetrachloroethene													2, ND		1 /		4.2 /		32 / ND	6 /					
Chloroform	1																		1 / ND		3 /	3,9 /			
Toluene			2	6, ND	1					2			5, ND												
ORGANIC ACIDS																									
4-Methylphenol (p-Cresol)										75															
Benzoic Acid		45	40	110,110				110		61	105	240	420,390	150					380	160	108	430,69		58	
PHTHALATES																									
Bis(2-ethylhexyl) phthalate	41			69,75						300		49	65,65				61,60			46					62
Butyl benzyl phthalate					130		250			890															
Di-n-butyl phthalate																									
PESTICIDES																			36		39			40	
DDT	620,170			4.4,ND				13																	
DDD	6.3,ND																								
DDE	130,93																								
Heptachlor Epoxide																									
Dieldrin								7.2																	
PCB's																									
Aroclor 1242	ND,74																								
Aroclor 1248	230,74	73		75,46		2500		2200		6200			1800,2000				33000		270						6800
Aroclor 1254	61,74					490		580		1000							3600		78						
PAH's																									
Naphthalene					210															86					
2-Methylnaphthalene					107															52					
Acenaphthene					610								39,ND							270					
Anthracene					760								55,61							220					
Fluoranthene	102	44		160,570	3500	340	104	160	510	370	52	120	1040,1000				98,140		85	1900				60	330
Pyrene	83	40		104,410	2500	260	80	130	370	330	36	110	950,950				79,120		77	1800				46	280
Phenanthrene	49			260,71	3700	200	43	79	220	190	340	64	550,560				51,92		68	1300				37	170
Benzo(a)anthracene	56			260,60	1200	150			180	160			500,500							740					109
Chrysene	63			260,86	1100	160			220	180		64	600,570							910					150
Benzo(b)fluoranthene	103			310,ND	920	190	120		220	250		07	630,590				57,84			980					130
Benzo(k)fluoranthene	77			310,ND	1200	190			220	180		78	480,560				55,55			730					110
Benzo(a)pyrene				290,ND	1200	190			190	200		66	550,550				43,53			810					96
Indeno(1,2,3-c)pyrene				160,ND	690				106	150			380,380				ND,44								62
Dibenzo(a,h)anthracene					310																				
Benzo(g,h,i)perylene				170,ND	630					170			380,390				45,48			490					59
Fluorene					560															180					
Dibenzofuran					330															109					
INORGANICS																									
Aluminum	5690	2810	1790	12000,11300	4390	4440	3800	11500	19500	7390	3900	5040	4940,5070	6350	9370	2900	2690,1910	1600	4070	6190	7940	5970,7830	2050	3620	8250
Arsenic	3.5	10	0.95	13.4,7.5	1.8	1.6	1.3	7.4	2.9	2.7	1.6	6.7	6.2,6.3	1.5	2.9	3	2.7,1.1		1.6	3.3	6.3	4.6,3.3		1.4	10.7
Barium	13.8	8	4.6	31.4,31.6	12	11.6	7.4	28.2	51.6	23.1	10.3	17.1	19.0,17.5	14.9	29.9	6.2	5.3,2.5	3.1	14.8	22	15.6	13,14.2	3.8	10	21.1
Beryllium									0.88																
Calcium	405	176		1020,1010	490	130	278	1470	11900	905	108	823	2610,2450	80.1			207,82.2		355	4550	329	141,198		218	507
Chromium	10.5	19.5	4.2	20.2,17.8	98.2	20.2	97.8	25.6	10.9	419	20.1	19.4	18.1,17.8												
Cobalt									15.2	3.3		7.1	ND,3.1												
Copper													,61.2												
Iron	8360	5590	4830	14200,13400	6960	6080	6340	14600	26600	7250	4810	8150	8760,8370												
Lead																									
Magnesium	739	486	223	1360,1240	729	771	703	1820	6060	933	484	839	1580,1530	1030	1560	522	279,139	227	644	1570	645	512,690	249	551	903
Manganese																									
Mercury										0.22			0.18,0.16			0.14		0.11		0.14	0.32				0.17
Nickel	7.4	5		10.0,10.1	7.1	6.5	7.4	9.9																	
Potassium	423	393	294	652,584	402	389	405	662	2070	716	275	303	342,316	478	644	503	333,390	287	411	414	450	409,377	338	357	527
Silver		0.33		0.29,0.30	1.7												2.5,2.8			0.88		0.8,ND			1.2
Sodium	186	188	184	206,248	209	492	225	337					,1580												
Vanadium	12.6	7.3	8.8	25.3,25.1	10.7	11	14	25.3	87.7	12.9	8	13	14.6,14.0												
Zinc																									
Cyanide										3.1															

SOIL GAS ANALYSES	SG202	SG203	SG204	SG205	SG206	SG207	SG208	SG209	SG210	SG211	SG213	SG214	SG215	SG216	SG217	SG218	SG219	SG220	SG221	SG222	SG225	SG226	SG227	SG228	SG229
1,1-Dichloroethene					1.2/6.3	20/2.8	4.3/1.4	1.4/1.0	1.2/1.4		3.1/5.1		1.3/6.4	ND/1.2					ND/2.0				ND/14	ND/2.0	
1,1,1-Trichloroethane	.39/ND				.19/ND		.17/ND				1.0/1.3	ND/.36	.34/.46		ND/.33								ND/.59	ND/.11	
Trichloroethene					2.2/.32	.21/ND	.54/ND		ND/.12		.88/2.2		11/1.8		.12/1.8				ND/.15					ND/.18	
Tetrachloroethane				/.07	.85/.05	.11/.60	.25/.41	.17/.06	.41/.23	.50/ND	.18/.42		.22/.27	.28/.09	ND/.11									ND/.19	

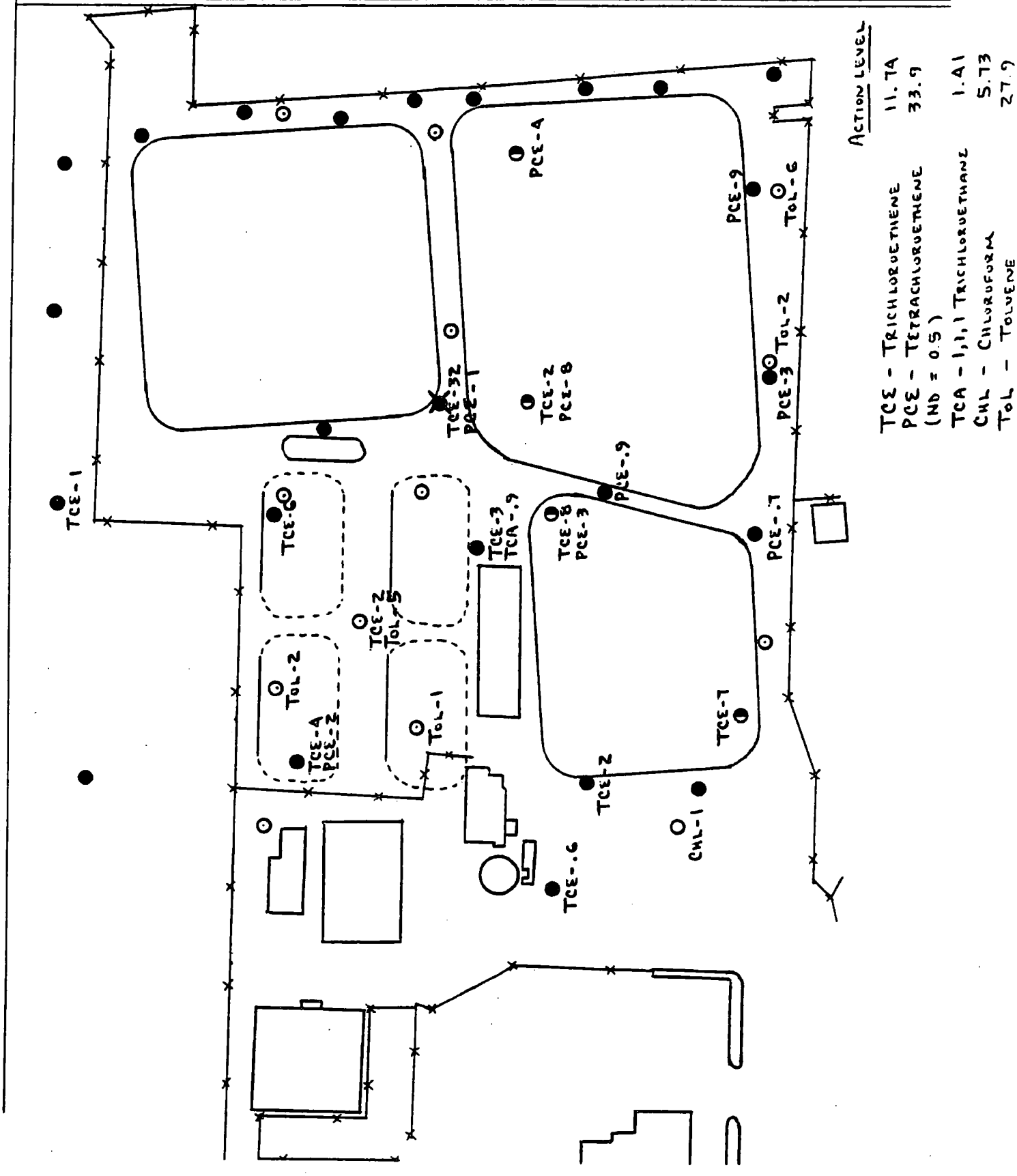
LER 8/30/93
8 1 of 1

CALCULATION WORKSHEET

Order No. 19115 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP / VOA ANALYSES	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER

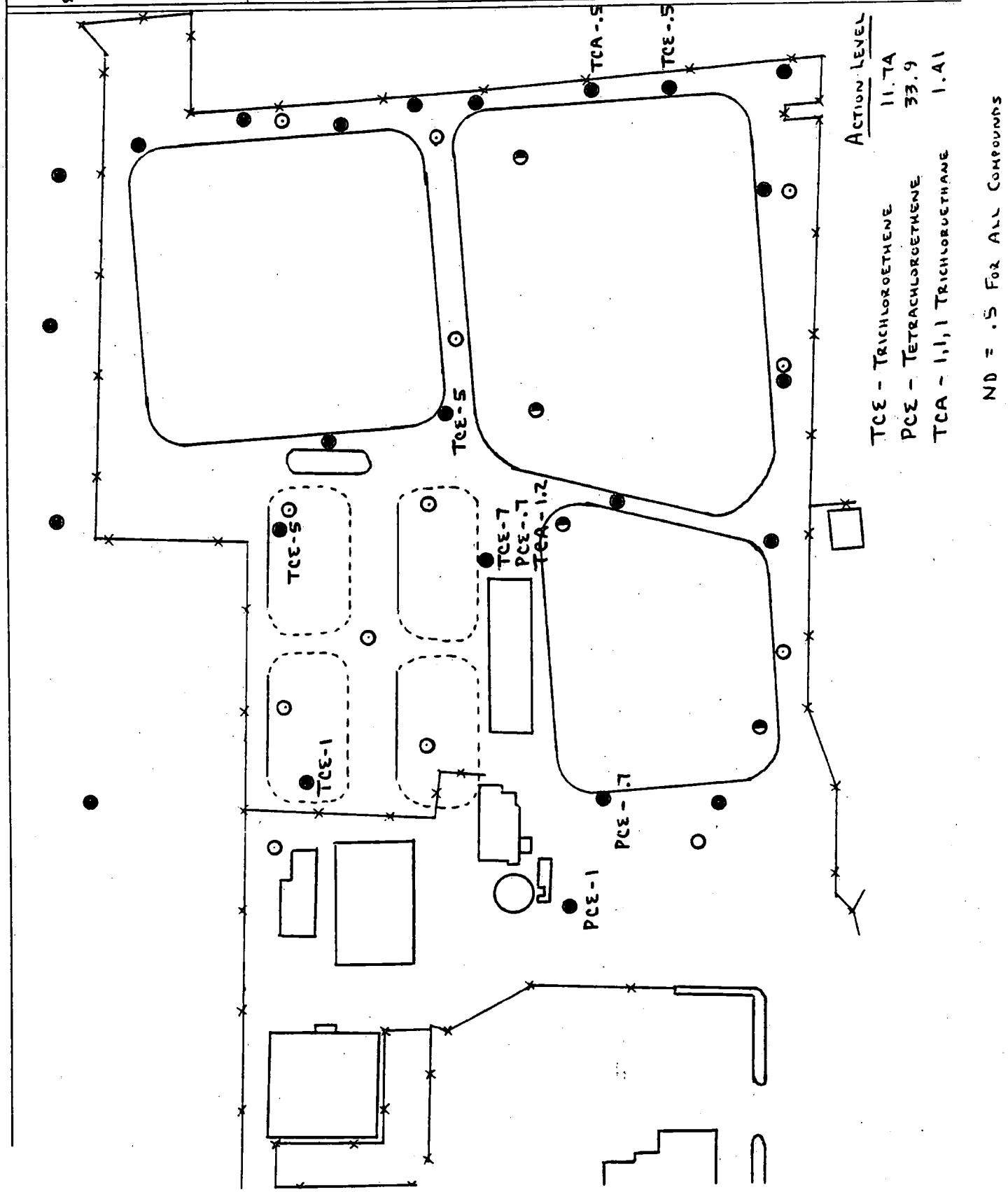
BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

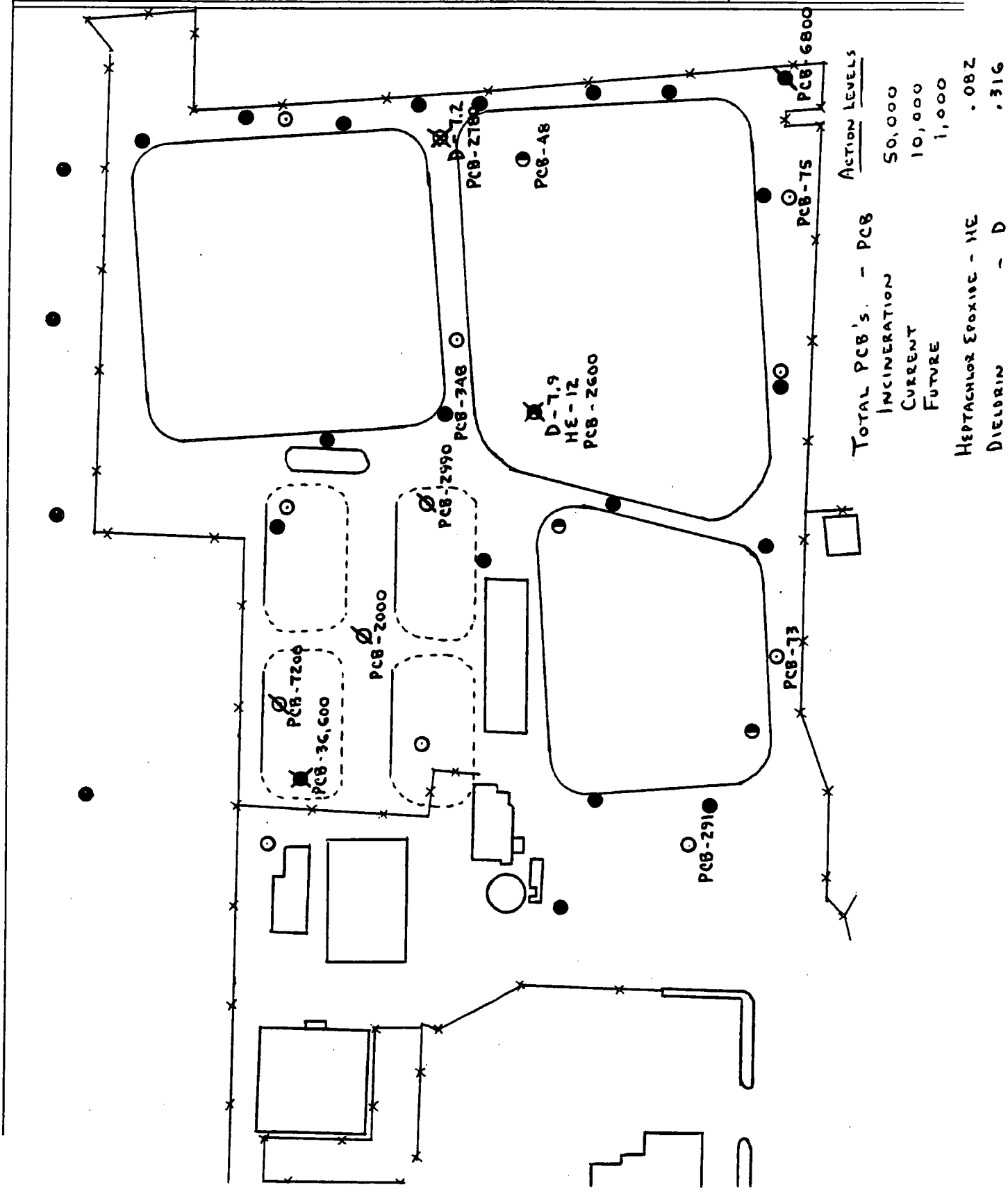
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP / VOA ANALYSES	
BASED ON DEEP SUB - SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19115 (01-91)

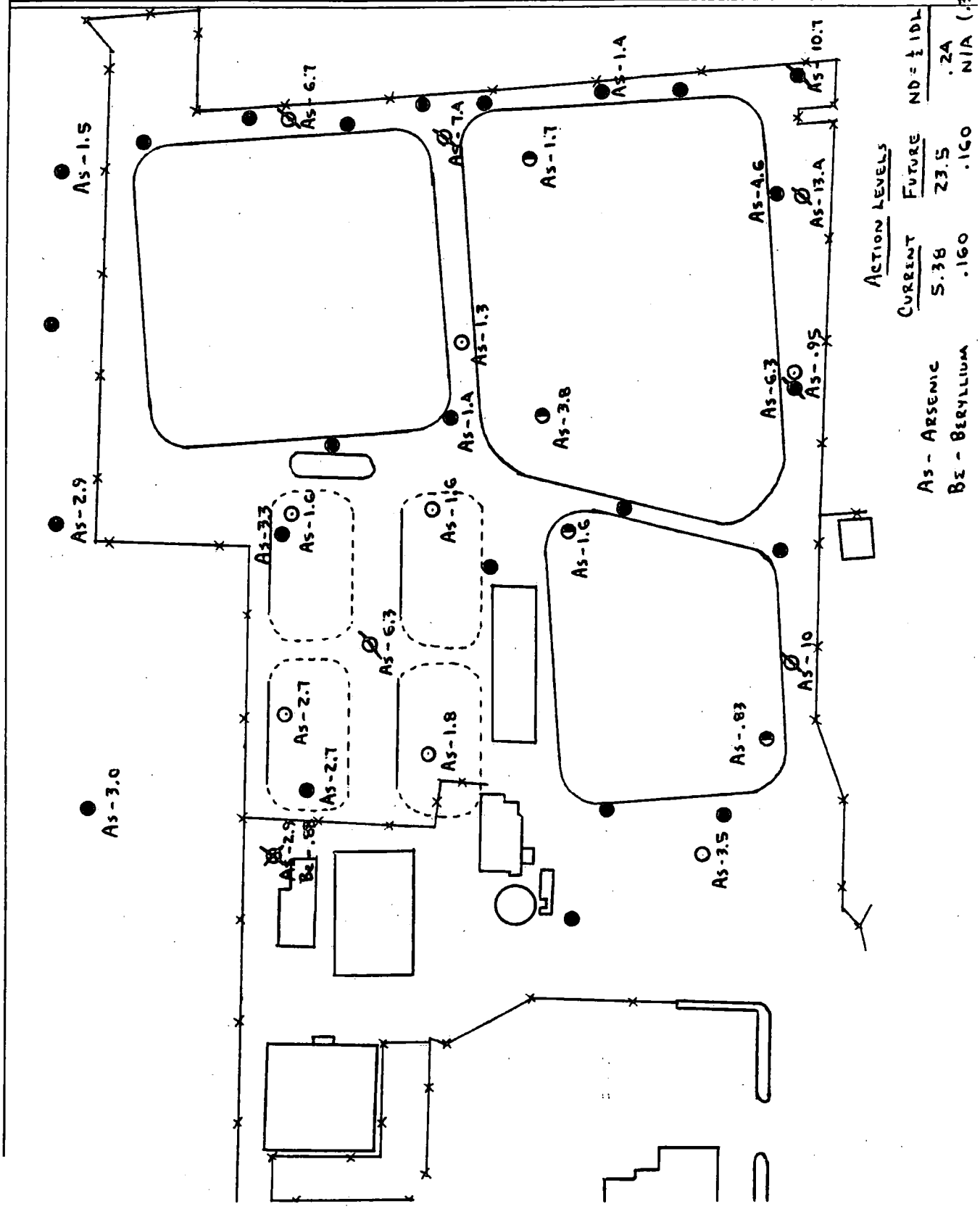
CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT: SITE 2 AREA MAP / PESTICIDE / PCB ANALYSES	
BASED ON: SURFACE SOIL / SHALLOW SUB SOIL	DRAWING NUMBER
BY: GND / CHECKED BY	APPROVED BY: LEK / DATE: 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

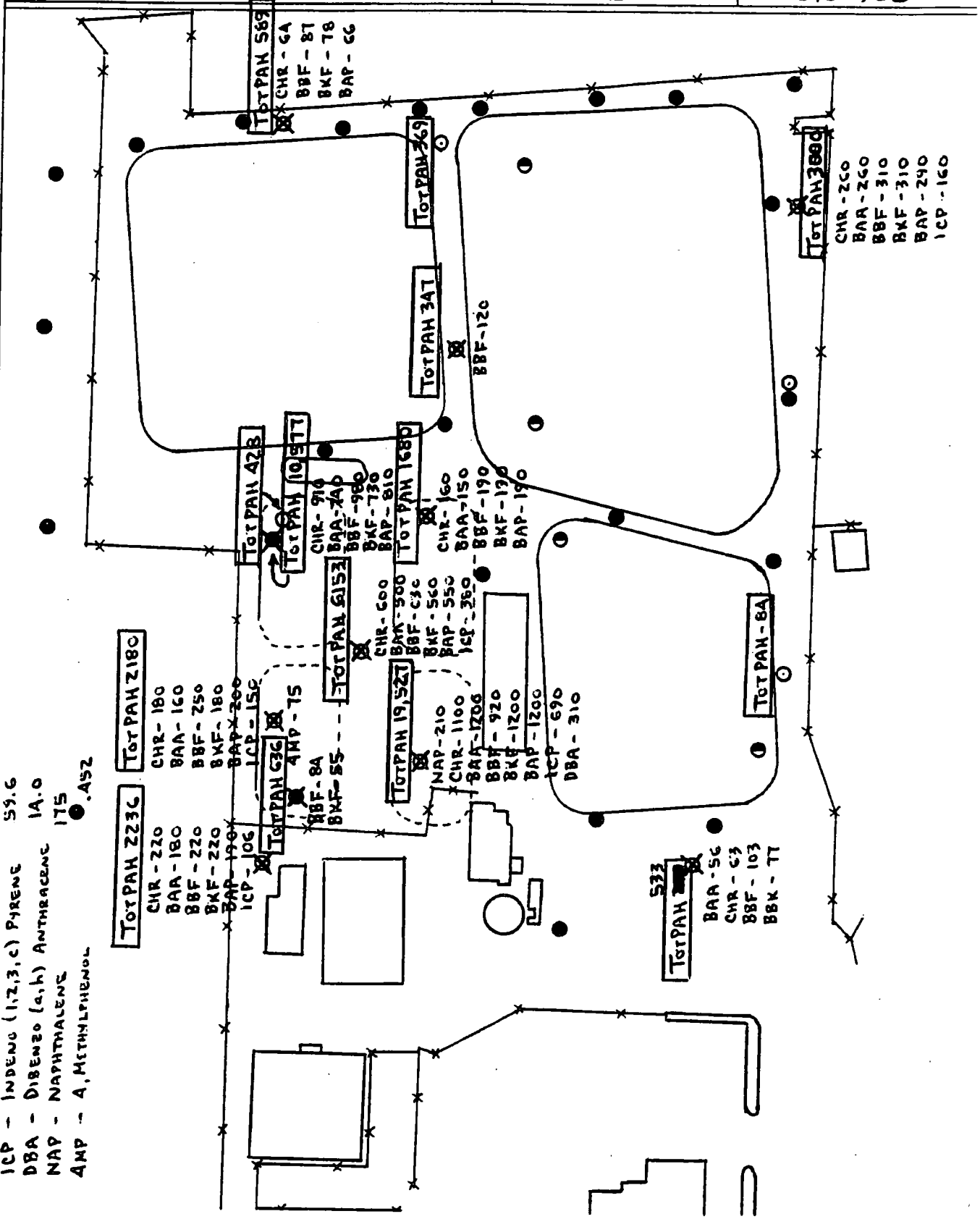
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - ARSENIC / BERYLLIUM ANALYSES	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER:
SUBJECT: SITE 2 AREA MAP - PAH ANALYSES + p.CRESOL	
BASED ON: SURFACE SOIL SAMPLES / SHALLOW	DRAWING NUMBER: SUB-SOIL SAMPLES
BY: GND / CHECKED BY:	APPROVED BY: LEK / DATE: 8/30/93



	Action Level
CHR - Chrysene	7.4A
BAA - Benzo (a) Anthracene	7.4A
BBF - Benzo (b) Fluoranthene	20.5
BKF - Benzo (k) Fluoranthene	20.5
BAP - Benzo (a) Pyrene	61.0
ICP - Indeno (1,2,3,c) Pyrene	59.6
DBA - Dibenzo (a,h) Anthracene	14.0
NAP - Naphthalene	175
AMP - 4, Methylphenol	.452

SITE 2

SOIL GAS VS. VOC CORRELATION

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SOIL GAS VS. VOA CORRELLATION			
BASED ON SITE 2		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

TRICHLOROETHENE

	VOA ANALYSIS	SOIL-GAS ANALYSIS
204-S	1	ND
~~204-D~~	~~--~~	~~ND~~
206-S	4.2	2.2
~~206-D~~	~~--~~	~~.32~~
215-S	32	11
~~215-D~~	~~ND~~	~~1.8~~
217-S	6	.12
~~217-D~~	~~ND~~	~~1.8~~

x COEFFICIENT = .33572

TETRACHLOROETHENE

215-S	1	.22
~~215-D~~	~~ND~~	~~.27~~
~~218-S~~	~~3~~	~~ND~~
~~218-D~~	~~--~~	~~ND~~
~~219-S~~	~~3.9~~	~~ND~~
~~219-D~~	~~--~~	~~ND~~

INSUFFICIENT SAMPLING POINTS EXCEPT FOR TRICHLOROETHENE:
USE ~~x COEFFICIENTS~~ RATIOS FROM SITE 1 (RATIOS)

TETRACHLOROETHENE	-	14.76	.565
TRICHLOROETHENE	-	8.78	.336
1,1,1 TRICHLOROETHANE	-	28.94	1.107

LEK 8/30/93
pg 2 of 2

SITE 2
Trichloroethene
Shallow Samples Only

VOA	Soil-Gas
1	0.05
4	2.2
32	11
6	0.12

Regression Output:

Constant	0
Std Err of Y Est	1.22076
R Squared	0.944919
No. of Observations	4
Degrees of Freedom	3

X Coefficient(s)	0.33572
Std Err of Coef.	0.037198

SITE 2

AREA OF CONTAMINATION
(FOR CAPPING ALTERNATIVES)

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT AREA REQUIRED FOR CAPPING			
BASED ON SITE 2 - CURRENT / FUTURE		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

CURRENT SCENARIO :

AREA = 163.0 + 7.7 + 1.0 + 3.7 + 5.8 + 12.8 + 6.7 - 1.0

AREA = 199.7 BLOCKS

1 BLOCK = 37.5 × 37.5 FT = 1406.25 FT^2

AREA = 199.7 × 1406.25 FT^2 = **280,828 FT^2**

FUTURE SCENARIO :

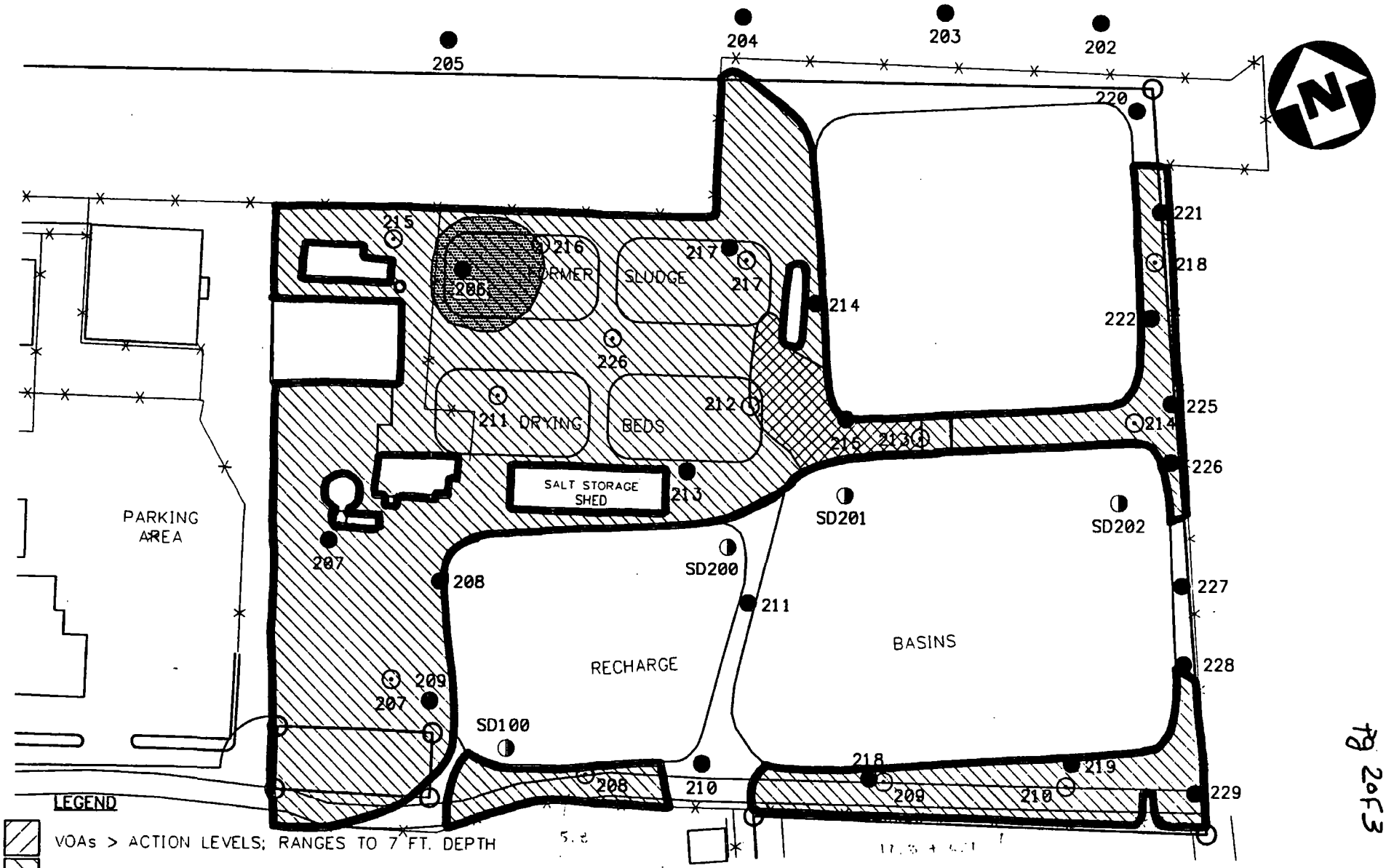
AREA = 163.0 + 1.0 + 7.7 + 3.7 + 12.8

AREA = 188.2 BLOCKS

1 BLOCK = 37.5 FT × 37.5 FT = 1406.25 FT^2

AREA = 188.2 × 1406.25 FT^2 = **264,656 FT^2**

ACAD: 1953/SITE2.DWG 7/21/93 MB (PLOT1)



LEGEND

VOAs > ACTION LEVELS; RANGES TO 7 FT. DEPTH

OTHER METALS AND INORGANICS > ACTION LEVELS RANGES TO 7 FT. DEPTH

PCBs > 10 ppm < 50 ppm; TO 7 FT. DEPTH

0 150 300

SCALE IN FEET

DENOTES CAPPED AREA

FIGURE 2-3

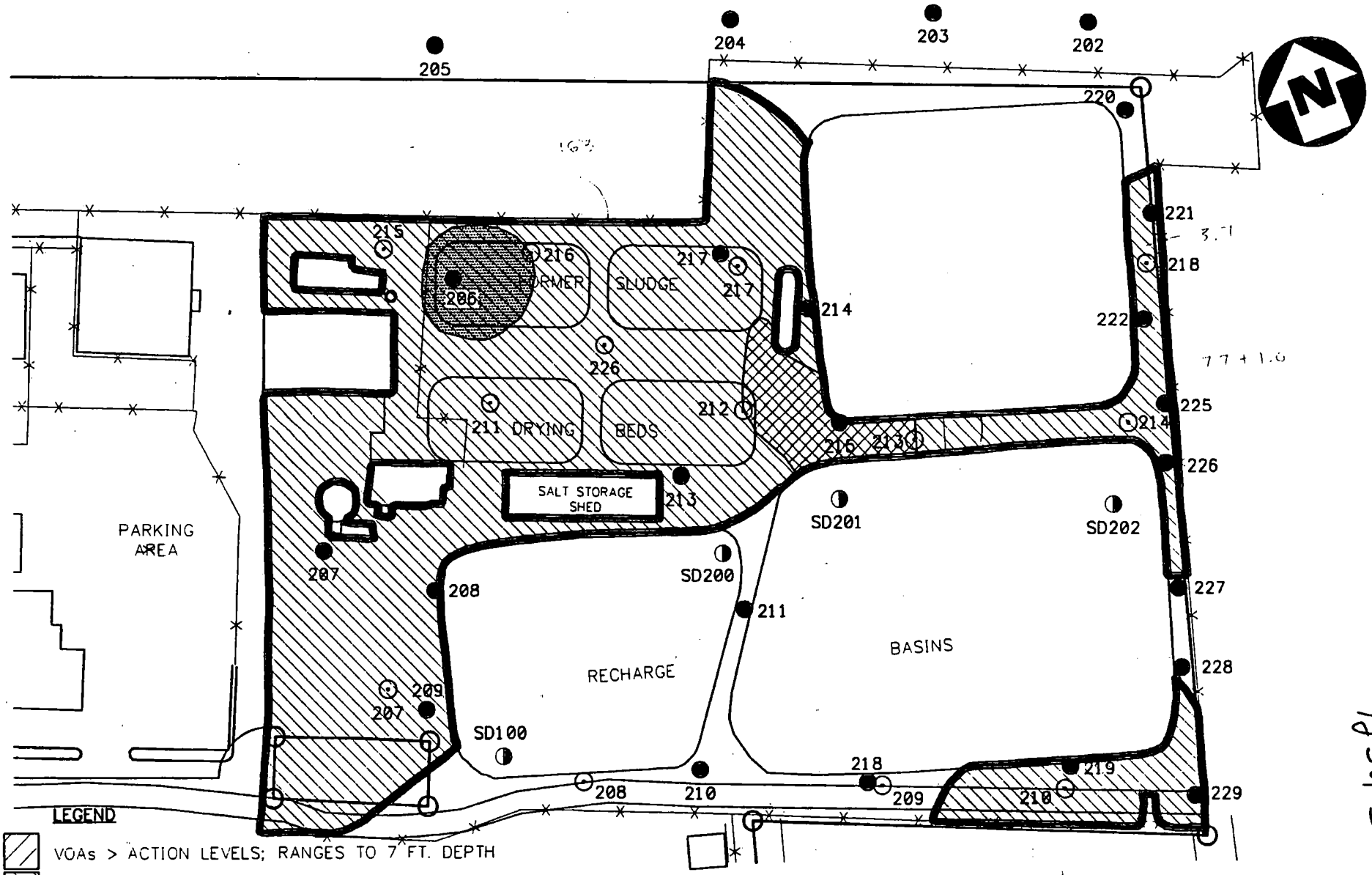
SITE 2 – CURRENT INDUSTRIAL USE SCENARIO

NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS Environmental Corporation

LEK 8/30/93 pg 2 of 3

ACAD: 1953/SITE2.DWG 7/21/93 MB (PLOT2)



LEGEND

VOAs > ACTION LEVELS; RANGES TO 7 FT. DEPTH

OTHER METALS AND INORGANICS > ACTION LEVELS RANGES TO 7 FT. DEPTH

PCBs > 10 ppm < 50 ppm; TO 7 FT. DEPTH

0 150 300

SCALE IN FEET

DENOTES CAPPED AREA

FIGURE 2-4

SITE 2 - FUTURE RESIDENTIAL USE SCENARIO
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

LEK 8/30/93
pg 3 of 3

SITE 2

SOIL VOLUME CALCULATIONS

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP – BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 2 – CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON VOA's (CURRENT & FUTURE SCENARIOS)		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① FOR SHALLOW SUB-SOILS : 0 TO 7 FT. DEPTH

BASED ON TRICHLOROETHENE CONTAMINATION

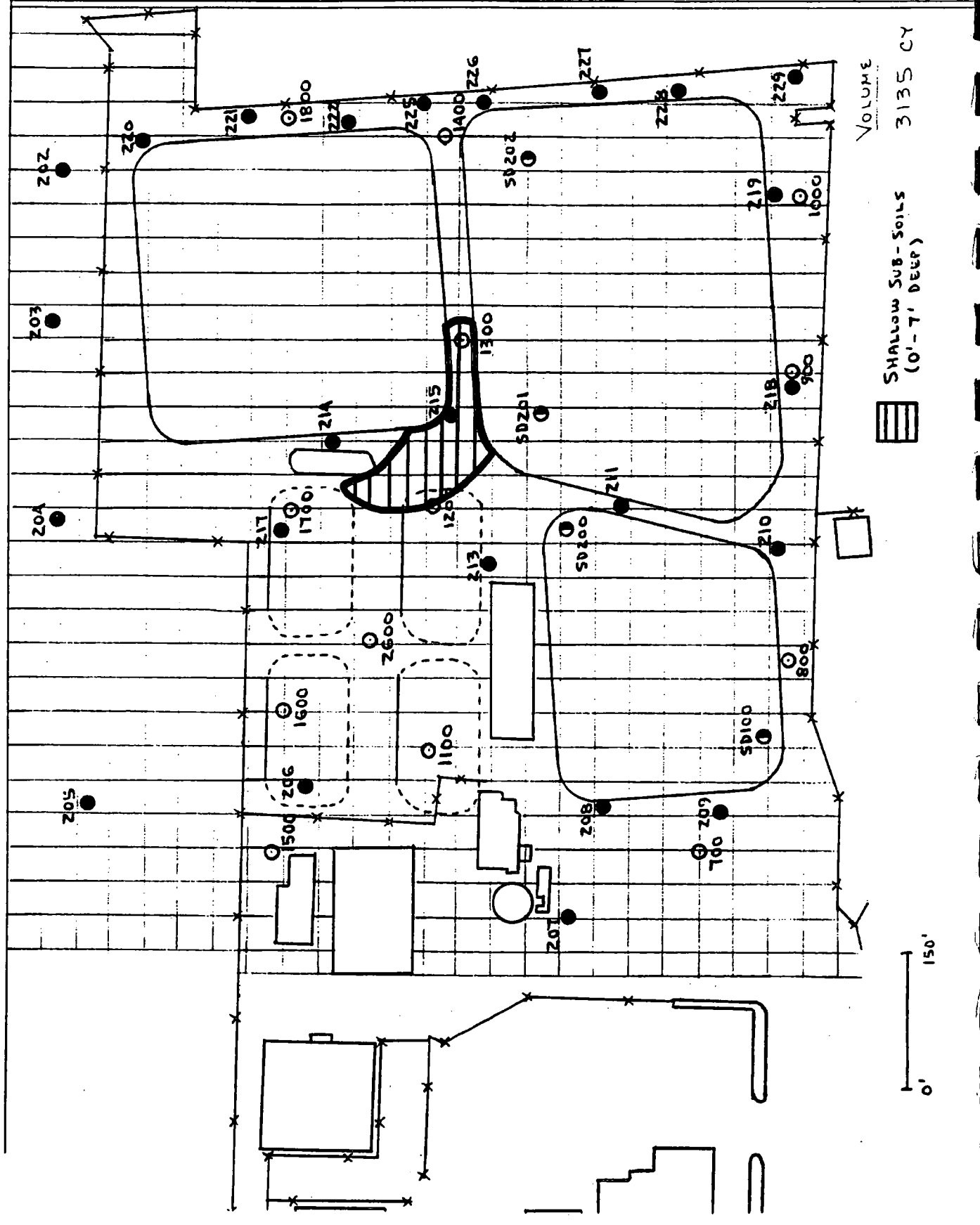
$$\text{Area} = 8.6 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1343.8\ YD^2$$

$$\text{Volume} = 1344\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{3135\ CY}$$

CALCULATION WORKSHEET

Order No. 19116 (01-91)

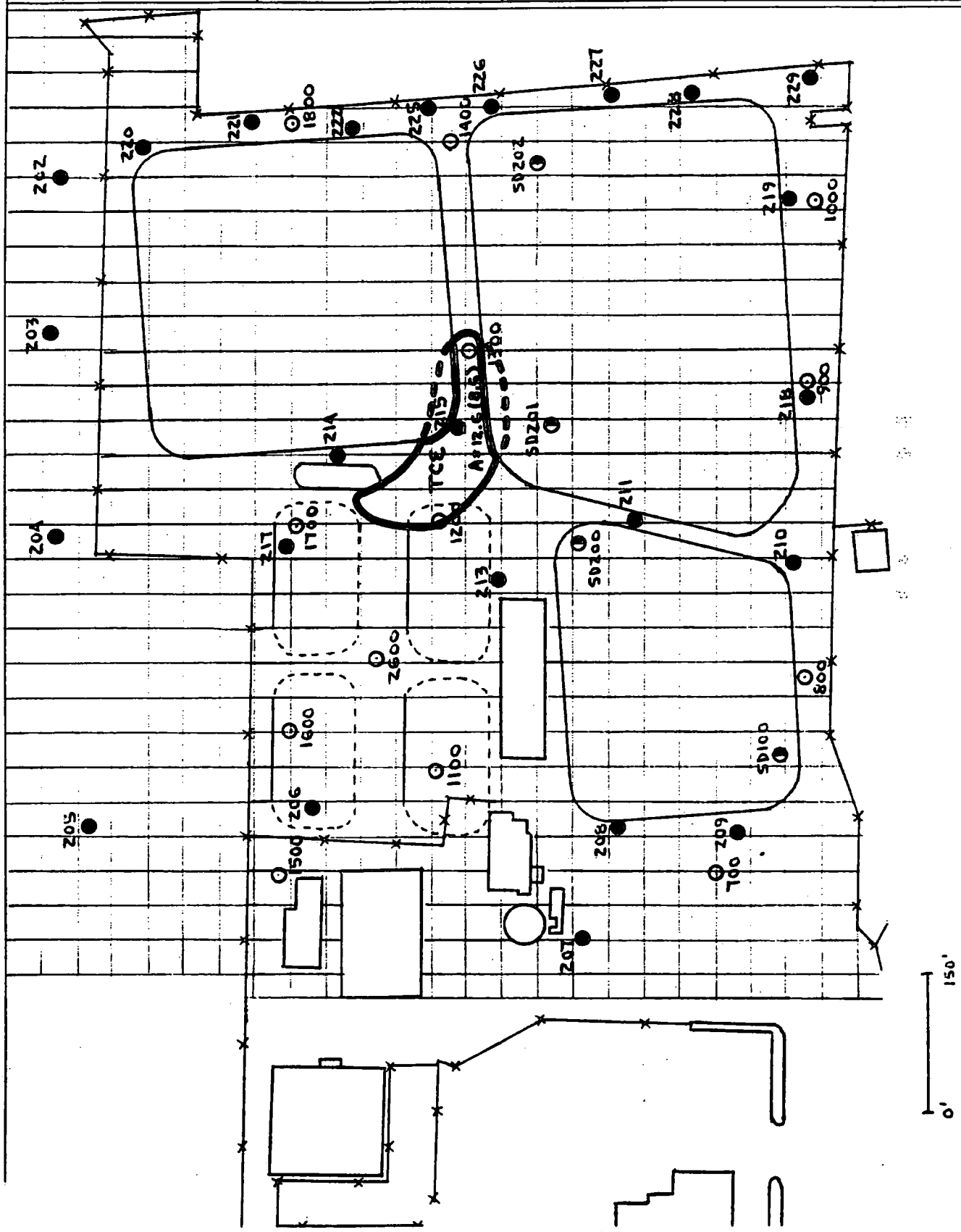
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP / VOA's (CURRENT & FUTURE SCENARIO)	
BASED ON ~~[illegible]~~ SHALLOW SOB - SOILS	DRAWING NUMBER
BY CND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 2 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON CURRENT SCENARIO EXCEPT VOA's		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① SURFACE SOILS : FOR ARSENIC, PAH's, AND DIELDRIN REMOVAL

DEPTH 0 TO 1 FT.

AREA = (142.9 + 5.8 + 12.8 + 10.4) × 1406.25 FT^2 × $\frac{YD^2}{9\ FT^2}$ = 26,859 YD^2

VOLUME = 26,859 YD^2 × 1 FT × $\frac{YD}{3\ FT}$ = **8953 CY**

② SURFACE SOIL / SHALLOW SUB-SOIL : FOR ARSENIC REMOVAL

DEPTHS : 0 TO 7 FT.

AREA = 6.4 × 1406.25 FT^2 × $\frac{YD^2}{9\ FT^2}$ = 1000 YD^2

VOLUME = 1000 YD^2 × 7 FT × $\frac{YD}{3\ FT}$ = **2333 CY**

③ SHALLOW SUB-SOIL : FOR ARSENIC REMOVAL

DEPTH : 1 TO 7 FT.

AREA = 7.4 × 1406.25 FT^2 × $\frac{YD^2}{9\ FT^2}$ = 1156.3 YD^2

VOLUME = 1156 YD^2 × (7-1) FT × $\frac{YD}{3\ FT}$ = **2313 CY**

CLIENT	JOB NUMBER		
NWIRP - BETHPAGE, NY			
SUBJECT: SITE 2 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON: CURRENT SCENARIO EXCEPT VOA's.	DRAWING NUMBER		
BY: GND	CHECKED BY	APPROVED BY: LEK	DATE: 8/30/93

(4) SURFACE SOIL / SHALLOW SUB-SOIL : FOR PAH REMOVAL

DEPTH : 0 TO ~~5~~ 7 FT.

AREA = $20.0 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 3125\ YD^2$

VOLUME = $3125\ YD^2 \times \cancel{5}\ 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} =$ ~~5208~~ 7292 CY

(5) SHALLOW SUB-SOIL: FOR PAH REMOVAL

DEPTH : 1 TO ~~5~~ 7 FT.

AREA = $(63.7 - 20.0) \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 6828\ YD^2$

VOLUME = $6828\ YD^2 \times (\cancel{5-1}\ 7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} =$ ~~910A~~ 13,656 CY

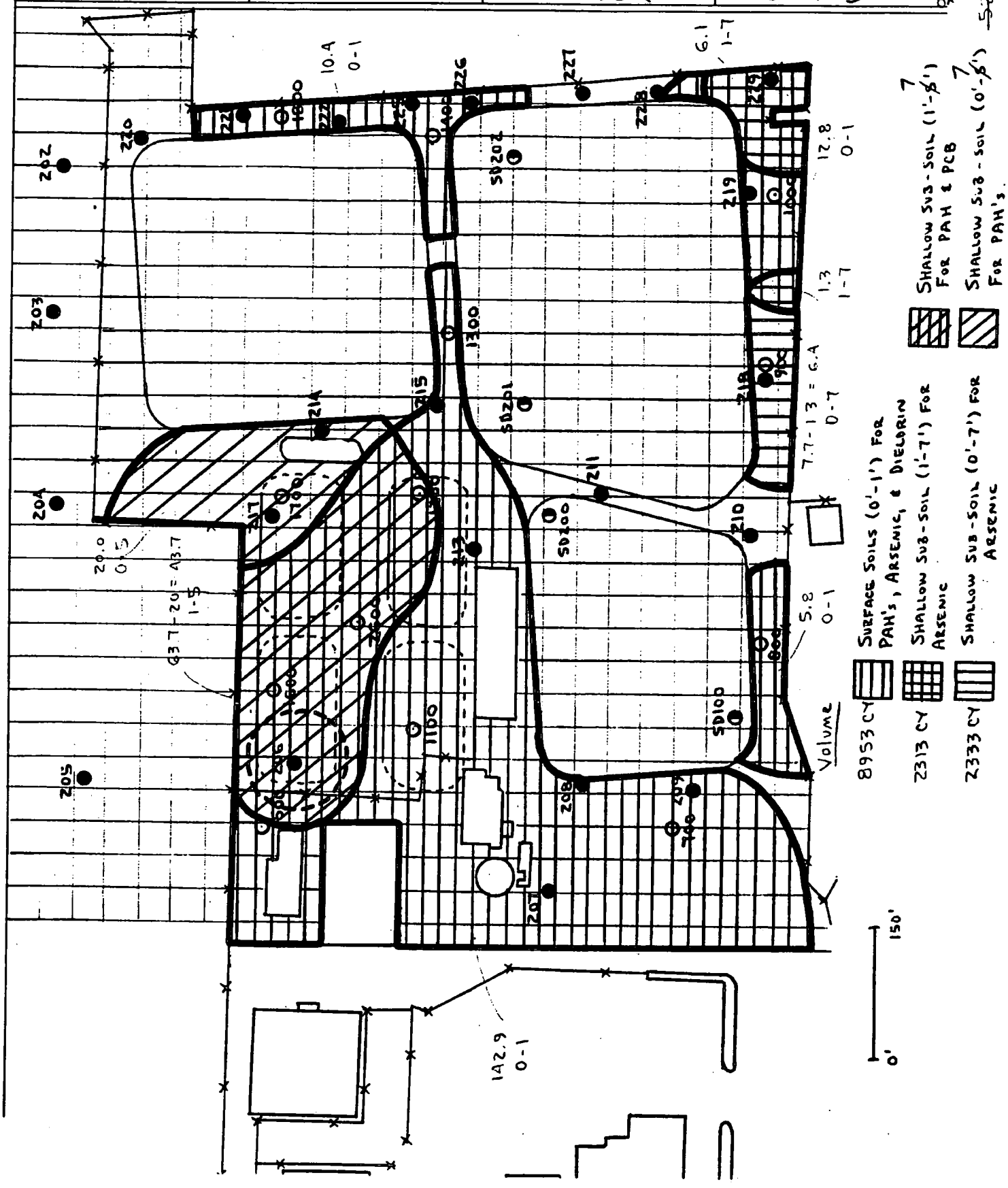
(5A) PCB PORTION OF ~~910A~~ 13,656 CY

AREA = $7.1 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1109$ [redacted] YD^2

VOLUME = 1109 [redacted] $YD^2 \times (\cancel{5-1}\ 7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} =$ ~~1479~~ 2218 CY

CALCULATION WORKSHEET Order No. 19116 (01-91)

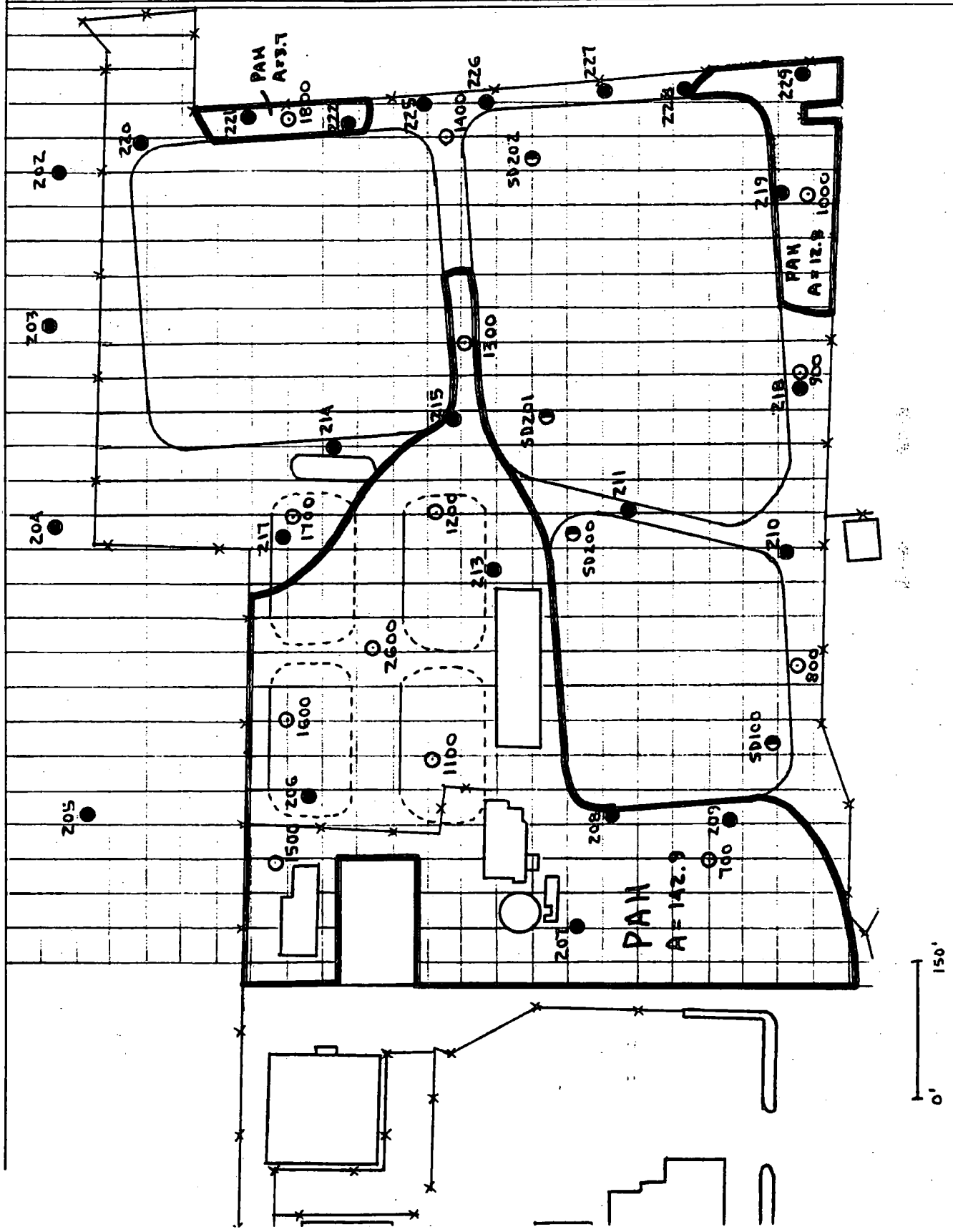
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - ARSENIC, PCB's, PAH's, DIELDRIN (CURRENT)	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LER / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

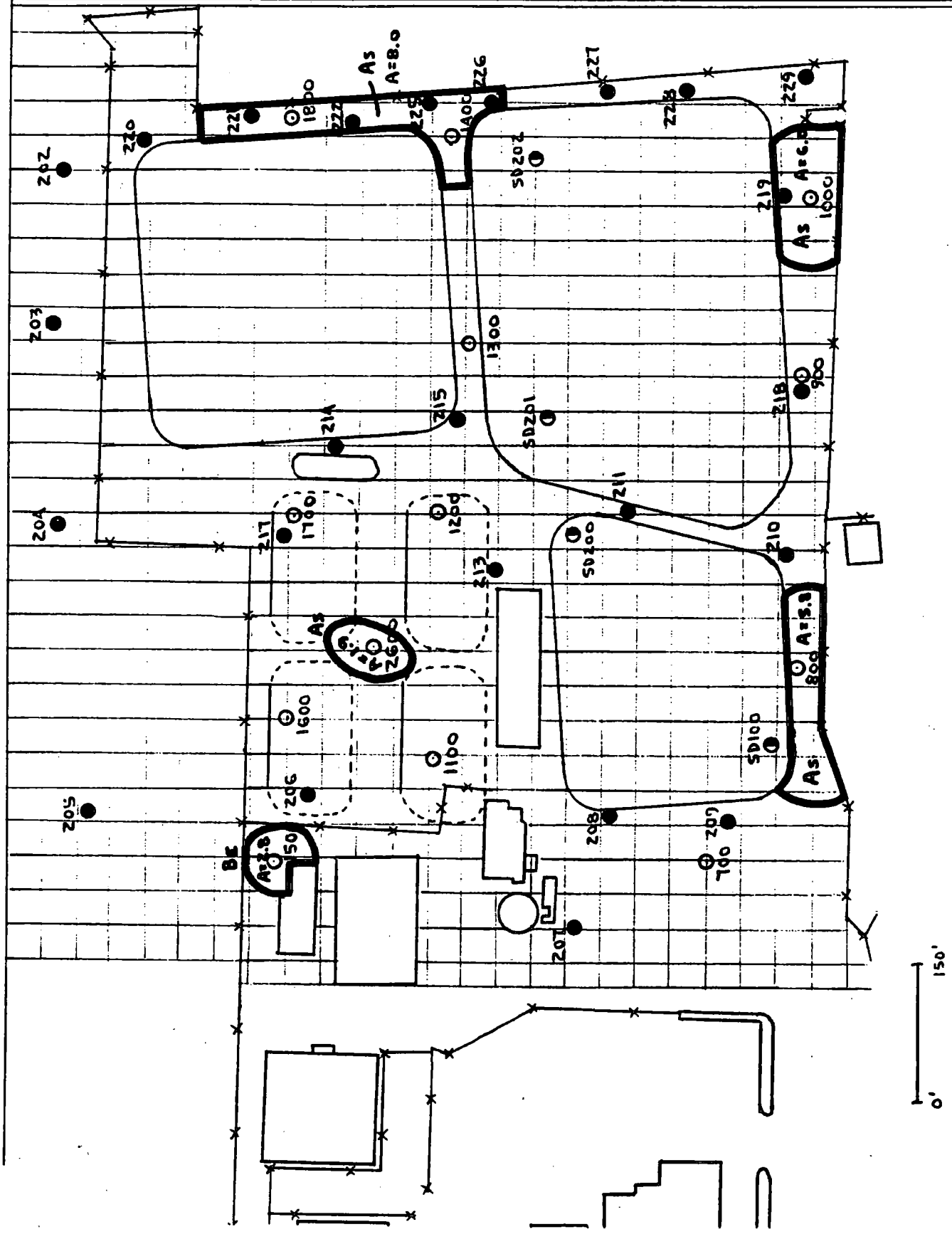


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - ARSENIC / BERYLLIUM (CURRENT SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

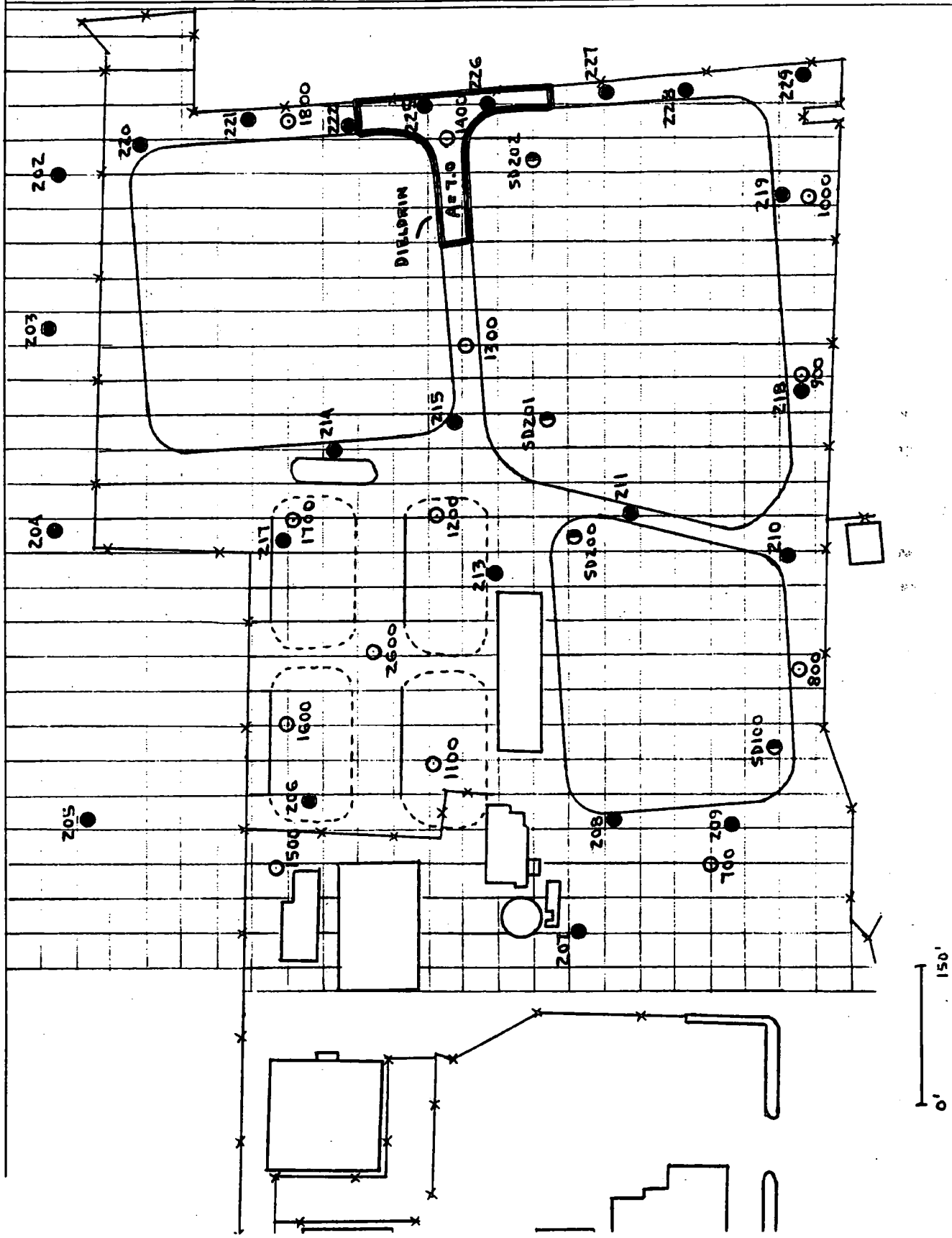


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB'S (CURRENT SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

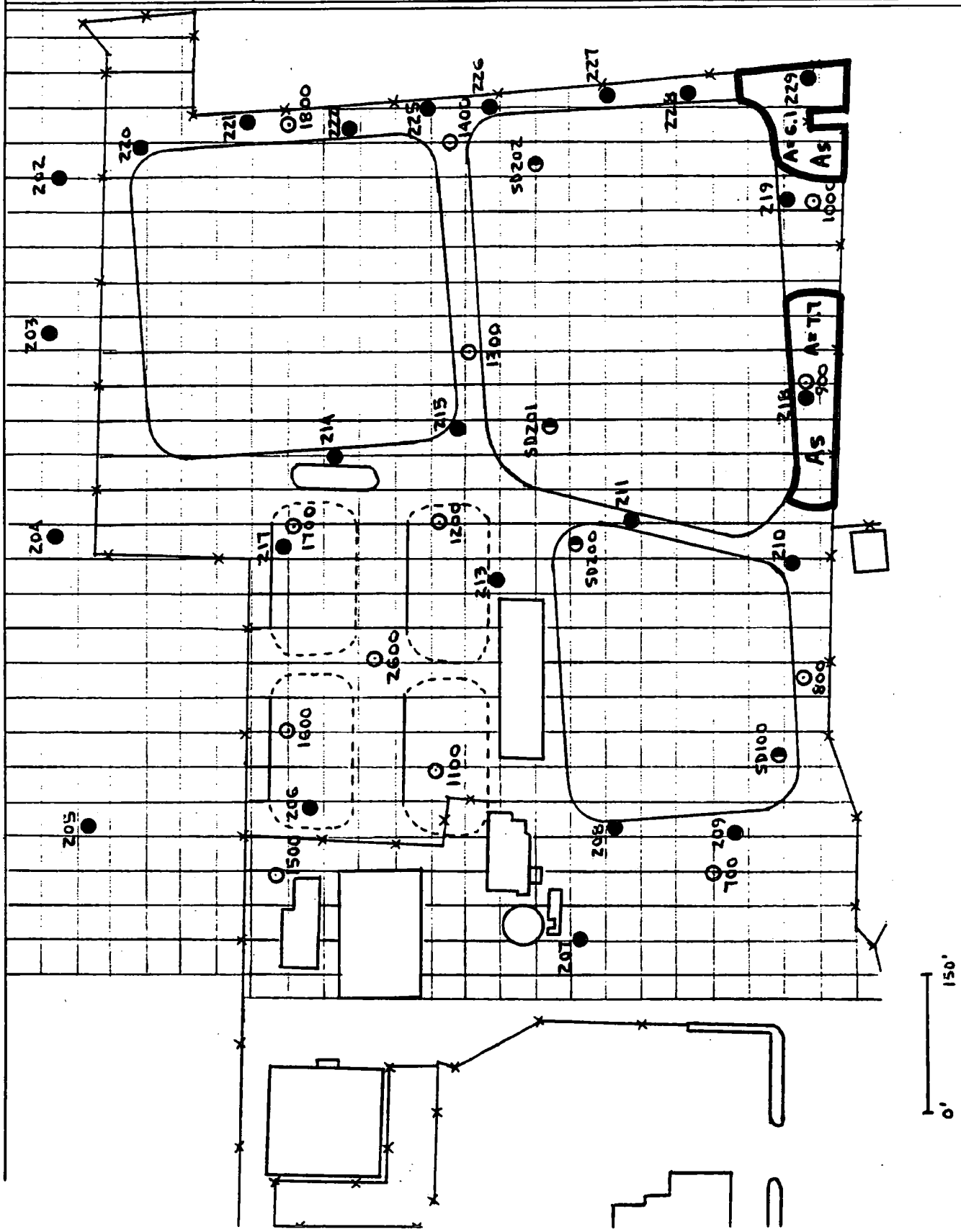


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - ARSENIC (CURRENT SCENARIO)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER

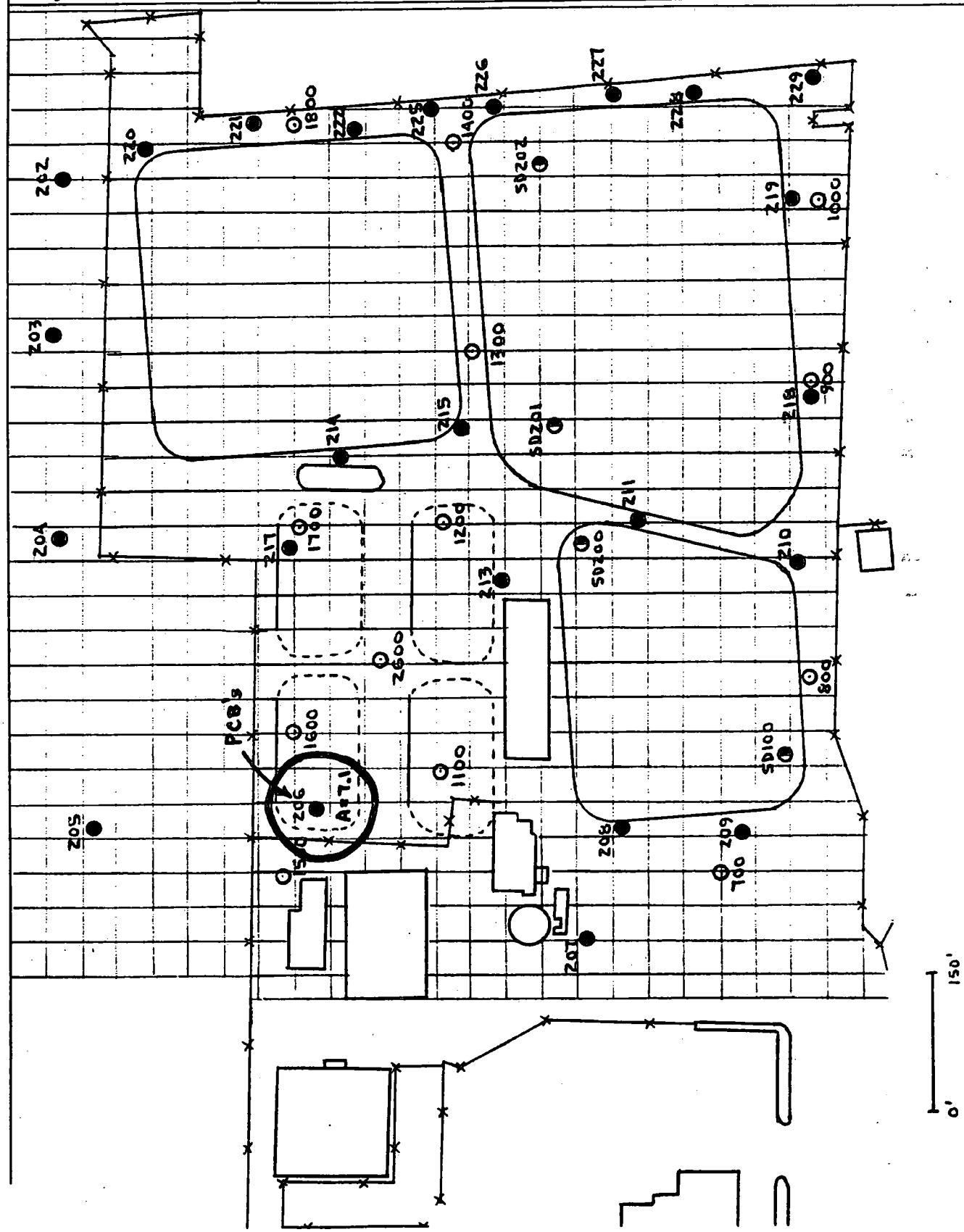
BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

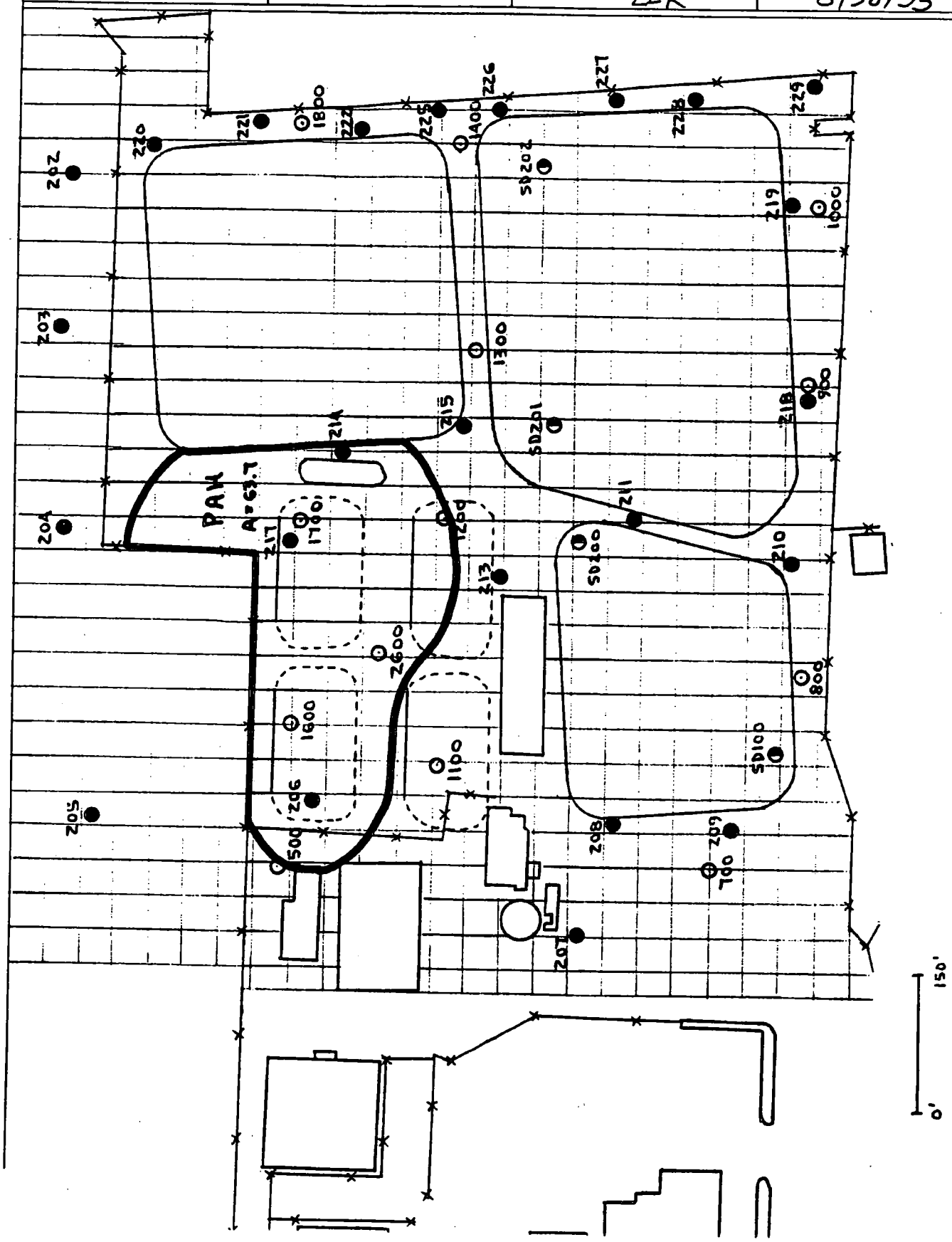
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (CURRENT SCENARIO)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

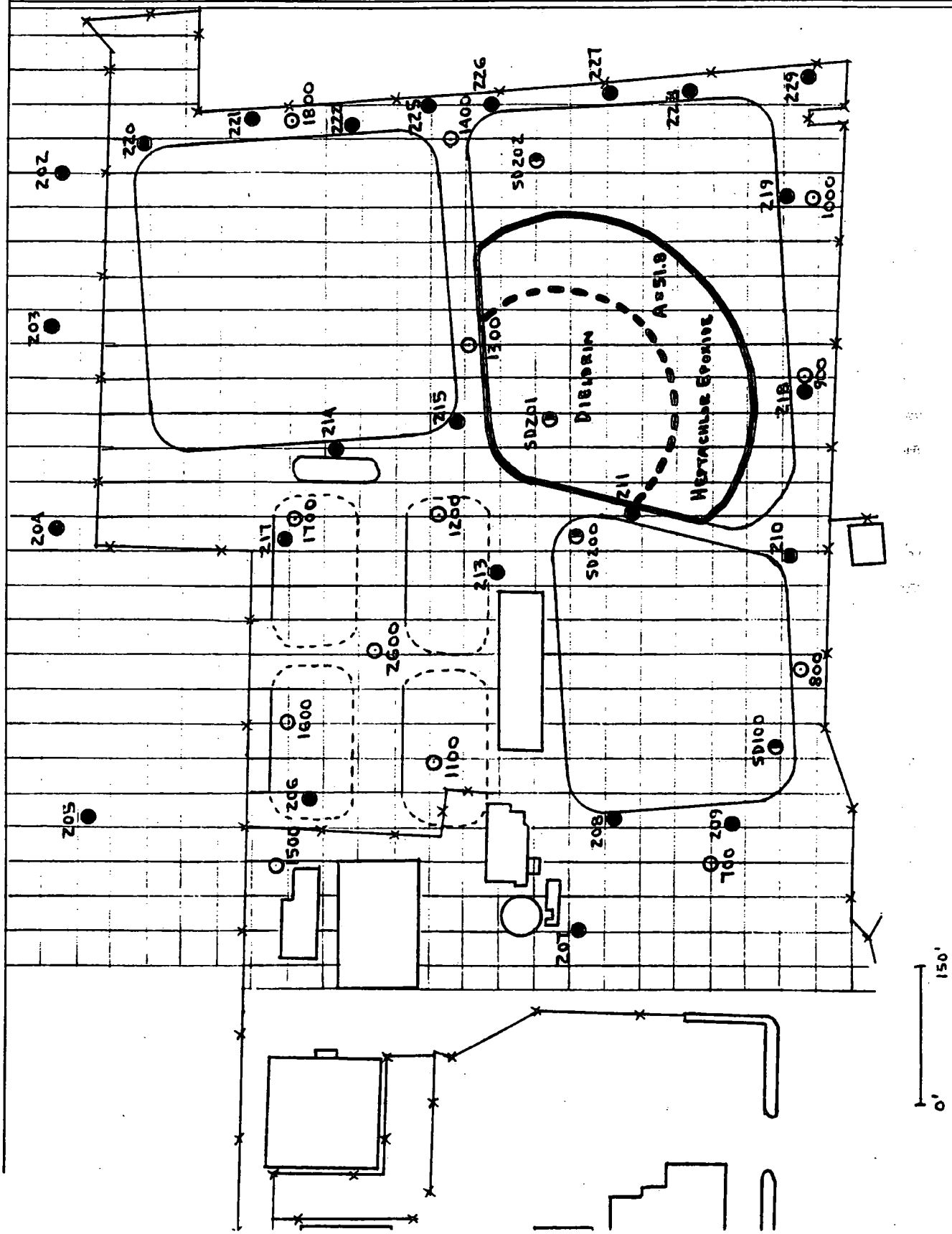
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19115 (01-91)

CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER:
SUBJECT: SITE 2 AREA MAP - PESTICIDES / PCB's (CURRENT SCENARIO)	
BASED ON: SEDIMENTS (NOT INCLUDED IN SOIL VOLUME CALCULATIONS)	DRAWING NUMBER:
BY: GND	CHECKED BY:
APPROVED BY: LEK	DATE: 8/30/93



CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 - CONTAMINATED SOIL VOLUME CALCULATIONS	
BASED ON FUTURE SCENARIO EXCEPT VOA's	DRAWING NUMBER
BY CND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

① SURFACE SOILS : FOR BERYLLIUM, PAH's, PCB's AND DIELDRIN REMOVAL.

DEPTH : 0 TO 1 FT.

AREA = $(142.9 + 12.8 + 11.4) \times 1406.25\ FT^2 \times \frac{YD^2}{9\ FT^2} = 26{,}109\ YD^2$

VOLUME = $26{,}109\ YD^2 \times 1\ FT \times \frac{YD}{3\ FT} = \boxed{8703\ CY}$

② SURFACE SOIL / SHALLOW SUB-SOIL : FOR PAH REMOVAL

DEPTH : 0 TO ~~8~~ 7 FT

AREA = $20.0 \times 1406.25\ FT^2 \times \frac{YD^2}{9\ FT^2} = 3125\ YD^2$

VOLUME = $3125\ YD^2 \times 5\ FT \times \frac{YD}{3\ FT} = \boxed{\cancel{5208}\ 7292\ CY}$

③ SHALLOW SUB SOIL : FOR PAH & PCB REMOVAL

DEPTH : 1 TO ~~8~~ 7 FT

AREA = $(54.2 + 2.5) \times 1406.25\ FT^2 \times \frac{YD^2}{9\ FT^2} = 8859\ YD^2$

VOLUME = $8859\ YD^2 \times (\cancel{8}\ 7 - 1)\ FT \times \frac{YD}{3\ FT} = \boxed{\cancel{11{,}813}\ 17{,}718\ CY}$

③A PCB PORTION OF ~~11,813~~ 17,718 CY

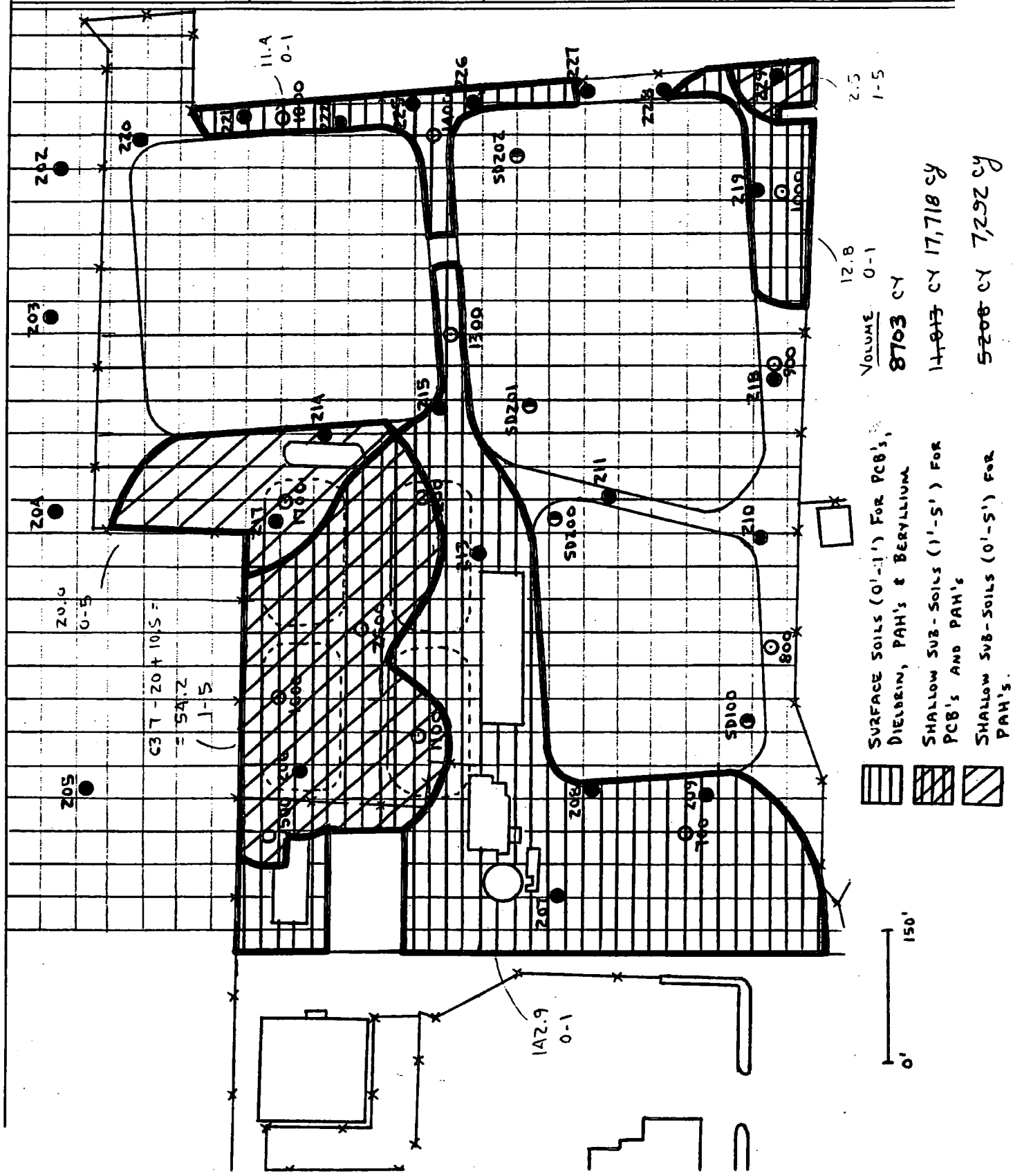
AREA = $(31.3 + 2.5) \times 1406.25\ FT^2 \times \frac{YD^2}{9\ FT^2} = 5281\ YD^2$

VOLUME = $5281\ YD^2 \times (5-1)\ FT \times \frac{YD}{3\ FT} = \underline{\underline{7042\ CY}}$

CALCULATION WORKSHEET

Order No. 19118 (01-91)

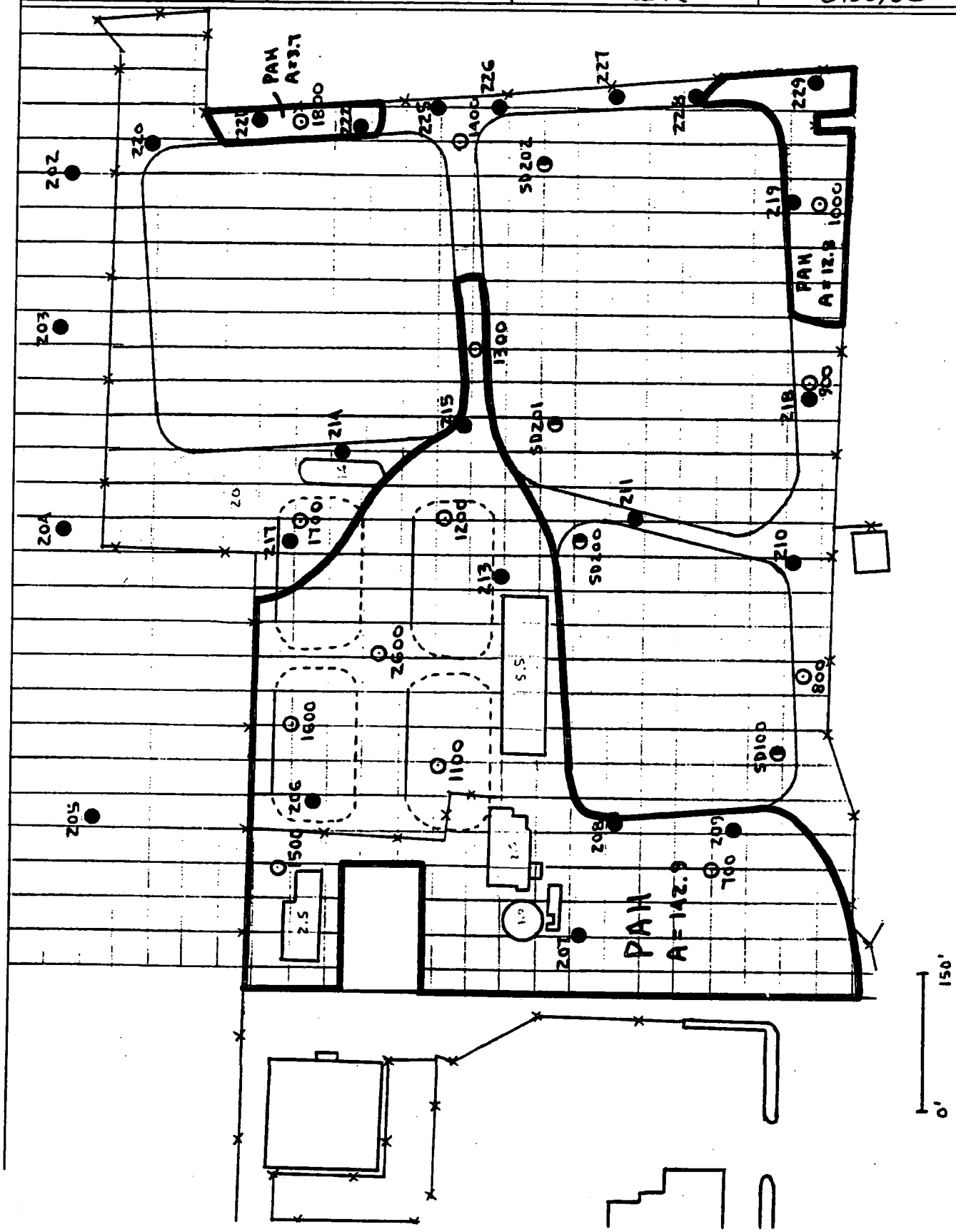
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - BERYLLIUM, PCB'S, PAH'S, DIELDRIN (FUTURE)	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

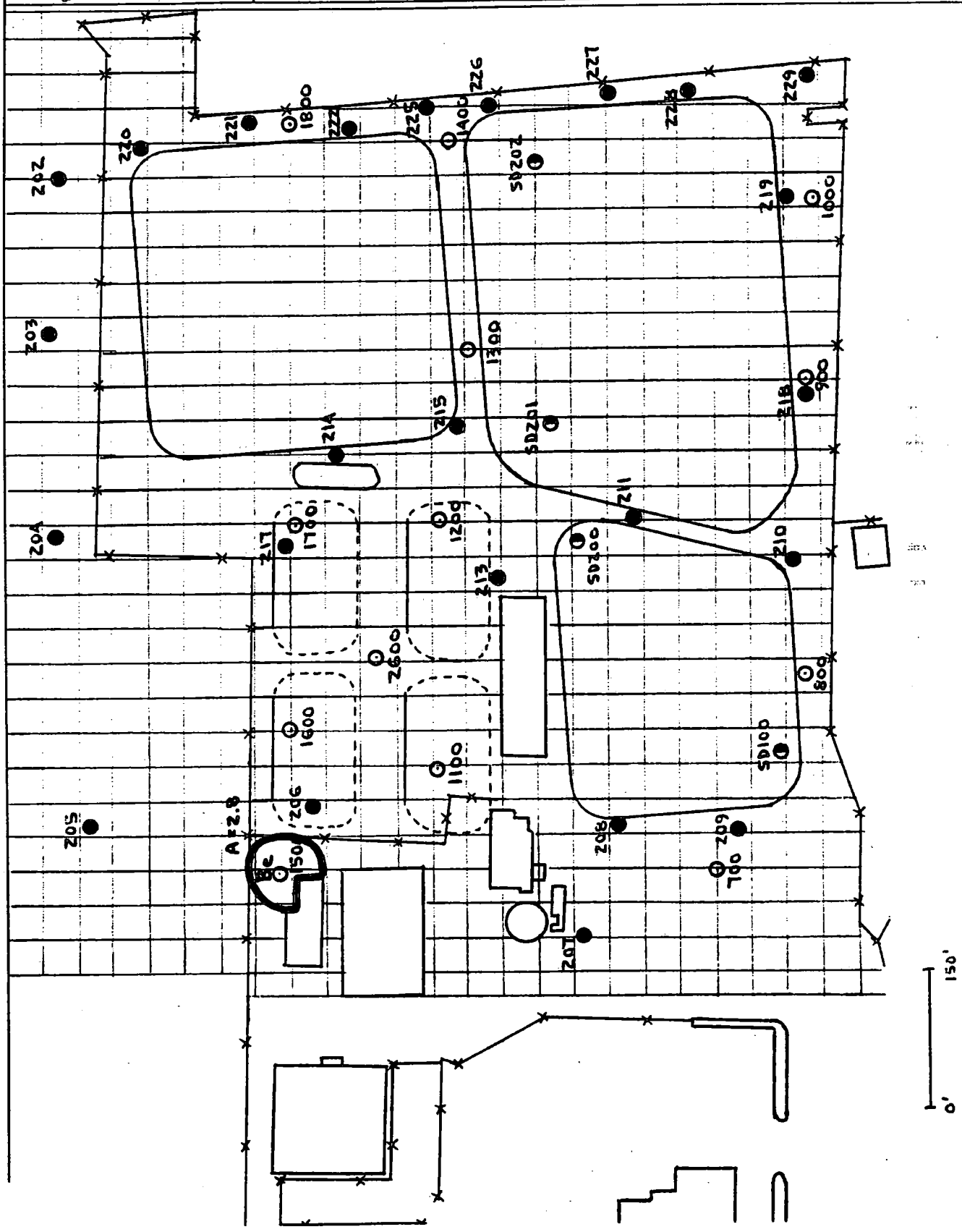
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - BERYLLIUM (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

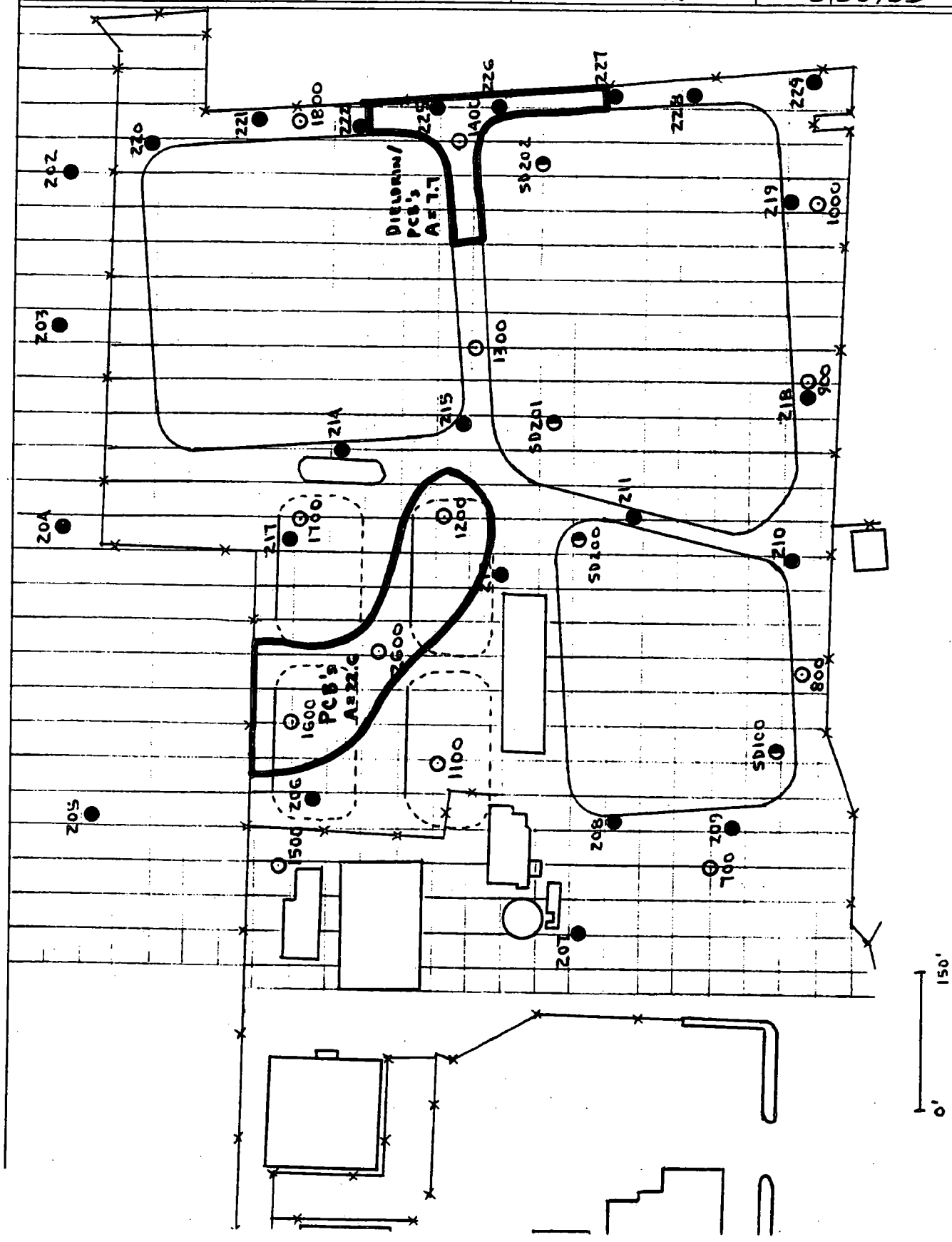


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

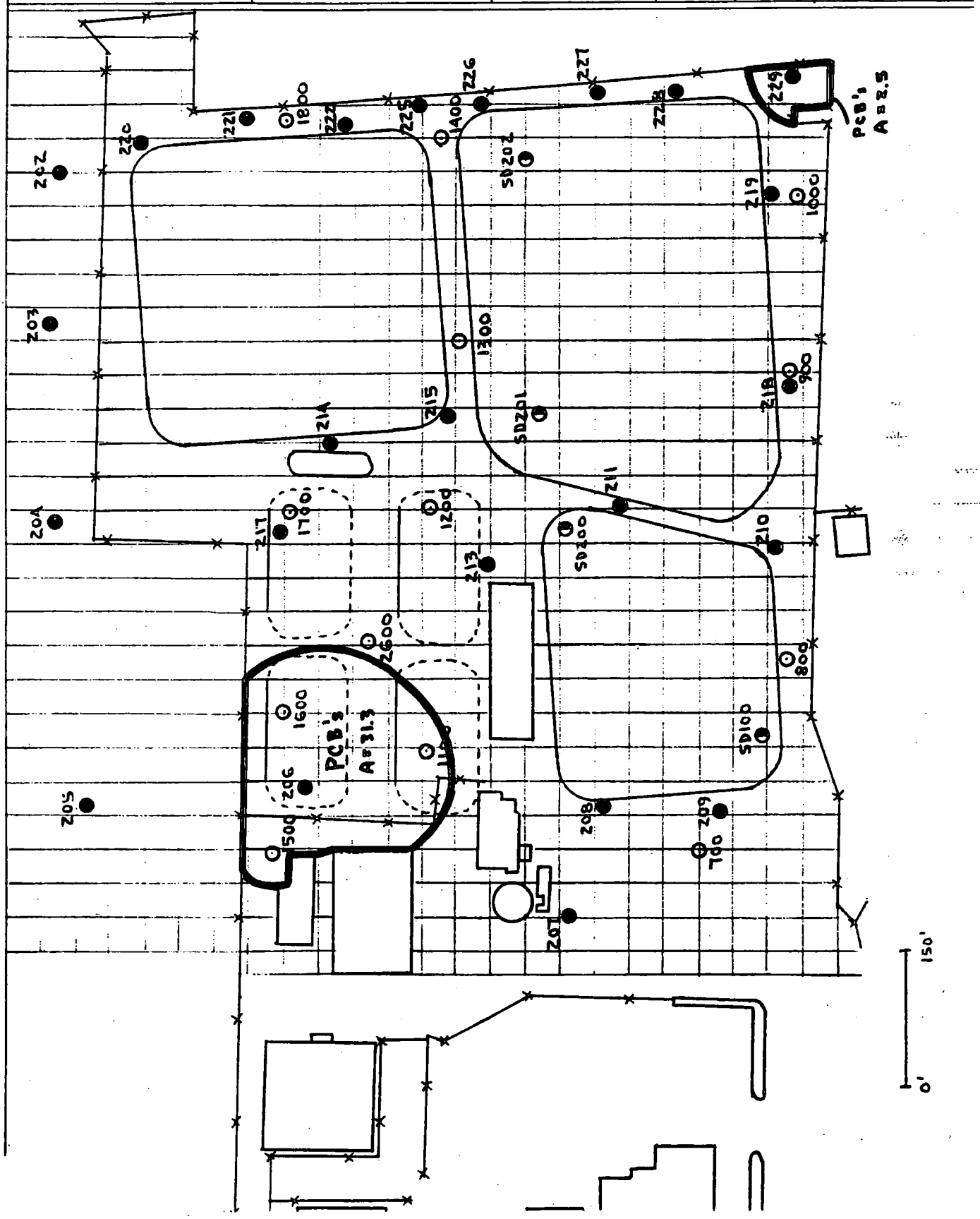


CALCULATION WORKSHEET

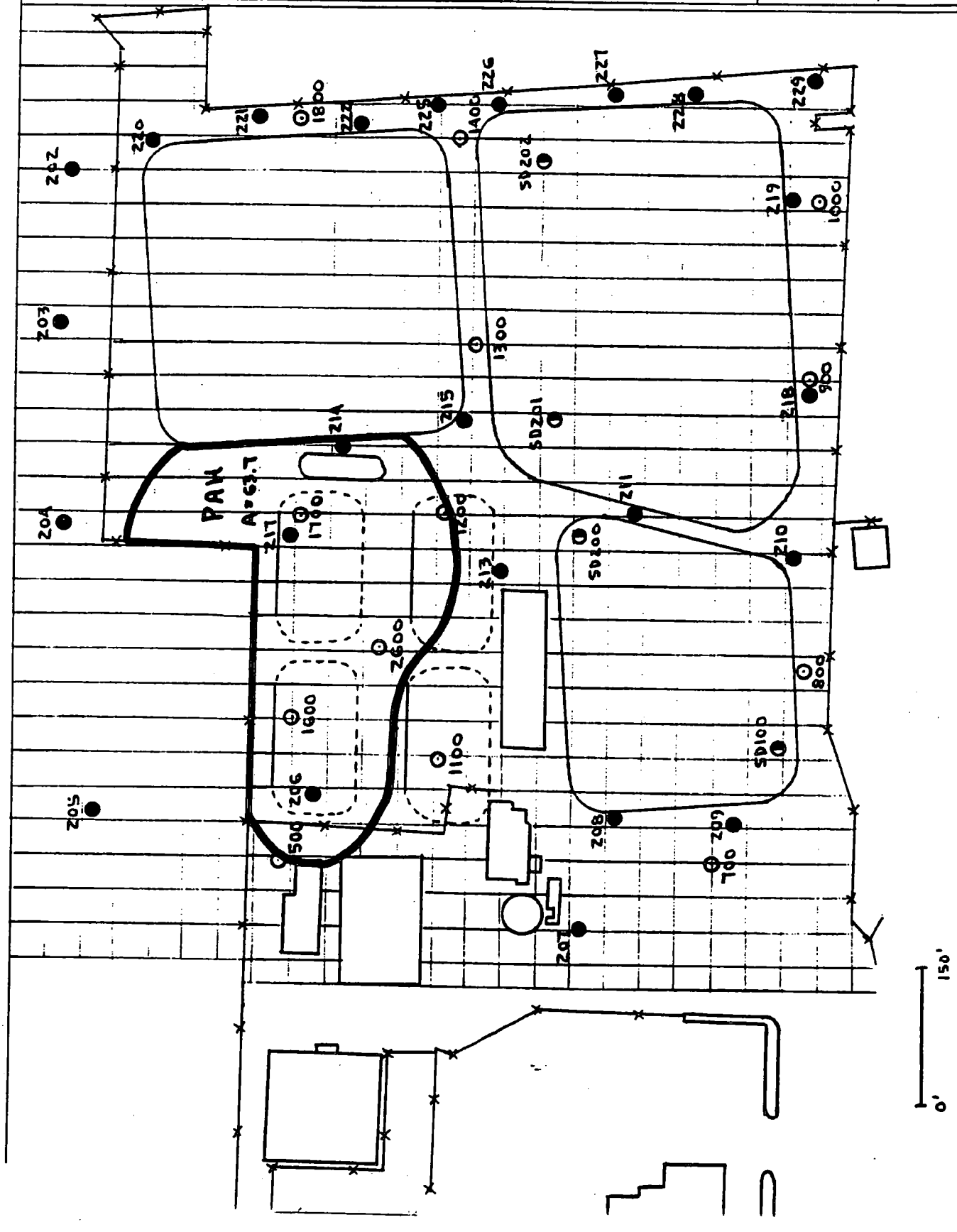
Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB'S (FUTURE SCENARIO)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



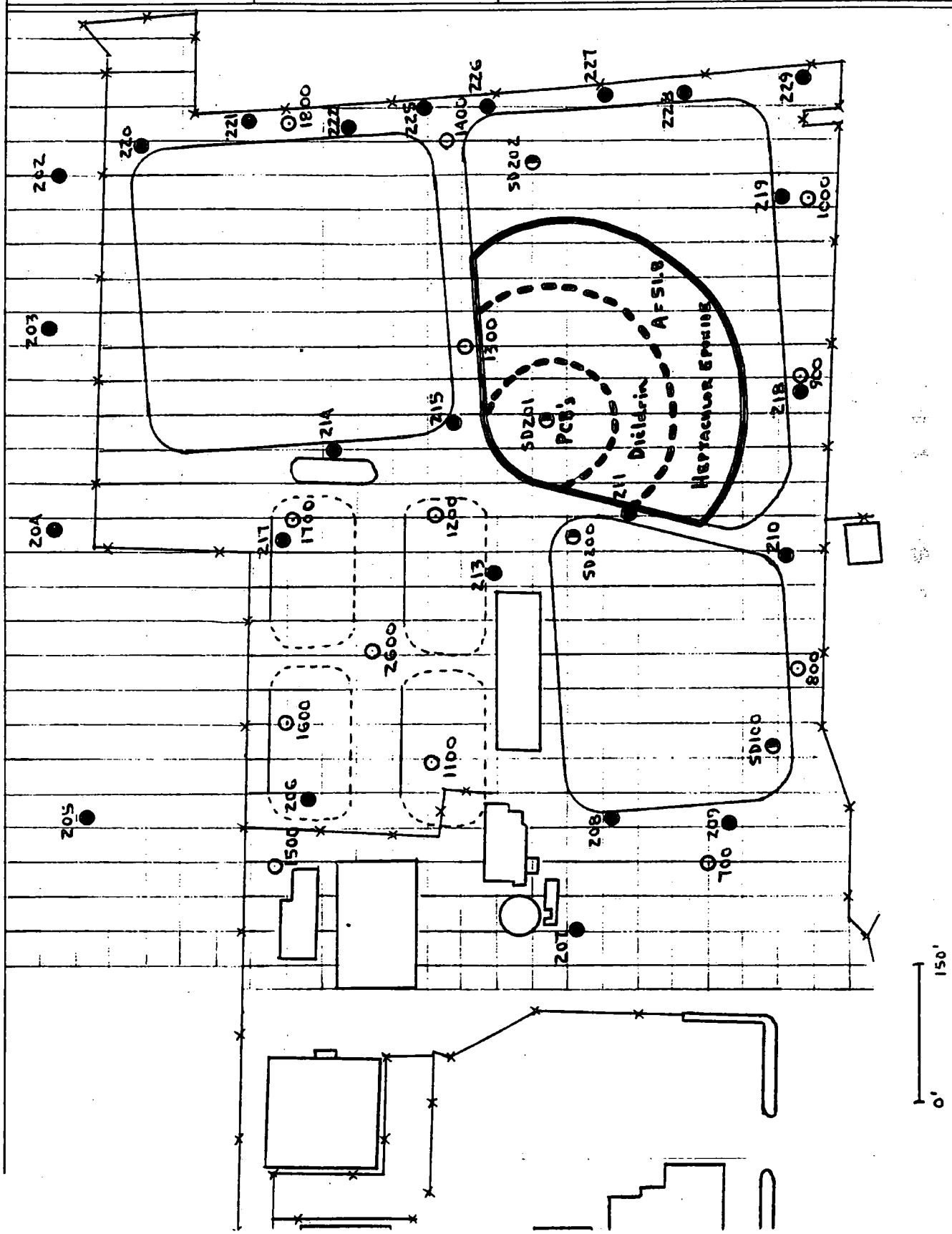
CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 2 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)			
BASED ON SHALLOW SUB-SOILS		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SEDIMENTS (NOT INCLUDED IN SOIL VOLUME CALCULATIONS)	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY / DATE



CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 2 - PCB CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① PCBs BETWEEN 10,000 μg/kg AND 50,000 μg/kg

Ⓐ SHALLOW SUB SOILS (0-7 FT DEPTH)

$$\text{AREA} = 7.1 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1109\ YD^2$$

$$\text{VOLUME} = 1109\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{2589\ CY}$$

② PCBs BETWEEN 1000 μg/kg AND 10,000 μg/kg

Ⓐ SHALLOW SUB SOILS (0-7 FT DEPTH)

$$\text{AREA}_1 = (31.3 - 7.1) \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 3781\ YD^2$$

$$\text{VOLUME}_1 = 3781\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \underline{8823\ CY}$$

$$\text{AREA}_2 = 2.5 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 391\ YD^2$$

$$\text{VOLUME}_2 = 391\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \underline{911\ CY}$$

$$\text{TOTAL VOLUME} = 8823 + 911 = \boxed{9734\ CY}$$

Ⓑ SURFACE SOILS (0-1 FT DEPTH)

$$\text{AREA}_1 = (22.6 - 12.6) \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1562\ YD^2$$

$$\text{VOLUME}_1 = 1562\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \underline{521\ CY}$$

$$\text{AREA}_2 = 7.7 \times 1406.25\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1203\ YD^2$$

$$\text{VOLUME}_2 = 1203\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \underline{401\ CY}$$

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 2 - PCB CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

(B) SURFACE SOILS (CONT)

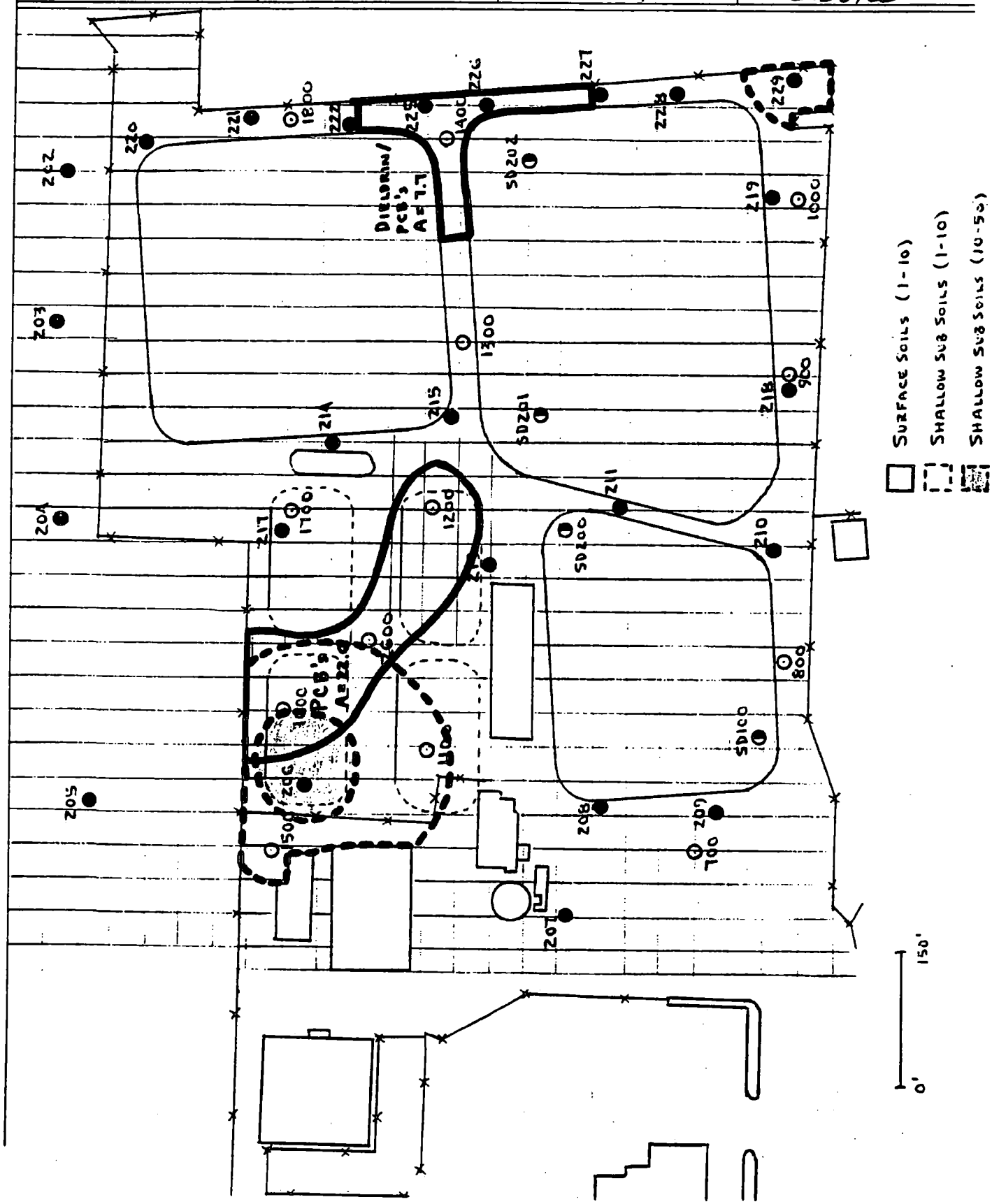
TOTAL VOLUME = 521 + 401 = 922 CY

TOTAL VOLUME OF PCB CONTAMINATED SOIL BETWEEN 1000 µg/kg AND 10,000 µg/kg:

V = 9734 CY + 922 CY = 10,656 CY

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER

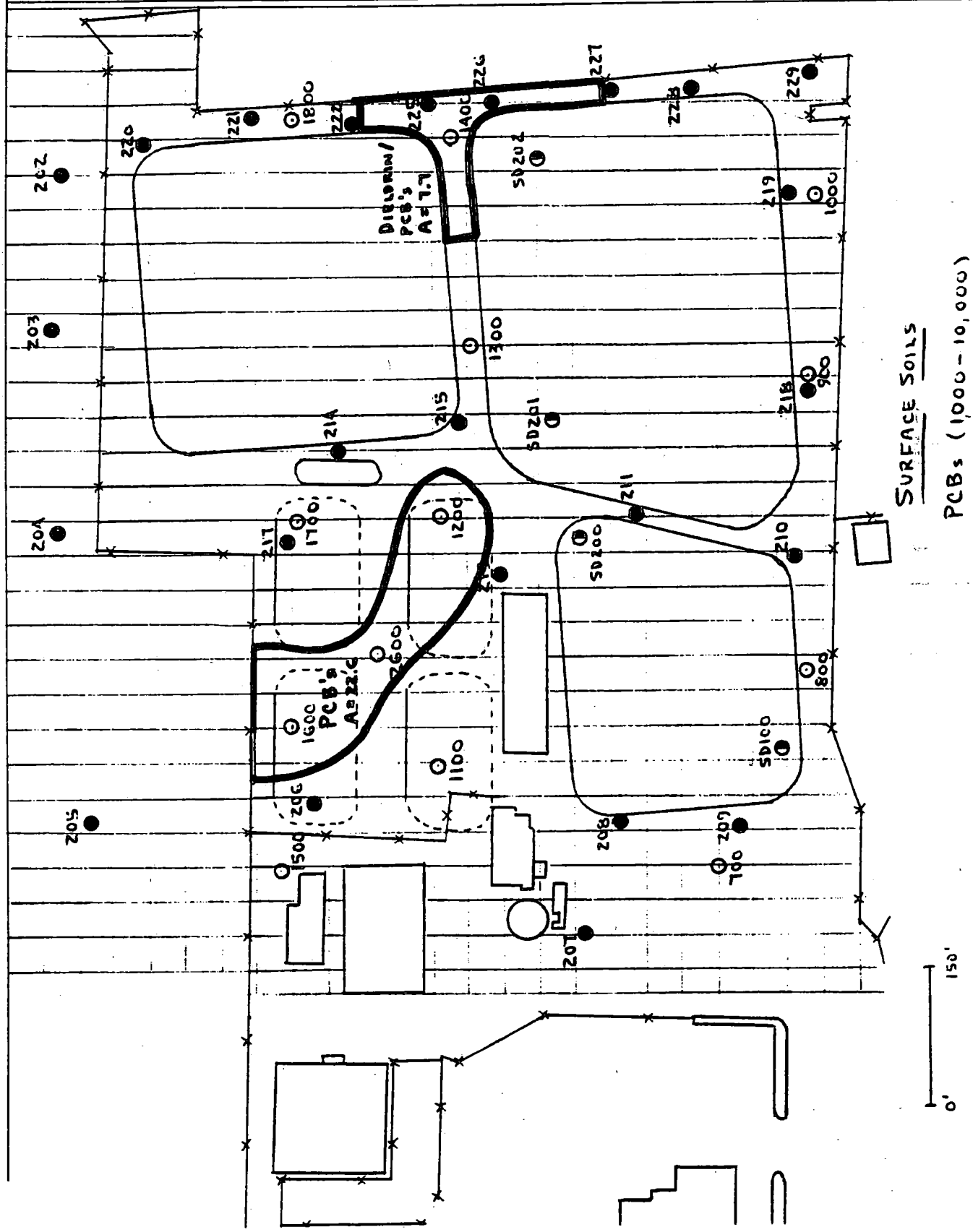
BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



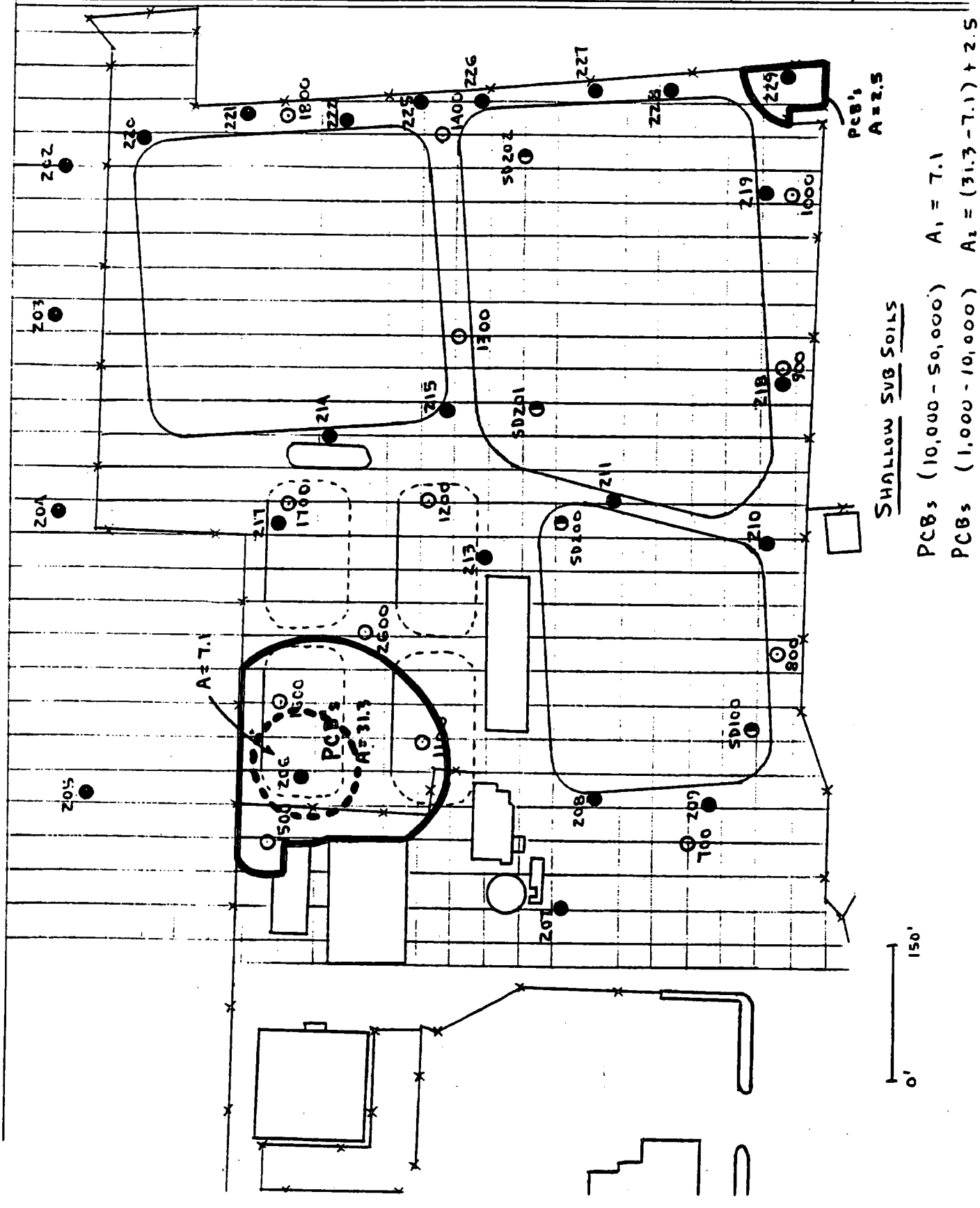
CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

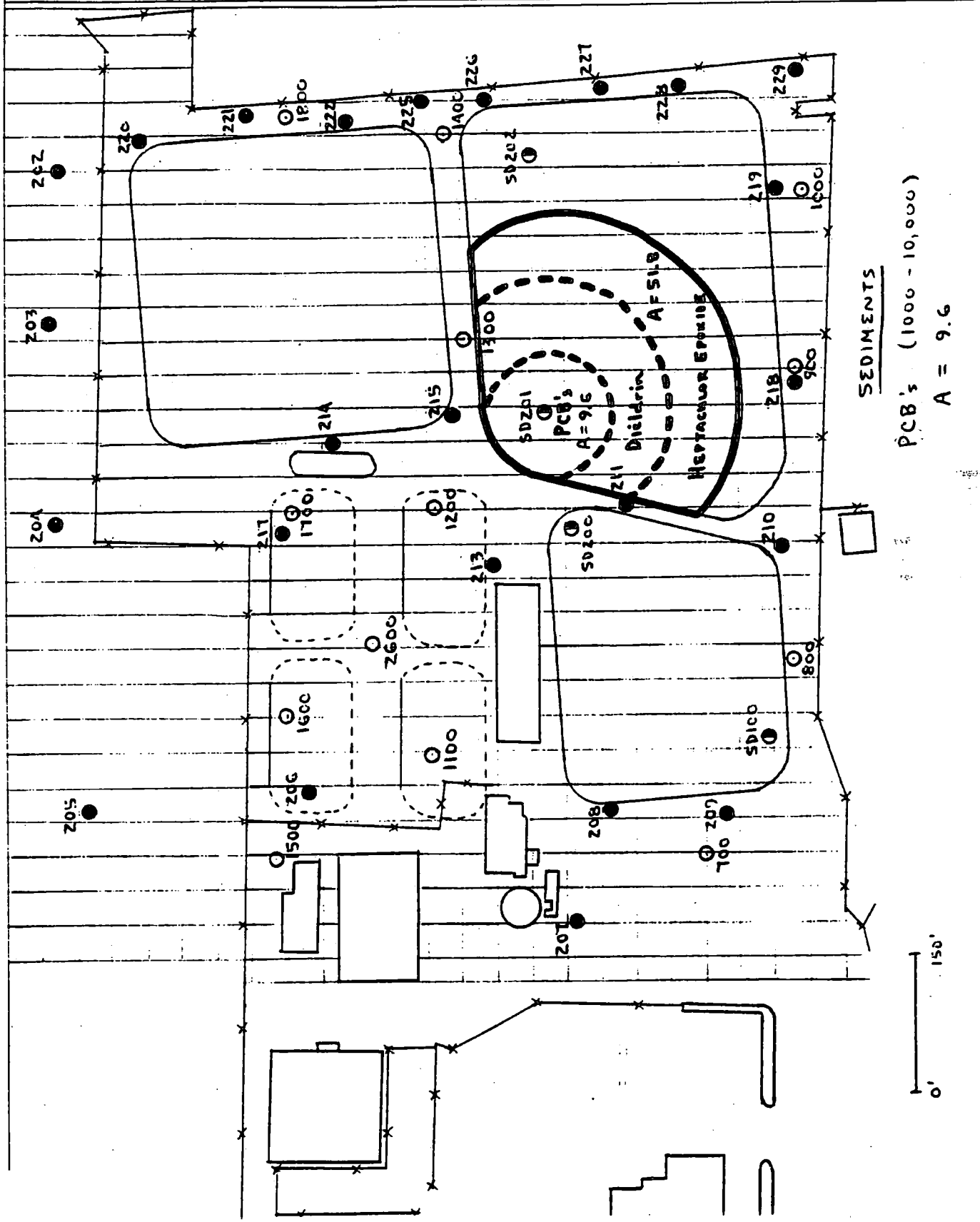


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 2 AREA MAP - PESTICIDES / PCB's (FUTURE SCENARIO)	
BASED ON SEDIMENTS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93

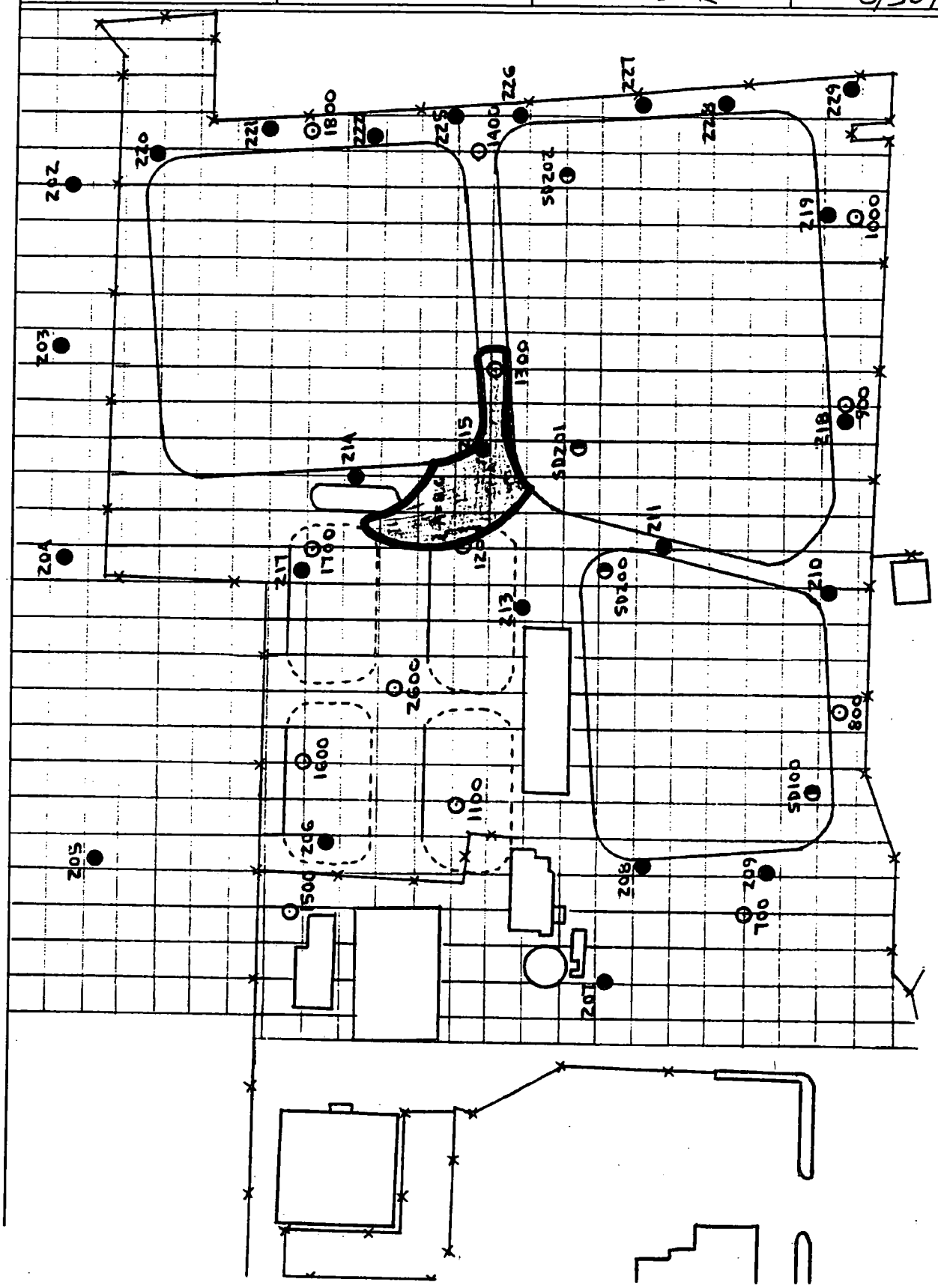


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT	JOB NUMBER
SUBJECT: SITE 2 - VOA OVERLAP W/ METALS & OTHER ORGANICS	
BASED ON: CURRENT & FUTURE SCENARIOS	DRAWING NUMBER: (SURFACE SOILS)

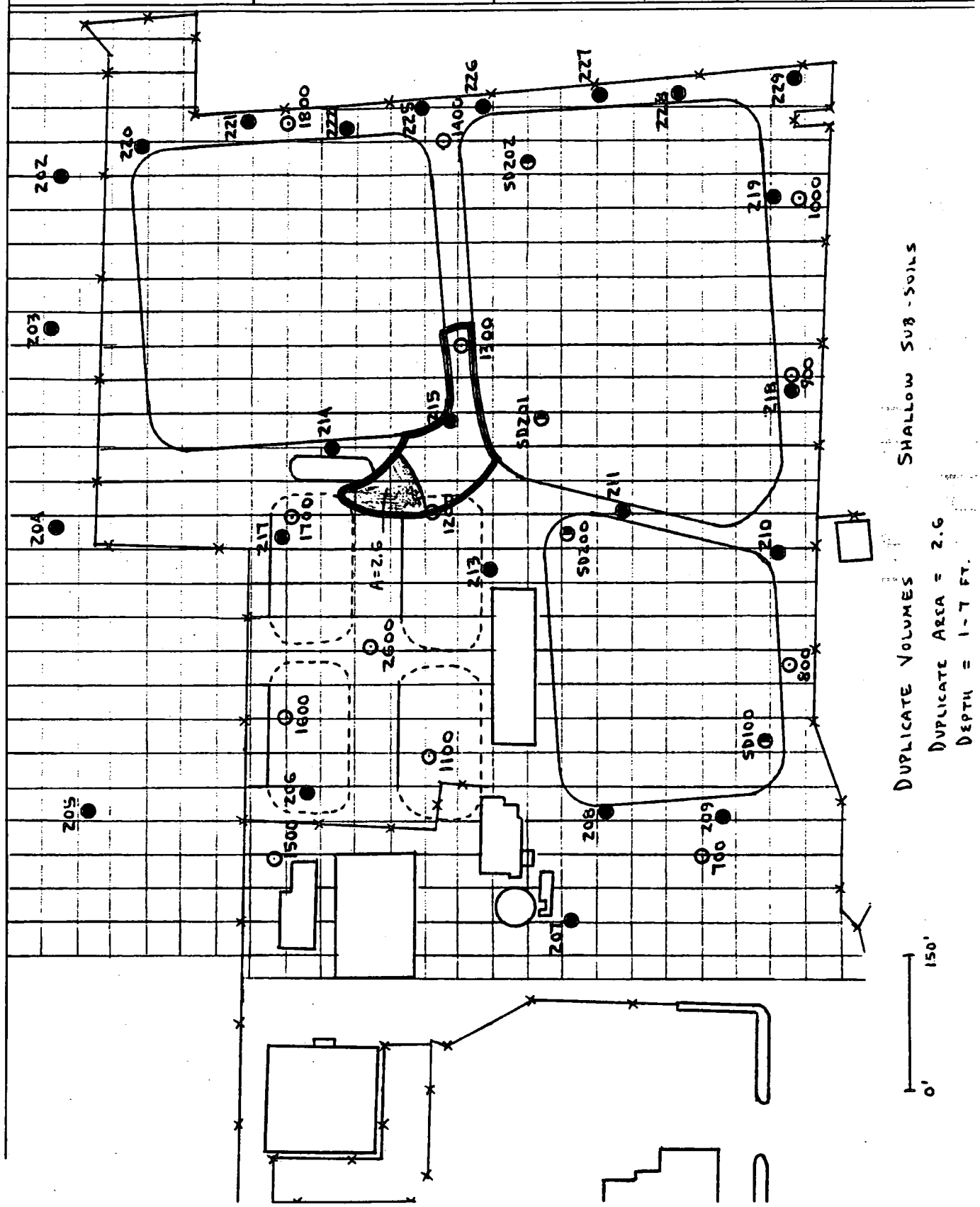
BY	CHECKED BY	APPROVED BY	DATE
		LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT	JOB NUMBER
SUBJECT: SITE 2 - VOA OVERLAP W/ METALS & OTHER ORGANICS	
BASED ON: CURRENT & FUTURE SCENARIOS	DRAWING NUMBER: (SHALLOW SUBSOILS)
BY / CHECKED BY	APPROVED BY: LEK / DATE: 8/30/93



SITE 3

SOIL CALCULATIONS

SITE 3

SOIL ACTION LEVELS

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 3 - SALVAGE STORAGE AREA
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 3**
SITE AREA (SF)	60,000
INFILTRATION FLOW RATE (CFY)	69,000
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.59
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcinogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 3						
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	9.98	64,000	527,000	9.98	4.00	N
Tetrachloroethene	5	5	5	5	364.0	0.67049	28.8	14,000	112,000	28.8	55.0	Y (2)
Chloroform	50		7	7	44.00	0.08105	4.87	110,000	29.0	4.87	ND	N
Toluene	5	1000	5	5	300.0	0.55260	23.7	20,000,000	3,435,000	23.7	22.0	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.384	4,000,000	102,000,000	0.384	ND	N
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.220	640	24.0	0.220	360	Y (1)
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	6,169	2,100	14,000	2,100	9.10	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,218	2,900	24,200	1,218	ND	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	3,480	2,100	17,100	2,100	6.90	N
Chlordane	2	2	0.1	0.1	140,000	257.9	221	540	3,650	221	110	N
Total PCB's	0.5	0.5	0.1	0.1				10,000	753 **	10,000	830	N
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	126,540,207		414,000	414,000	2,400	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	134,449	20,000,000	408,000,000	134,449	660	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	2,070,514	8,000,000	204,000,000	2,070,514	340	N
Dimethyl phthalate	50		50	50	17.40	0.03205	13.8	80,000,000	1,000,000,000 *	13.8	190	Y (1)
Naphthalene	50		10	10	940.0	1.731	149	300,000	81,600,000	149	61.0	N
2-Methylnaphthalene	50			50	5,800	10.68			40,800,000	40,800,000	54.0	N
Acenaphthene	50		20	20	4,600	8.473	1,455	5,000,000	122,400,000	1,455	270	N
Acenaphthylene	50			50	2,500	4.605					150	N
Anthracene	50		50	50	14,000	25.79	11,072	20,000,000	612,000,000	11,072	610	N
Fluoranthene	50		50	50	38,000	70.00	30,053	3,000,000	81,600,000	30,053	1,800	N
Pyrene	50		50	50	38,000	70.00	30,053	2,000,000	61,200,000	30,053	2,500	N
Phenanthrene	50		50	50	14,000	25.79	11,072			11,072	1,090	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	6.33	220		6.33	880	Y(1,2)
Chrysene	50		0.002	0.002	200,000	368.4	6.33			6.33	1,060	Y(1,2)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	17.4	220		17.4	1,200	Y(1,2)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	17.4	220		17.4	1,400	Y(1,2)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	1,740	61.0	670	61.0	1,300	Y(1,2)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	50.6			50.6	920	Y(1,2)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	36.5	14.0		14.0	ND	N
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,265,402			1,265,402	980	N
Fluorene	50		50	50	7,300	13.45	5,773	3,000,000	81,600,000	5,773	180	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	4.67	2,000,000	40,800,000	4.67	ND	N
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.20	7,000,000	37,000	1.20	ND	N
Carbon disulfide	50		3500	50	14.20	0.02616	11.2	8,000,000	310	11.2	1.00	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.37	8,000,000	204,000,000	2.37	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	5.14	12,000	9,070	5.14	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	34.7	5,400	56.0	34.7	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	87.0	8,000,000	218,000	87.0	ND	N
Xylenes	50	10,000		50	248.0	0.45682	196	200,000,000	30,400	196	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	40,800,000	2,000,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.775	4,000,000	102,000,000	0.775	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	3.04	2,000,000	40,800,000	3.04	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	7.59	160	1050	7.59	17.0	Y (1)
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.070	77.0	522	0.070	ND	N
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.269	44.0	297	0.269	5.00	Y (1)
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.269	200,000	612,000	0.269	ND	N

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 3 - SALVAGE STORAGE AREA
CURRENT EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 3**
SITE AREA (SF)	60,000
INFILTRATION FLOW RATE (CFY)	69,000
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.59
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 3					
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	CURRENT INDUSTRIAL LAND USE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE (mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	5.38	5.38	56.8	Y (1)
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	816	30.0	6.60	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	142	142	107	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	1.46	0.160	1.50	Y (1)
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	4.79	4.79	ND	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)		400	637	N (6)
Copper		1000	1000	1000					75,480	75,480	400	N
Lead		15	50	15	7.80	0.000	7.80	500		500	12.0	N
Manganese	300	50	600	50	167	0.000	167	20,000	142	142	267	Y (2)
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	127	20.0	0.500	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	34.5	34.5	ND	N
Silver	50	100	100	50	0.128	0.023	0.165	200	10,200	200	ND	N
Vanadium			250	250	17.9	0.000	17.9	600	14,280	600	150	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	612,000	20,000	20.0	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	40,800	2,000	4.20	N
Selenium	10	50	40	10	0.495	0.156	0.752		10,200	10,200	1.00	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	143	6.00	ND	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000
(6) Result is believed to be trivalent chromium...analysis will be performed to verify this

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 3 - SALVAGE STORAGE AREA
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 3**
SITE AREA (SF)	60,000
INFILTRATION FLOW RATE (CFY)	69,000
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.59
CHEMICAL SPECIFIC DATA	
ORG CARBON PARTITION COEFFICIENT-see K oc	
DISTRIBUTION COEFFICIENT - see K d	

* Risk based PRG is greater than pure product (1,000,000,000 ug/kg)
** Risk based carcinogenic PRG based on target cancer risk of 1E-6 rather than 1E-4 was not used
(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17,1994
ND Not detectable - NPDWR detection limits used

	GROUNDWATER CRITERIA					SITE 3						
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	K oc (ug/kg)/(ug/l)	K d (ug/kg)/(ug/l)	GW PROTECTION SOIL ACTION LEVEL (ug/kg)	NEW YORK STATE SOIL ACTION LEVEL (ug/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (ug/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (ug/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(ug/kg)	CHEMICAL OF CONCERN
Trichloroethene	5	5	10	5	126.2	0.23246	9.98	64,000	58,100	9.98	4.00	N
Tetrachloroethene	5	5	5	5	364.0	0.67049	28.8	14,000	12,300	28.8	55.0	Y (2)
Chloroform	50		7	7	44.00	0.08105	4.87	110,000	105,000	4.87	ND	N
Toluene	5	1000	5	5	300.0	0.55260	23.7	20,000,000	15,643,000	23.7	22.0	N
4-Methylphenol (p-Cresol)	50		1	1	24.30	0.04476	0.384	4,000,000	3,911,000	0.384	ND	N
Bis(2-chloroethyl) ether	50		1	1	13.90	0.02560	0.220	640	581	0.220	360	Y (1)
DDT	50		0.1 ND	0.1 ND	3,900,000	7,184	6,169	2,100	1,880	1,880	9.10	N
DDD	50		0.1 ND	0.1 ND	770,000	1,418	1,218	2,900	2,660	1,218	ND	N
DDE	50		0.05 ND	0.05 ND	4,400,000	8,105	3,480	2,100	1,880	1,880	6.90	N
Chlordane	2	2	0.1	0.1	140,000	257.9	221	540	491	221	110	N
Total PCB's	0.5	0.5	0.1	0.1				1,000	83.0 **	1,000	830	N
Bis(2-ethylhexyl) phthalate	50	4 (3)	4200	4	2,000,000,000	3,684,000	126,540,207		45,600	45,600	2,400	N
Butyl benzyl phthalate	50		50	50	170,000	313.1	134,449	20,000,000	15,643,000	134,449	660	N
Di-n-butyl phthalate	50		770	770	170,000	313.1	2,070,514	8,000,000	7,821,000	2,070,514	340	N
Dimethyl phthalate	50		50	50	17.40	0.03205	13.8	80,000,000	782,143,000	13.8	190	Y (1)
Naphthalene	50		10	10	940.0	1.731	149	300,000	3,129,000	149	61.0	N
2-Methylnaphthalene	50			50	5,800	10.68			1,564,000	1,564,000	54.0	N
Acenaphthene	50		20	20	4,600	8.473	1,455	5,000,000	4,693,000	1,455	270	N
Acenaphthylene	50			50	2,500	4.605					150	N
Anthracene	50		50	50	14,000	25.79	11,072	20,000,000	23,464,000	11,072	610	N
Fluoranthene	50		50	50	38,000	70.00	30,053	3,000,000	3,129,000	30,053	1,800	N
Pyrene	50		50	50	38,000	70.00	30,053	2,000,000	2,346,000	30,053	2,500	N
Phenanthrene	50		50	50	14,000	25.79	11,072			11,072	1,090	N
Benzo(a)anthracene	50		0.002	0.002	200,000	368.4	6.33	220		6.33	880	Y(1,2)
Chrysene	50		0.002	0.002	200,000	368.4	6.33			6.33	1,060	Y(1,2)
Benzo(b)fluoranthene	50		0.002	0.002	550,000	1,013	17.4	220		17.4	1,200	Y(1,2)
Benzo(k)fluoranthene	50		0.002	0.002	550,000	1,013	17.4	220		17.4	1,400	Y(1,2)
Benzo(a)pyrene	50	0.2 (3)	0.02 ND	0.02 ND	5,500,000	10,131	1,740	61.0	87.5	61.0	1,300	Y(1,2)
Indeno(1,2,3-c)pyrene	50		0.002	0.002	1,600,000	2,947	50.6			50.6	920	Y(1,2)
Dibenzo(a,h)anthracene	50		0.0007	0.0007	3,300,000	6,079	36.5	14.0		14.0	ND	N
Benzo(g,h,i)perylene	50			50	1,600,000	2,947	1,265,402			1,265,402	980	N
Fluorene	50		50	50	7,300	13.45	5,773	3,000,000	3,129,000	5,773	180	N
Trans-1,2-dichloroethene	5	100	5	5	59.00	0.10868	4.67	2,000,000	1,564,000	4.67	ND	N
1,1,1-Trichloroethane	5	200	5	5	15.20	0.02800	1.20	7,000,000	70,393,000	1.20	ND	N
Carbon disulfide	50		3500	50	14.20	0.02616	11.2	8,000,000	7,821,000	11.2	1.00	N
1,1-Dichloroethane	5		5	5	30.00	0.05526	2.37	8,000,000	7,821,000	2.37	ND	N
1,1-Dichloroethene	5	7	5	5	65.00	0.11973	5.14	12,000	1,060	5.14	ND	N
Carbon tetrachloride	5	5	5	5	439.0	0.80864	34.7	5,400	54,800	34.7	ND	N
Ethylbenzene	5	700	5	5	1,100	2.026	87.0	8,000,000	7,821,000	87.0	ND	N
Xylenes	50	10,000		50	248.0	0.45682	196.1	200,000,000	156,429,000	196	ND	N
Di-n-octylphthalate	50		50	50	3,600,000,000	6,631,200	1,000,000,000 *	2,000,000	1,564,000	1,564,000	ND	N
2-Methylphenol (o-Cresol)	50		2	2	24.50	0.04513	0.775	4,000,000	3,911,000	0.775	ND	N
2,4-Dimethylphenol	50		2	2	96.00	0.17683	3.04	2,000,000	1,564,000	3.04	ND	N
Heptachlor	0.4	0.4	0.04 ND	0.04 ND	12,000	22.10	7.59	160	142	7.59	17.0	Y (1)
Heptachlor Epoxide	0.2	0.2	0.02 ND	0.02 ND	220.0	0.40524	0.070	77.0	70.2	0.070	ND	N
Dieldrin	50		0.01 ND	0.01 ND	1,700	3.131	0.269	44.0	39.9	0.269	5.00	Y (1)
Endrin	0.2	2 (3)	0.01 ND	0.01 ND	1,700	3.131	0.269	200,000	23,500	0.269	ND	N

LEK 8/30/93

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
SITE 3 - SALVAGE STORAGE AREA
FUTURE EXPOSURE SCENARIO

GENERAL DATA	
INFILTRATION RATE (FPY)	1.150
MIXING ZONE (F)	50
HYDRAULIC CONDUCTIVITY (CCS/SC)	0.020
HYDRAULIC CONDUCTIVITY (CFY/SF)	20,692
HYDRAULIC GRADIENT (F/F)	0.0023
TOC - IN SOIL (MG/KG)	1842
SOIL ORGANIC CARBON (KG/KG)	0.001842
SITE SPECIFIC DATA	**SITE 3**
SITE AREA (SF)	60,000
INFILTRATION FLOW RATE (CFY)	69,000
UPPER GRADIENT (F)	220
CROSS SECTIONAL AREA (SF)	11,000
GROUNDWATER FLOW RATE (CFY)	523,511
DILUTION RATIO (CFY/CFY)	8.59
CHEMICAL SPECIFIC DATA	
MEAN BACKGROUND SOIL CONCENTRATION (MG/KG)	
STANDARD DEVIATION FOR n SAMPLES ANALYZED	

	GROUNDWATER CRITERIA						SITE 3					
	DRINKING WATER LAWS New York MCL (ug/l)	DRINKING WATER LAWS NPDWR MCL (ug/l)	GUIDELINES New York CONC (ug/l)	TRIGGER GW CONC (ug/l)	MEAN SOIL BACKGROUND CONC (mg/kg)	STD DEVIATION ON BACKGROUND CONC (mg/kg)	95% UCL SOIL BACKGROUND CONC (mg/kg)	NEW YORK STATE SOIL ACTION LEVEL (mg/kg)	FUTURE RESIDENTIAL ON-SITE - RISK BASED REMEDIATION GOAL (mg/kg)	MINIMUM SITE SPECIFIC SOIL ACTION LEVEL (mg/kg)	MAXIMUM SOIL CONCENTRATION AT SITE(mg/kg)	CHEMICAL OF CONCERN
Arsenic	50	50	50	50	2.50	0.688	3.63	80.0	23.5	23.5	56.8	Y (1)
Antimony		6 (3)	3	3	2.75	0.000	2.75	30.0	31.3	30.0	6.60	N
Barium	2000	2000	2000	2000	18.4	10.181	35.1	4,000	5,475	4,000	107	N
Beryllium		4 (3)	3	3	0.437	0.047	0.514	0.160	0.663	0.160	1.50	Y (1)
Cadmium	5	5	20	5	0.536	0.049	0.617	80.0	39.1	39.1	ND	N
Chromium	10	100	100 (4)	10	12.7	0.000	12.7	400 (5)		400	637	N (6)
Copper		1000	1000	1000					391	391	400	Y (1)
Lead		15	50	15	7.80	0.000	7.80	500		500	12.0	N
Manganese	300	50	600	50	167	0.000	167	20,000	391	391	267	N
Mercury	2	2	4	2	0.075	0.043	0.146	20.0	23.5	20.0	0.500	N
Nickel		100 (3)	2000	100	2.77	0.306	3.27	2,000	1,564	1,564	ND	N
Silver	50	100	100	50	0.128	0.023	0.165	200	391	200	ND	N
Vanadium			250	250	17.9	0.000	17.9	600	548	548	150	N
Zinc	5000	5000	5000	5000	20.0	0.000	20.0	20,000	23,464	20,000	20.0	N
Cyanide		200 (3)	400	200	1.14	0.109	1.32	2,000	1,564	1,564	4.20	N
Selenium	10	50	40	10	0.495	0.156	0.752		391	391	1.00	N
Thallium		2 (3)	4	2	0.364	0.033	0.417	6.00	5.48	5.48	ND	N

(1) Concentration of specific contaminant exceeds action level in surface soils
(2) Concentration of specific contaminant exceeds action level in sub-surface soils
(3) Rule effective January 17, 1994
(4) Trivalent Chromium, 35,000
(5) Trivalent Chromium, 80,000
(6) Result is believed to be trivalent chromium ...analysis will be performed to verify this

LEK 8/30/98

SITE 3

ANALYTICAL SUMMARIES AND MAPS

SITE 3 - SALVAGE STORAGE AREA

CONDENSED SUMMARY OF ANALYTICAL DATA

	SS1900	SS2000	SS2100	SS2200	SS2300	SS2400	SS2700	SS2800	SS2900	SB304	SB307	SB314	SB316	SB318	SB328	SB329	SB334	SB338
VOLATILES																		
Trichloroethene					3								2 / ND		4 / ND		4 / ND	
Tetrachloroethene										1 / 55			5 / 4	2 / 1	2 / ND	4 /	8 / 2	5 / 1
Toluene	3	3			3		22,18								1 / ND			
Carbon disulfide																1 /		
Acetone													65 / ND			108 /		
1,1,2,2-Tetrachloroethane														ND / 1				
2-Butanone															35 / ND			
ORGANIC ACIDS																		
2,4-Dichlorophenol									360									
Benzoic Acid	360							300	120				52		200	101	93	
ETHERS																		
Bis(2-chloroethyl) ether									360									
PHTHALATES																		
Bis(2-ethylhexyl) phthalate	70		390	2400	370	66	ND,900,2000	1100		140								
Butyl benzyl phthalate	38		190	98				660										41
Di-n-butyl phthalate				340				290									57	
Dimethyl phthalate								190										
PESTICIDES																		
DDT				9.1														
DDE				6.9														
Chlordane				110														
Heptachlor				17														
Dieldrin				5														
PCB's																		
Aroclor 1248							830	250	44									
Aroclor 1254								530										
PAH's																		
Naphthalene																61		
2-Methylnaphthalene				54														
Acenaphthene		140	160													270		
Acenaphthylene			150															
Anthracene		610	240	34				36								230		
Fluoranthene	280	1600	1800	450	260	35	160,470,ND	210	36						49	1060	70	
Pyrene	260	2100	2500	500	360	44		420	36						48	1000		
Phenanthrene	140	1090	1050	270	210		410,400,250	190								1030		
Benzo(a)anthracene		800	880	320	200											510		
Chrysene	140	1060	1010	380	180			160								510	43	
Benzo(b)fluoranthene	180	670	1200	450	190											450	46	
Benzo(k)fluoranthene	140	1200	1400	280	140		ND,400,510	510								410	43	
Benzo(a)pyrene	120	960	1300	260	160											540	50	
Indeno(1,2,3-c)pyrene	88		920	190	120		700,500,750									340		
Benzo(g,h,i)perylene	97	670	980	210	120		740,ND,830								41	300		
Fluorene		180	170													160		
Dibenzofuran																68		
INORGANICS																		
Aluminum	9900	8260	8280	28000	9270	19100	9850,17200	10500	21400		1530	1880	5450	2480	10400	10100	6550	1720
Antimony			3				6.6,5.5	2.9										
Arsenic	4.1	3	3.6	56.8	7.9	2	4.1,4.0		1.1				1.4	1.8	4.6	2.6	3.5	1.2
Barium	22.2	56.1	43.7	99	36.5	23.9	53.5,55.6	107	23.4		4.8	7.5	11.1	4.2	28.5	22.6	23.4	5
Beryllium		0.53	0.53	1.5	0.6	1.1	.46,.56	0.38	1.4									
Calcium	997	66700	42200	2660	2500	13300	41900,41600	34800	13300				100	67	564	583	322	69.6
Chromium	10.4	13	41.1	121	21	4.6	52.4,71.3	637					6.5	5.1		12.7	9.9	2.4
Cobalt	4	6.4	5.4	14.6	3.6	17.9	5.9,5.8	19.2	19.9									
Copper							158,400	400									8.8	3.3
Iron	11000	12300	12900	41000	16500	36600	26300,23600	135000	40200				5980	5250		11400	9150	4060
Lead													3.1	1.9		7.8	12	1.2
Magnesium	1100	8150	4640	894	1910	5230	6160,4560	4510	5110		306	562	568	278	936	1080	564	283
Manganese													121	90.6		167	267	61.4
Mercury	0.12	0.16	0.14	0.3	0.11		.19,.23	0.5									0.18	
Potassium	395	1050	696	1350	556	349	702,814	490	261		348	350	183	113	554	353	238	145
Selenium				1														
Sodium													167	146		190	169	131
Vanadium	20.5	23.7	25.8	49.4	26.5	119	22.1,22.6	41.9	150				8.8	5.8		17.9	11.2	4.3
Zinc													16.1	7.4		20		
Cyanide					4.2													

SOIL GAS ANALYSES	SG303	SG304	SG305	SG306	SG307	SG308	SG309	SG310	SG311	SG312	SG313	SG314	SG315	SG316	SG317	SG318	SG319	SG320
1,1-Dichloroethene	ND/3.7	17/43	3.3/14	131/125	138/179	25/27	8.4/12	23/27	1.0/14	28/23	10/4.3	9.6/11	4.5/ND	21/33	23/8.7	74/65	19/27	52/61
1,1-Dichloroethane																ND/1.1		
Cis-1,2-dichloroethene																3.4/7.4		
1,1,1-Trichloroethane	ND/.14	3.0/3.1	ND/.36	46/37	60/48	.51/.54	.19/.37	.30/.30	.50/14	.14/.15	2.8/1.3	ND/.12	.82/ND	1.9/3.0	1.9/.70	5.1/4.9	1.7/2.3	3.0/3.8
Trichloroethene	ND/.13	12/4.8	.21/1.3	12/9.7	10/9.2	.52/.87	.37/.28		ND/2.2		2.7/1.0		.63/ND	1.7/3.6	1.8/.88	38/47	4.0/4.4	.23/.95
Tetrachloroethene	.13/.20	.61/.49	.12/.54	.67/.67	.97/.76	.33/.46	2.3/1.4				1.7/.35			8.9/8.5	3.5/.87	54/51	2.7/9.6	1.0/.93

SOIL GAS ANALYSES	SG321	SG322	SG325	SG326	SG327	SG328	SG329	SG334	SG336	SG338	SG340	SG341	SG342	SG343
1,1-Dichloroethene	16/38	96/95	5.6/2.7	5.0/18	3.8/2.2	41/33	2.6/2.5	50/28	26/45	28/42	ND/5.4	39/71	31/18	33/9.5
1,1-Dichloroethane	1.8/9.3							16/11	ND/3.9	2.1/5.5				ND/1.6
Cis-1,2-dichloroethene	3.6/20							4.3/1.6		12/30				7.7/ND
1,1,1-Trichloroethane	5.8/11	2.4/2.1	.63/.22	ND/.23		4.0/2.4	.17/ND	5.3/3.5	4.0/6.2	6.8/15	.15/2.1	1.0/2.2	2.8/1.9	3.3/1.1
Trichloroethene	15/17	.28/.35	.32/.12		.20/.16	4.9/9.7	ND/.22	17/13	3.8/7.4	13/17	.16/.18	1.9/7.2	4.2/3.2	4.4/1.5
Tetrachloroethene	2.6/4.4	.31/.24	.89/.49	ND/.47	.34/.18	5.5/2.8	.08/.06	ND/12	4.3/5.0	8.6/24	.16/.12	5.2/6.5	12/4.2	6.2/1.6

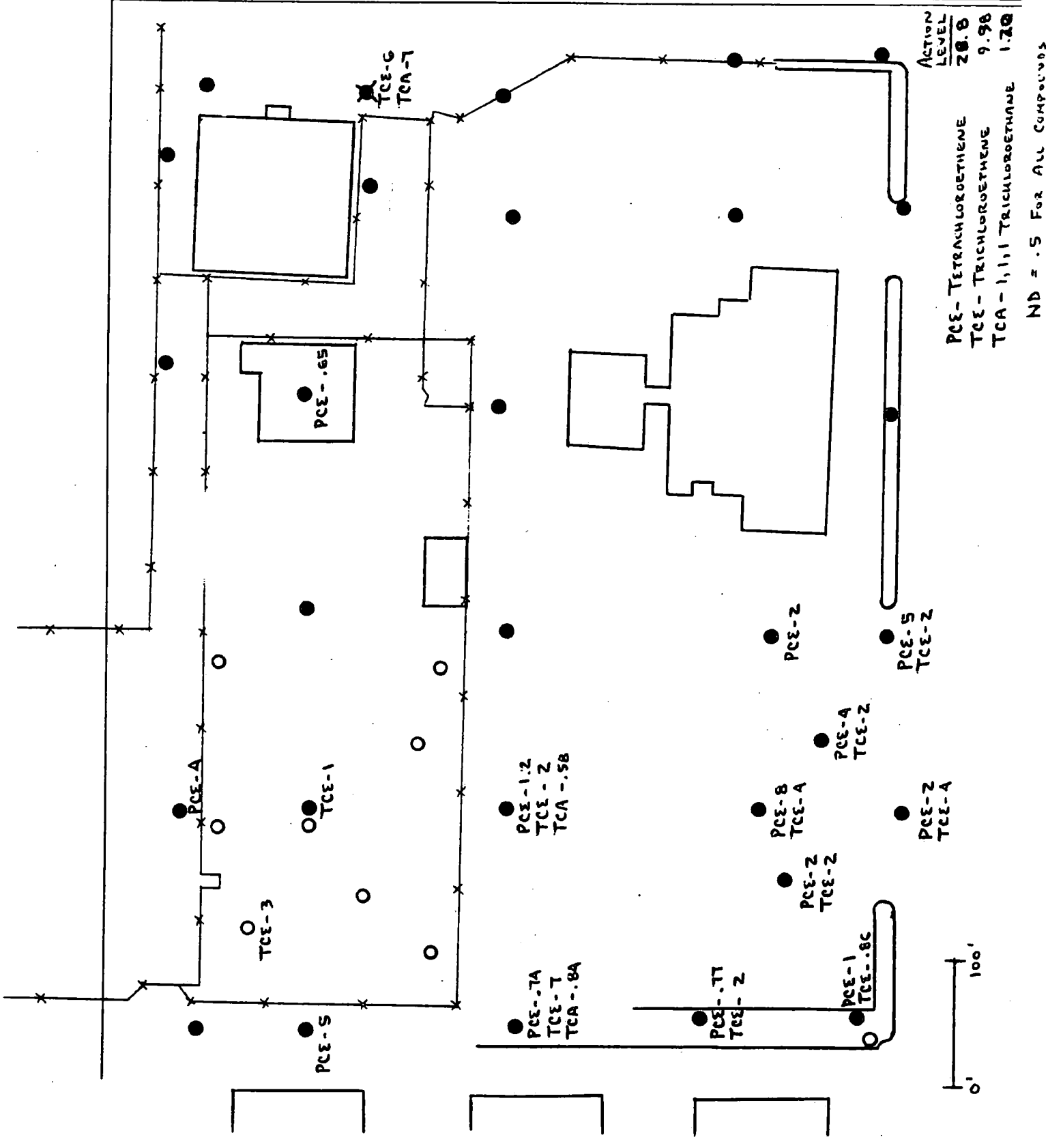
LEK 8/30/93

Pg 1 of 1

CALCULATION WORKSHEET

Order No. 19116 (01-91)

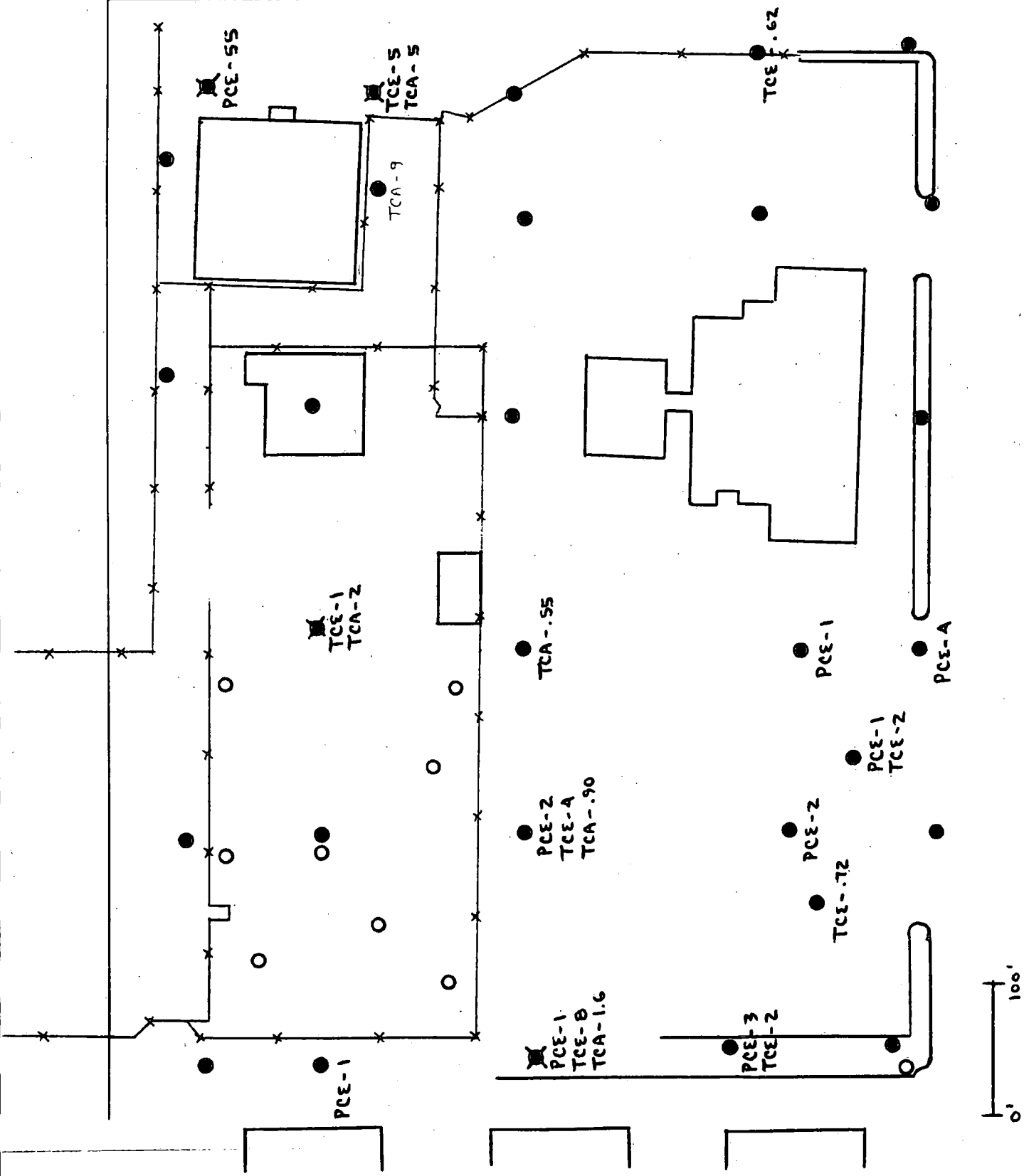
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - VOA ANALYSES	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

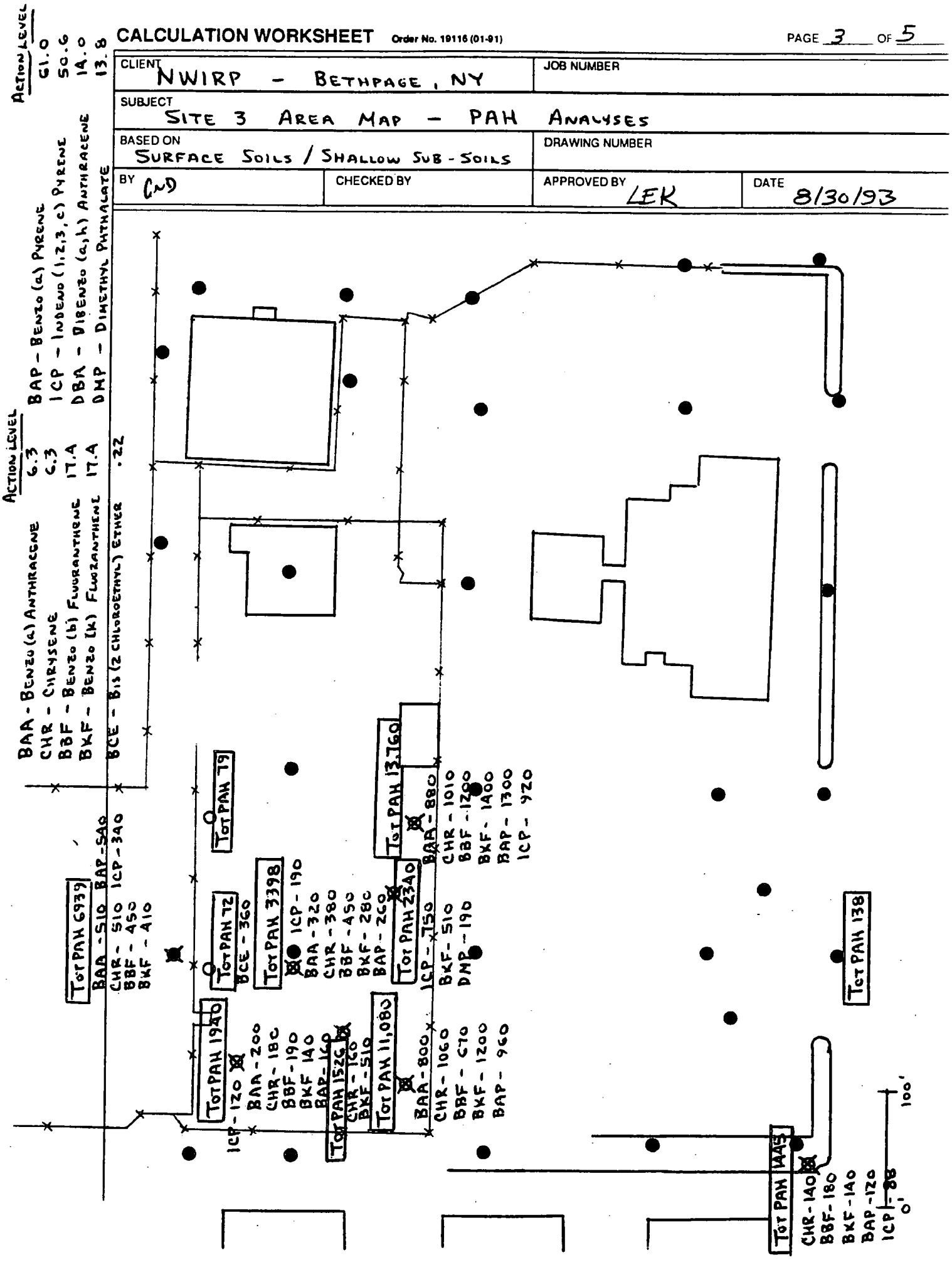
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - VOA ANALYSES	
BASED ON DEEP SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/97



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT: SITE 3 AREA MAP - PAH ANALYSES	
BASED ON: SURFACE SOILS / SHALLOW SUB-SOILS	DRAWING NUMBER
BY: CND / CHECKED BY	APPROVED BY: LEK / DATE: 8/30/93

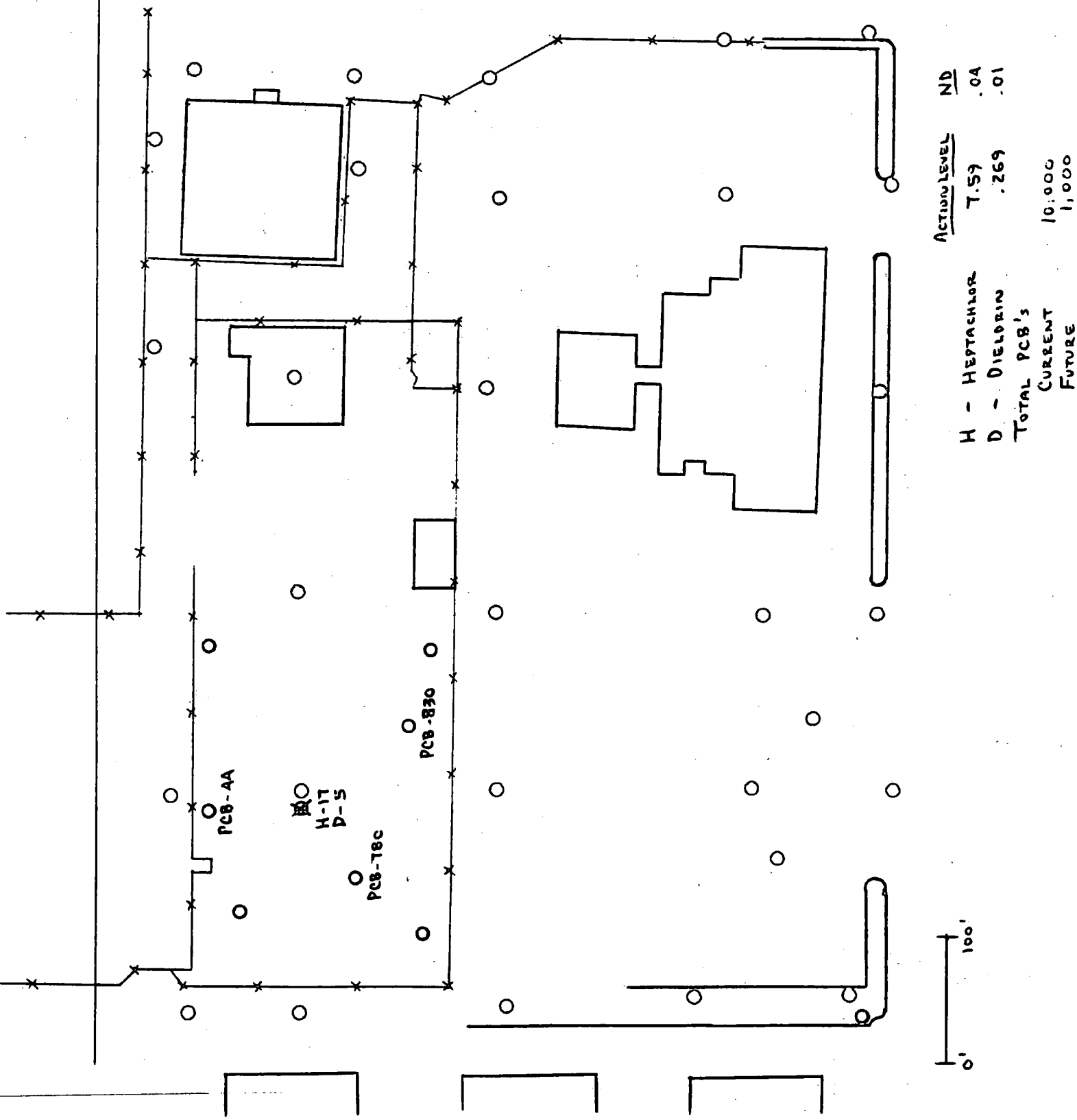


CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PESTICIDE / PCB ANALYSES	
BASED ON SURFACE SOILS	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GMD		LEK	8/30/93

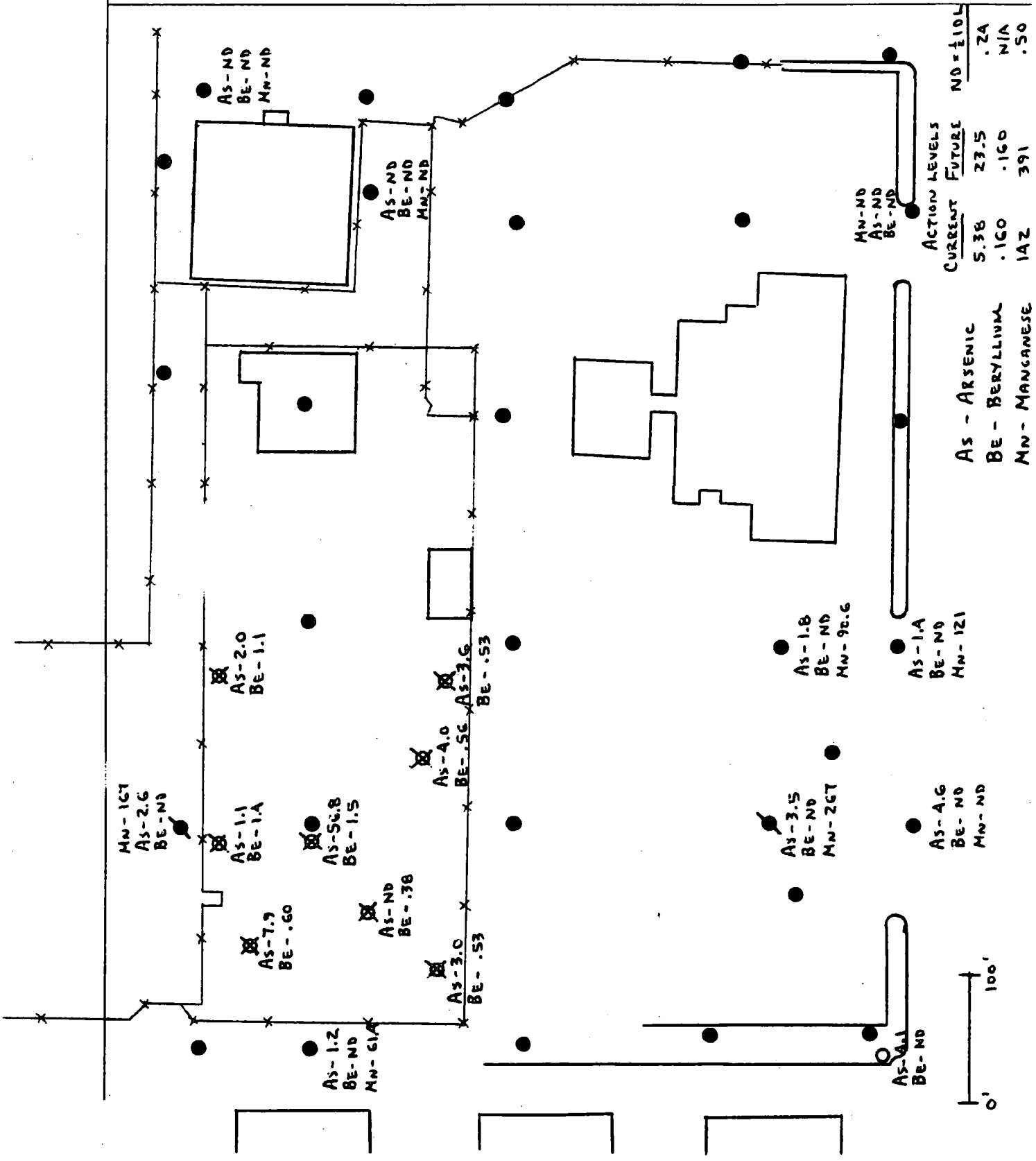


	ND	ACTION LEVEL
H - HEPTACHLOR	.04	7.59
D - DIELDRIN	.01	.269
TOTAL PCB'S		
CURRENT		10,000
FUTURE		1,000

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - ARSENIC / BERYLLIUM / MANGANESE ANALYSES	
BASED ON SURFACE SOIL / SHALLOW SUB-SOIL	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



SITE 3

ANALYTICAL SUMMARIES AND MAPS

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP – BETHPAGE, NY	JOB NUMBER
SUBJECT SOIL GAS VS. VOA CORRELATION	
BASED ON SITE 3	DRAWING NUMBER
BY CND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

TETRACHLOROETHENE

	VOA ANALYSIS	SOIL-GAS ANALYSIS
30A-S	1	.61
~~304-D~~	~~55~~	~~.49~~
~~307-S~~	~~ND~~	~~.97~~
~~307-D~~	~~ND~~	~~.76~~
316-S	5	8.9
316-D	4	8.5
318-S	2	54
318-D	1	51
328-S	2	5.5
~~328-D~~	~~ND~~	~~2.8~~
329-S	4	.08
~~329-D~~	~~–~~	~~.06~~
~~334-S~~	~~8~~	~~ND~~
334-D	2	12
338-S	5	8.6
338-D	1	24

x COEFFICIENT = 3.51

TRICHLOROETHENE

316-S	2	1.7
~~316-D~~	~~ND~~	~~3.6~~
328-S	4	4.9
~~328-D~~	~~ND~~	~~9.7~~
334-S	4	17
~~334-D~~	~~ND~~	~~13~~

x COEFFICIENT = 2.53

INSUFFICIENT DATA POINTS EXCEPT FOR TETRACHLOROETHENE

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SOIL GAS VERSUS VOLATILE ANALYSES CORRELATION			
BASED ON SITE 3		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

BASED ON 10 OBSERVATIONS:

TETRACHLOROETHENE x COEFFICIENT = $\boxed{3.51}$

FOR: TRICHLOROETHENE

x COEFFICIENT = $3.51 \times \frac{.0091}{.0153} = \boxed{2.09}$

FOR: 1,1,1 TRICHLOROETHANE

x COEFFICIENT = $3.51 \times \frac{.0300}{.0153} = \boxed{6.88}$

LEK 8/30/93
Pg 3 of 3

SITE 3
Tetrachloroethene

VOA	Soil–Gas
1	0.61
5	8.9
4	8.5
2	54
1	51
2	5.5
4	0.08
2	12
5	8.6
1	24

Regression Output:

Constant	0
Std Err of Y Est	24.26309
R Squared	−0.51658
No. of Observations	10
Degrees of Freedom	9

X Coefficient(s)	3.509588
Std Err of Coef.	2.463544

SITE 3

AREA OF CONTAMINATION
(FOR CAPPING ALTERNATIVES)

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT AREA REQUIRED FOR CAPPING			
BASED ON SITE 3 - CURRENT / FUTURE		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

CURRENT SCENARIO :

AREA = 297.3 + 36.5 + 1.5 + 12.1 = 347.4 BLOCKS

1 BLOCK = 25 FT × 25 FT = 625 FT^2

AREA = 347.4 × 625 FT^2 = **217,125 FT^2**

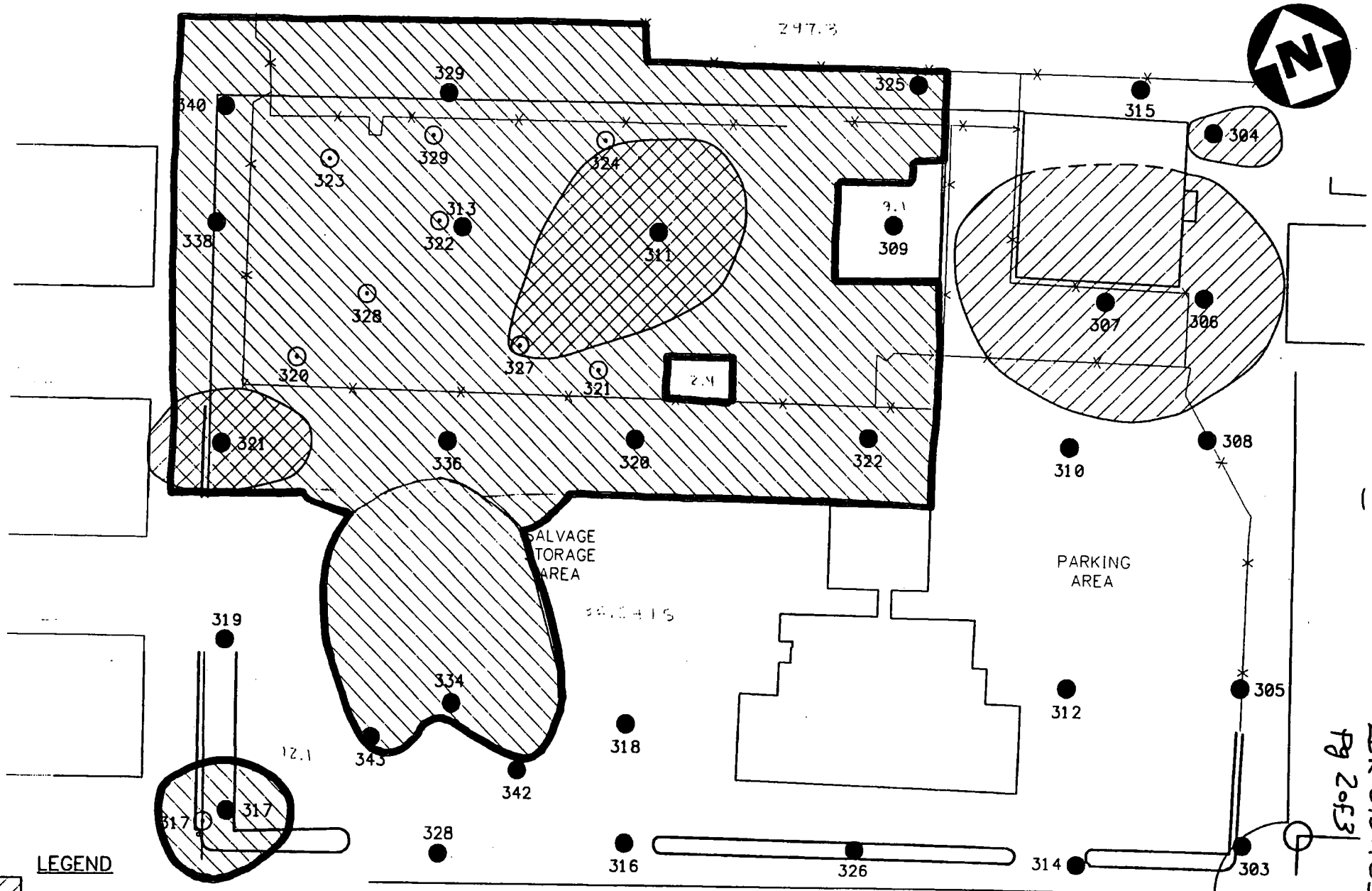
FUTURE SCENARIO :

AREA = 297.3 + 5.2 + 12.1 = 314.6 BLOCKS

1 BLOCK = 25 FT × 25 FT = 625 FT^2

AREA = 314.6 × 625 = **196,625 FT^2**

ACAD: 1953/SITE3.DWG 7/21/93 MB (PLOT1)



LEGEND

VOAs > ACTION LEVELS; RANGES 0 TO 50 FT. DEPTH

OTHER METALS AND ORGANICS > ACTION LEVELS; RANGES 0-7 FT. DEPTH

0 100 200
SCALE IN FEET

DENOTES CAPPED AREA

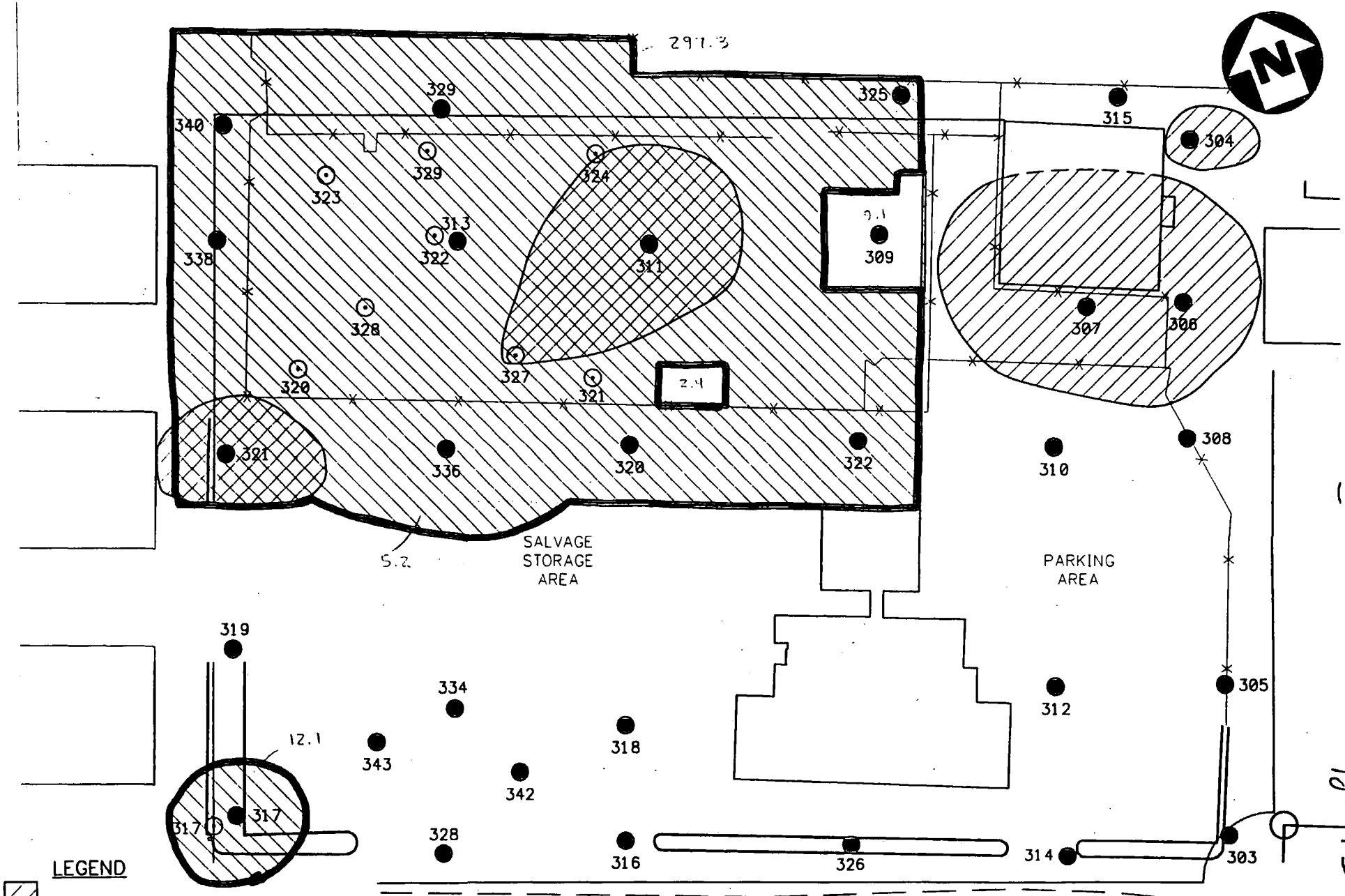
FIGURE 2-5

SITE3 – CURRENT INDUSTRIAL USE SCENARIO
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

LEK 8/30/93
Pg 2 of 3

ACAD: 1953/SITE3.DWG 7/21/93 MB (PLOT2)



LEGEND

VOAs > ACTION LEVELS; RANGES 0 TO 50 FT. DEPTH

OTHER METALS AND ORGANICS > ACTION LEVELS; RANGES 0-5 FT. DEPTH

0 100 200
SCALE IN FEET

DENOTES CAPPED AREA

FIGURE 2-6

SITE3 – FUTURE RESIDENTIAL USE SCENARIO
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

LEX 8/30/93
3 of 3

SITE 3

SOIL VOLUME CALCULATIONS

CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP – BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 – CONTAMINATED SOIL VOLUME CALCULATIONS	
BASED ON VOA's (CURRENT & FUTURE SCENARIO)	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93

① FOR SHALLOW SUB-SOILS: 0 TO 7 FT. DEPTH

BASED ON 1,1,1 TRICHLOROETHANE CONTAMINATION

$$\text{AREA} = 16.2 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 1125\ YD^2$$

$$\text{VOLUME} = 1125\ YD^2 \times 7\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{2625\ CY}$$

② FOR DEEP SUB-SOILS: TO 50 FT. DEPTH

BASED ON 1,1,1 TRICHLOROETHANE CONTAMINATION:

$$\text{AREA} = (13.7 + 31.7 + 55.6) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 7013.9\ YD^2$$

$$\text{VOLUME} = (\cancel{55.6} + 16.2) \times (50-7\ \cancel{FT}) \times \frac{YD}{3\ \cancel{FT}} \times \frac{YD^2}{9\ \cancel{FT^2}} \times 625\ \cancel{FT^2} + $$

$$+ (31.7 + 13.7 + 39.4) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} \times (50-0)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}}$$

$$\text{VOLUME} = \cancel{39,210}\ 61,700 + 52,546 = \boxed{\cancel{91,756}\ CY}\ 114,200\ CY$$

BASED ON TETRACHLOROETHENE CONTAMINATION:

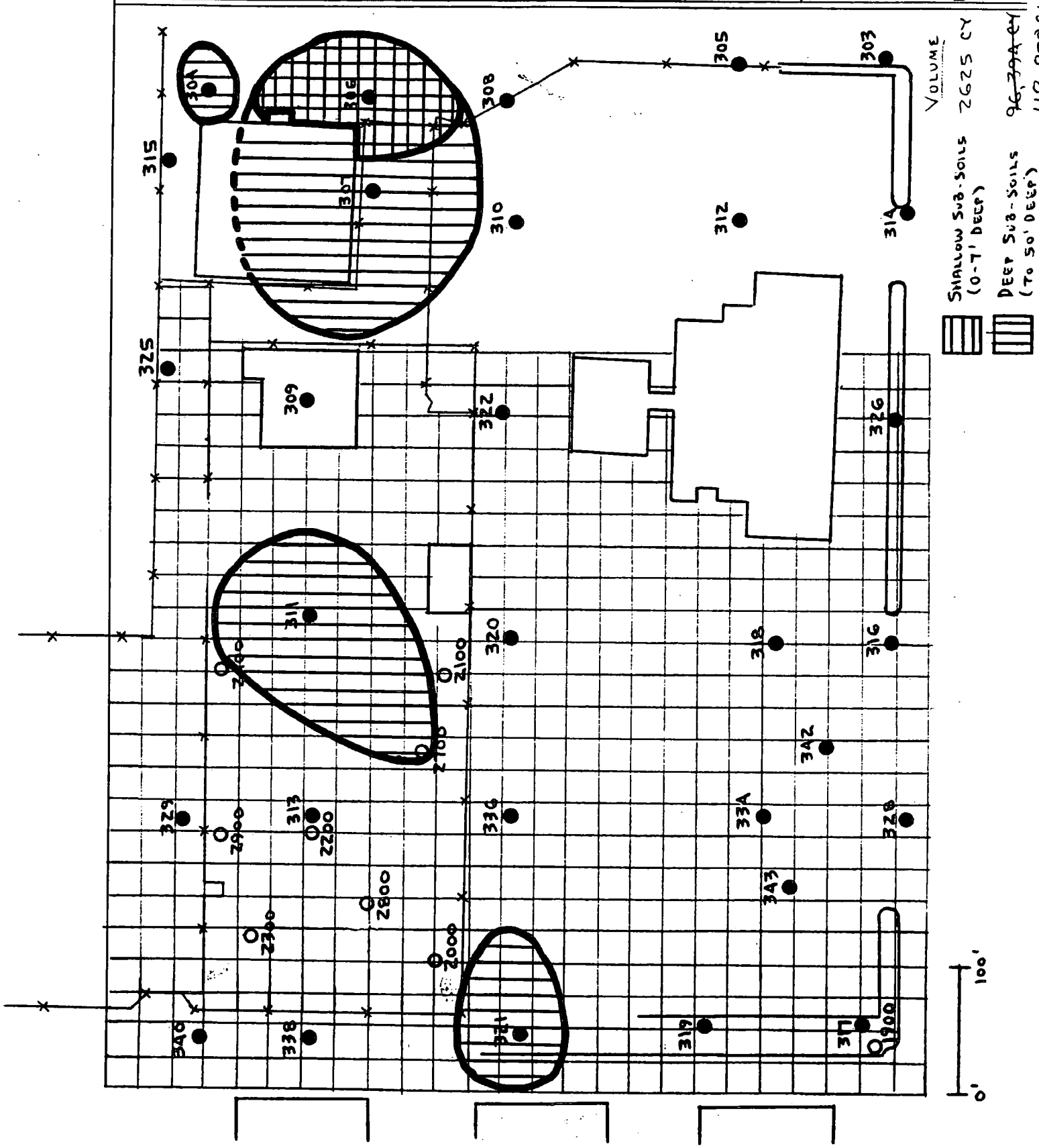
$$\text{AREA} = 4.0 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 278\ YD^2$$

$$\text{VOLUME} = 278\ YD^2 \times (50-0)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{4630\ CY}$$

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - VOA's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW & DEEP SUB-SOILS	DRAWING NUMBER

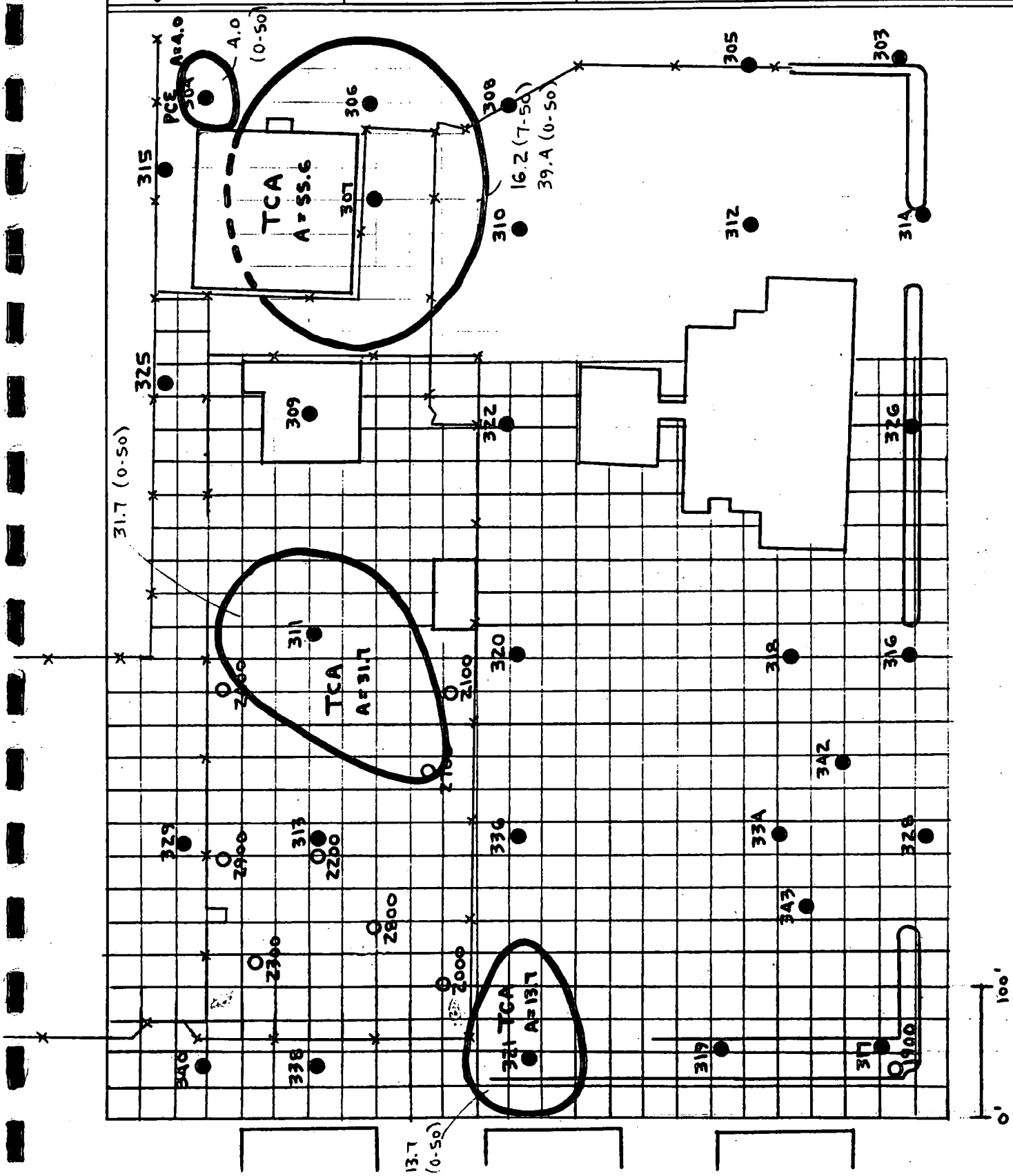
BY	CHECKED BY	APPROVED BY	DATE
GND		LEK	8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

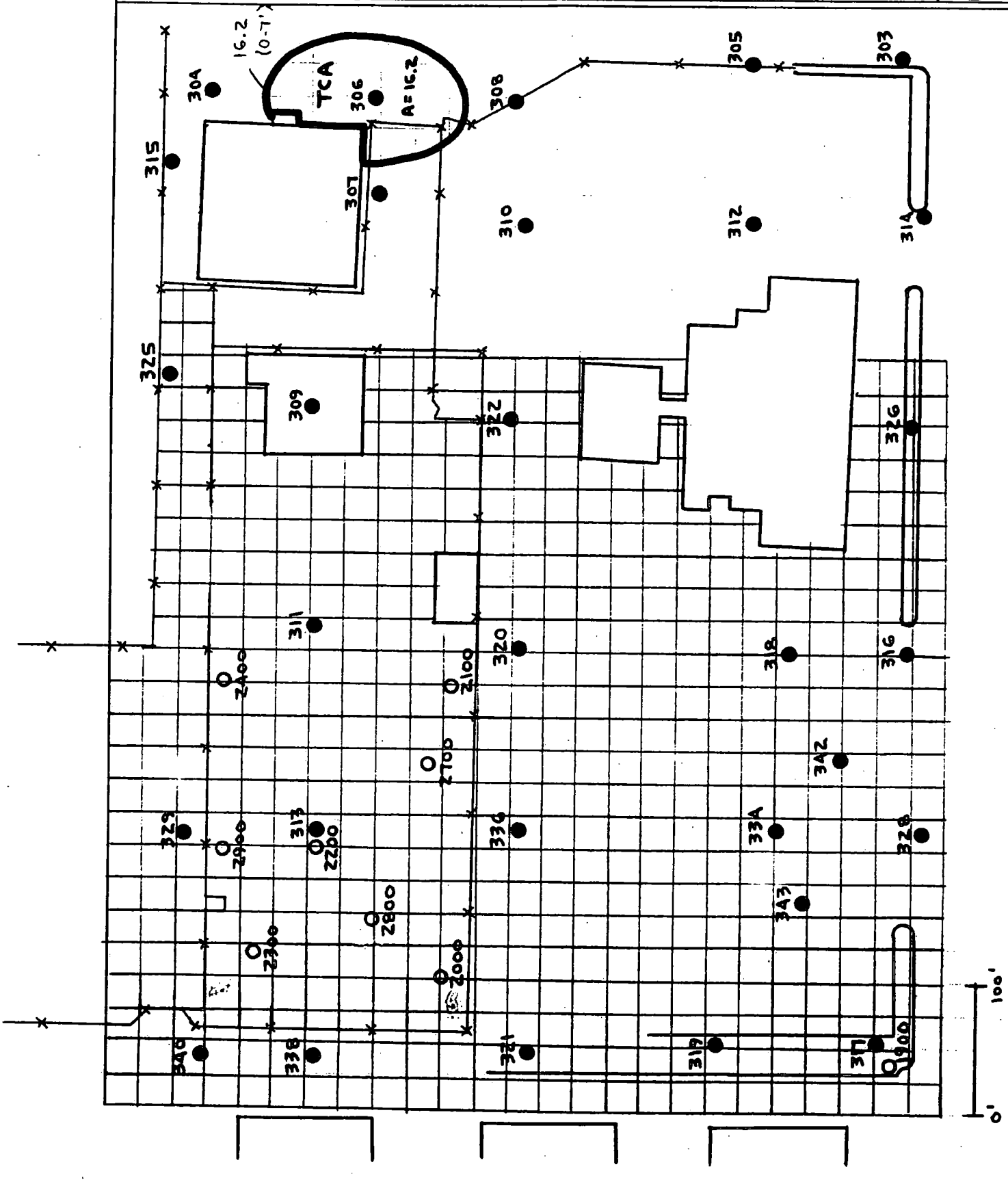
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - VOA's	
BASED ON DEEP SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19115 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - VOA's	
BASED ON SHALLOW SUB - SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 3 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON CURRENT SCENARIO EXCEPT VOA's		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① FOR SURFACE SOILS : 0 TO 1 FT. DEPTH
BASED ON BERYLLIUM AND PAH CONTAMINATION

$$\text{AREA} = (297.3 + 5.3 + 12.1) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 21{,}854\ YD^2$$

$$\text{VOLUME} = 21{,}854\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{7285\ CY}$$

② FOR SHALLOW SUB-SOILS : 1 TO ~~5~~ 7 FT DEPTH
BASED ON PAH CONTAMINATION

$$\text{AREA} = (41.8 - 8.2) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 2333\ YD^2$$

$$\text{VOLUME} = 2333\ YD^2 \times (\cancel{5-1}\ 7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{\cancel{3111\ CY}\ 4666\ CY}$$

FOR SHALLOW SUB-SOILS : 1 TO 7 FT DEPTH AND 0 TO 7 FT DEPTH
BASED ON MANGANESE CONTAMINATION

$$\text{AREA}_1 = (8.2 + 2.0) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 708\ YD^2$$

$$\text{AREA}_2 = (36.5 - 2.0) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 2396\ YD^2$$

$$\text{VOLUME}_1 = 708\ YD^2 \times (7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = 1417\ CY$$

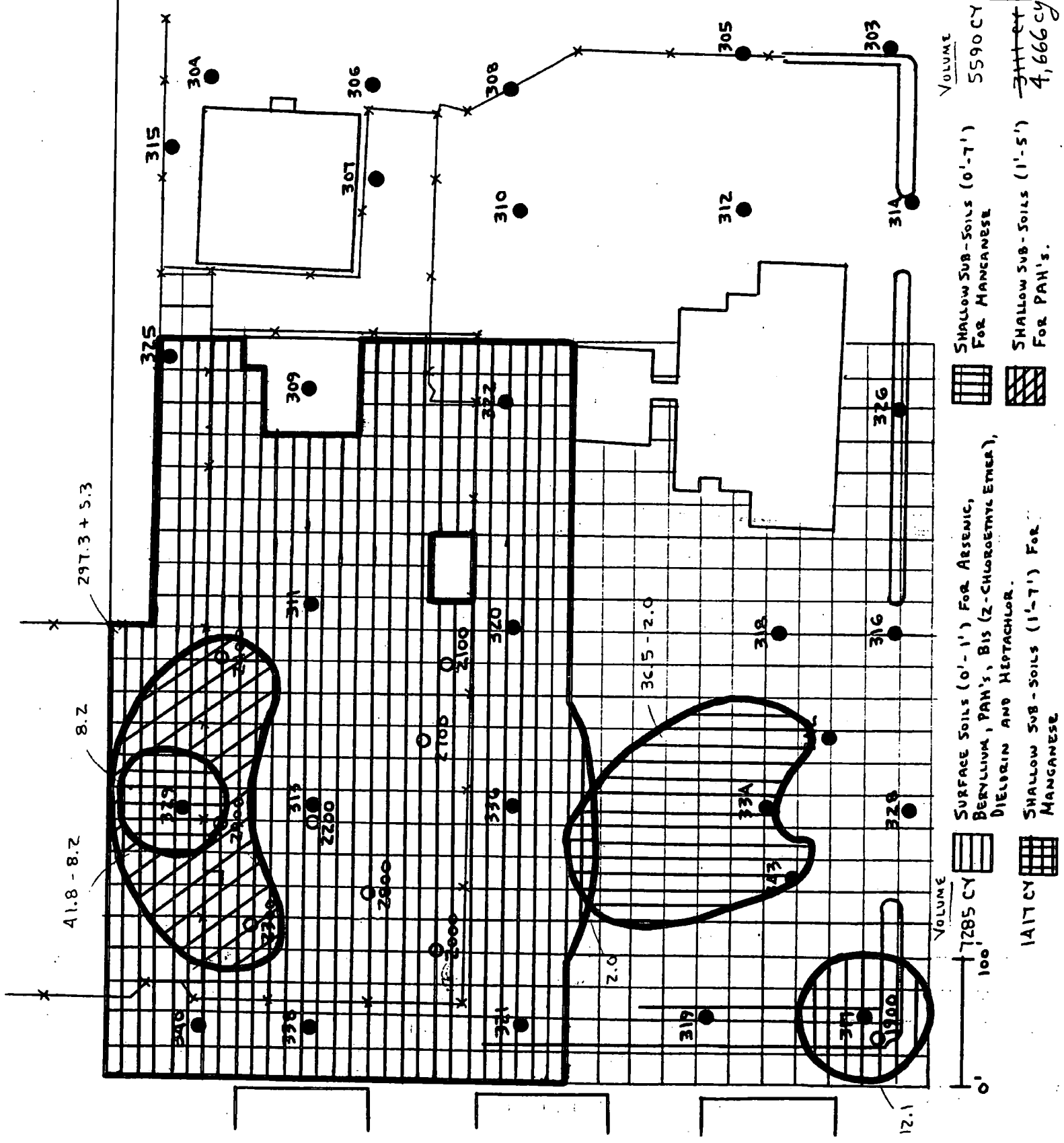
$$\text{VOLUME}_2 = 2396\ YD^2 \times (7-0)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = 5590\ CY$$

$$\text{VOLUME} = 1417\ CY + 5590\ CY = \boxed{7007\ CY}$$

CALCULATION WORKSHEET

Order No. 19115 (01-91)

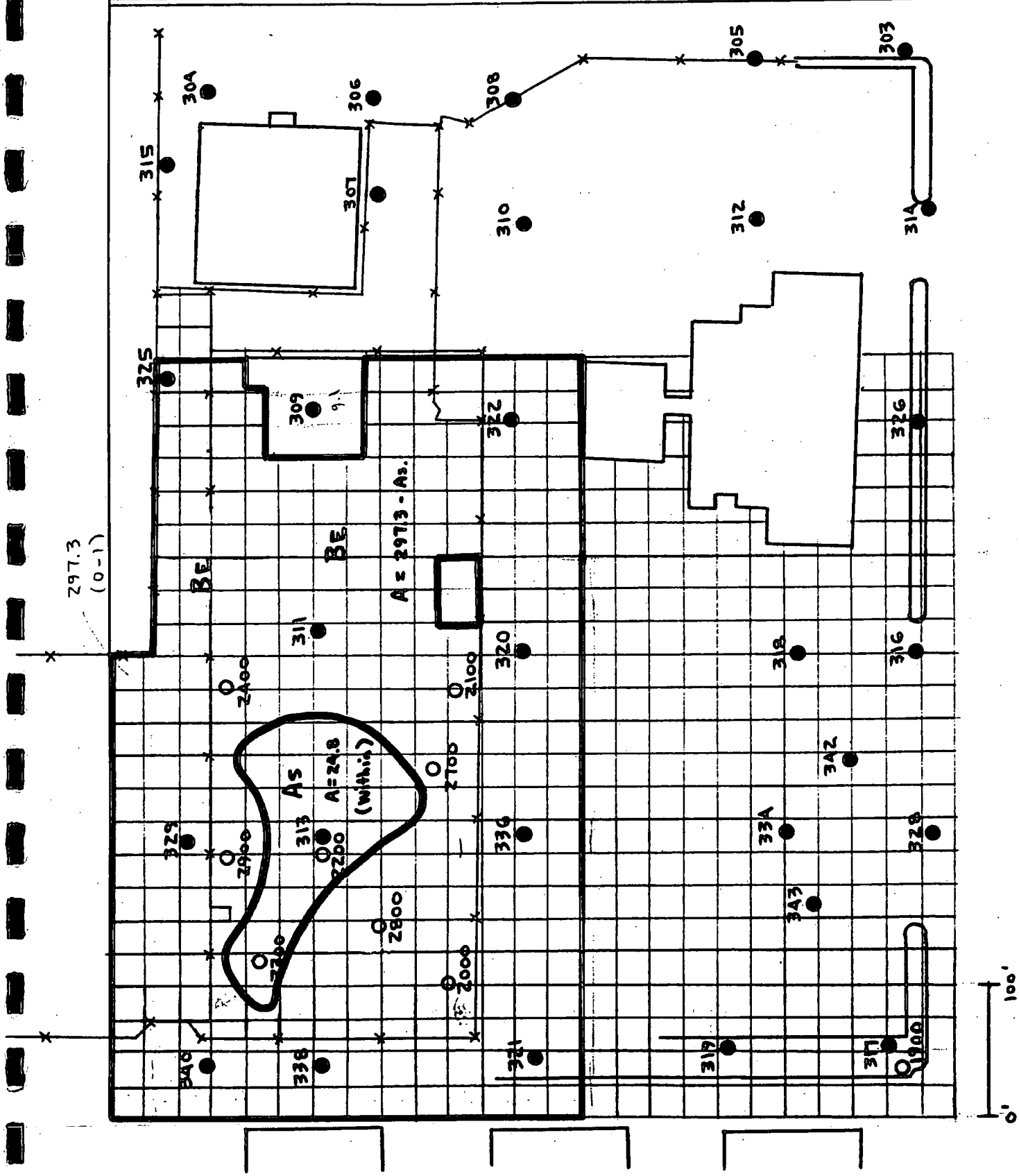
CLIENT NWIRP – BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP – ARSENIC, BERYLLIUM, PAH's, BIS (2-CHLOROETHYL) ETHER, MN	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	~~DRAWING NUMBER~~ DIELDRIN & HEPTACHLOR (CURRENT)
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



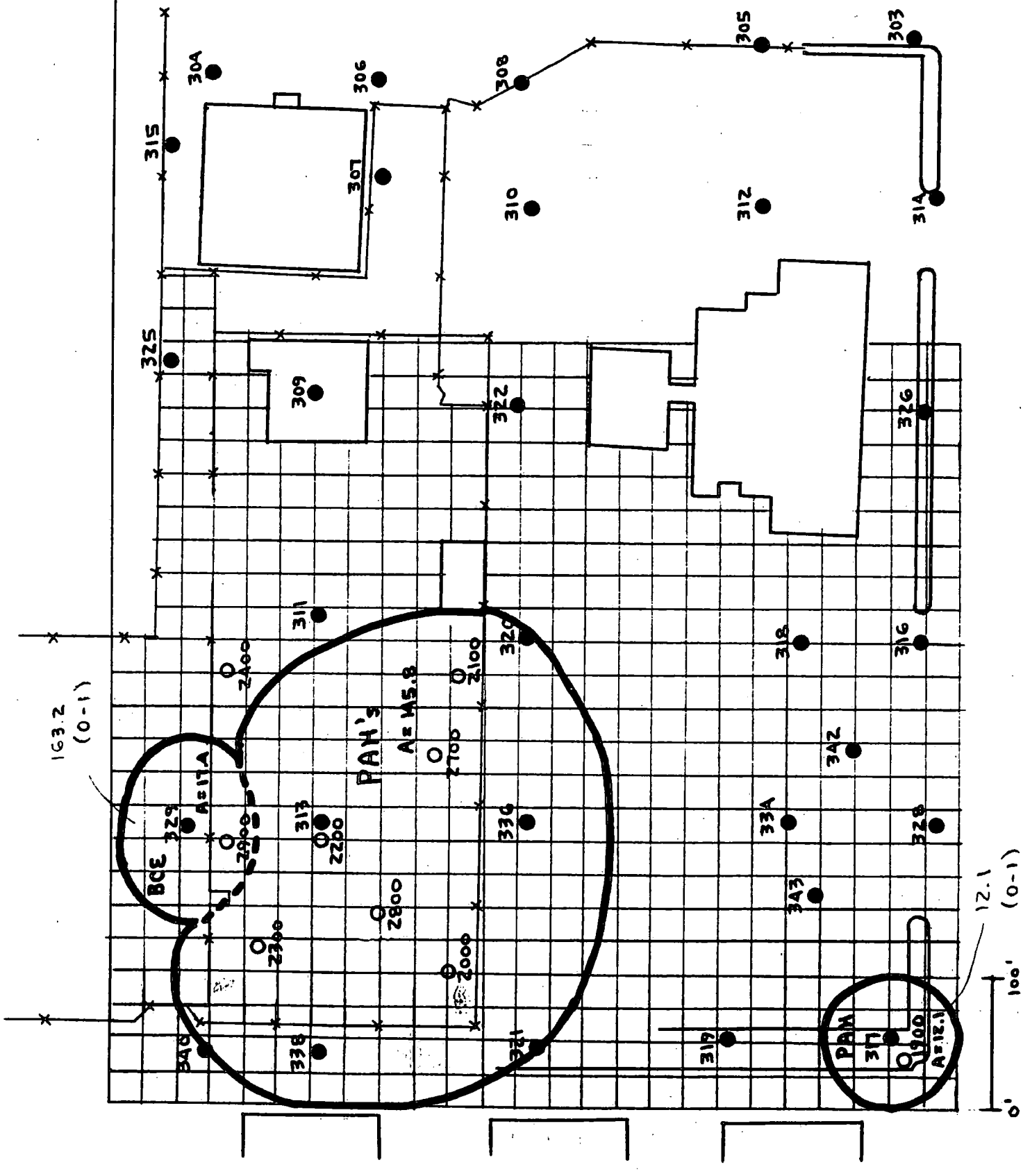
CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - ARSENIC / BERYLLIUM ANALYSES (CURRENT SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



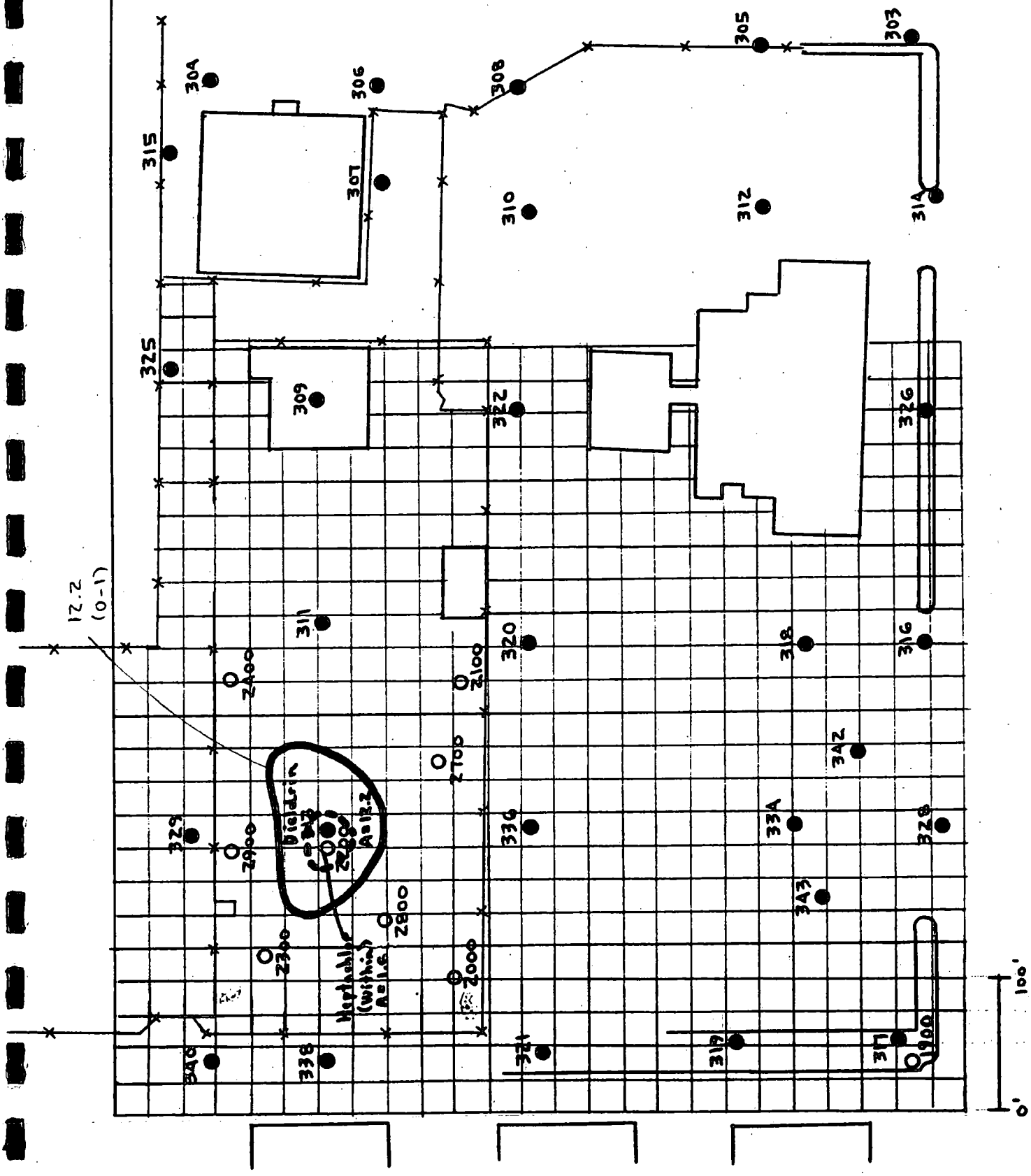
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

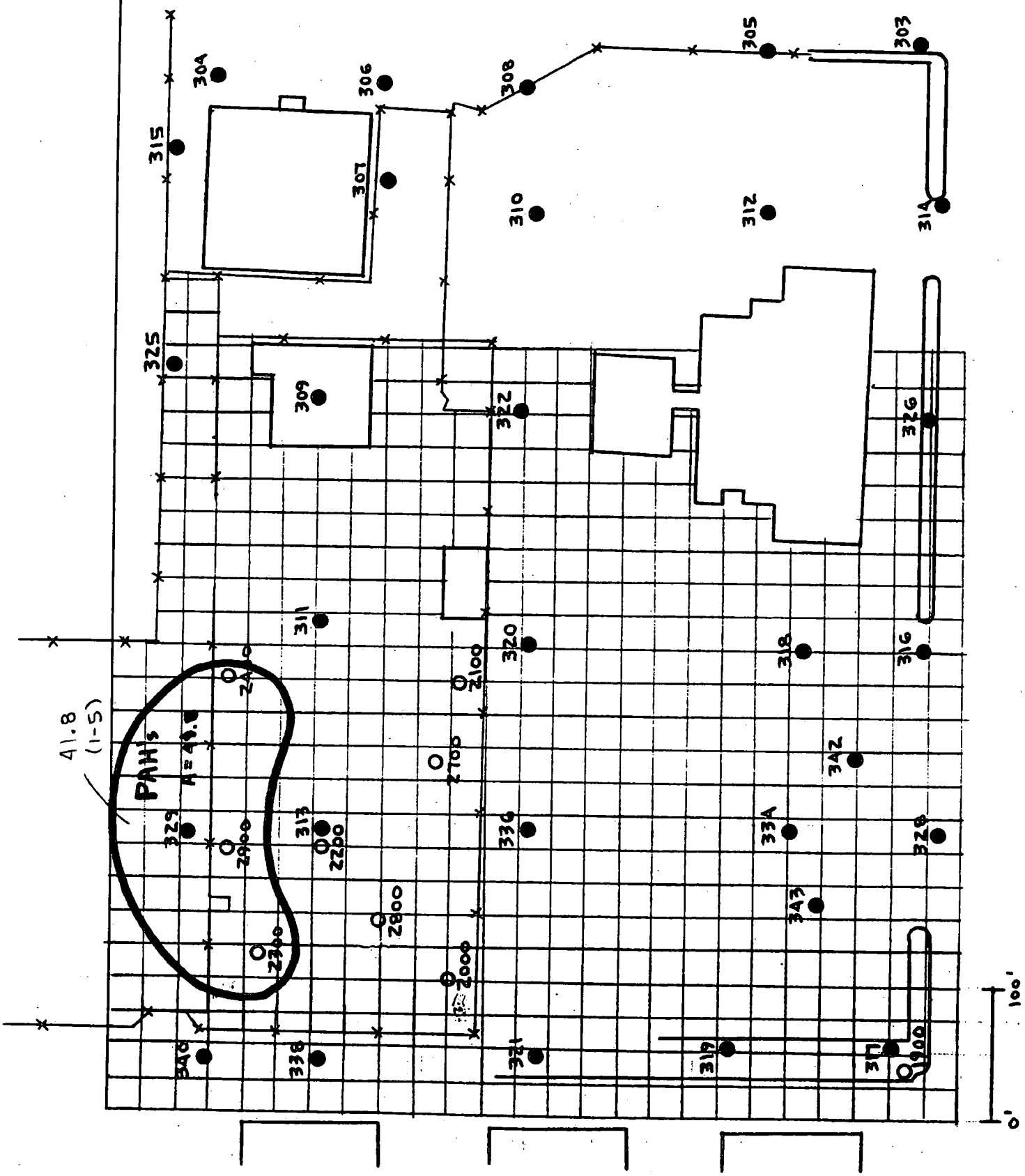
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PESTICIDES (CURRENT & FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

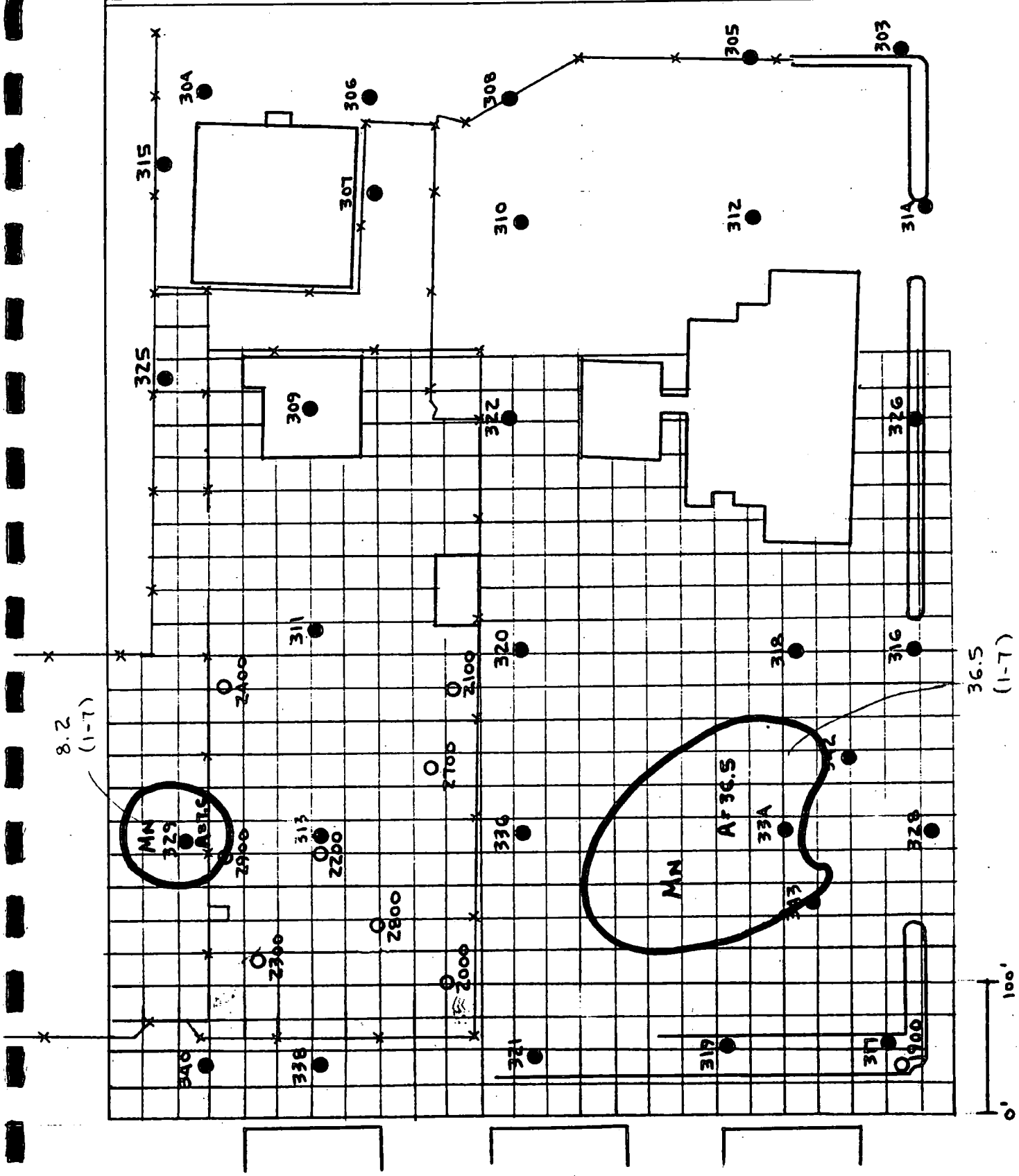
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 10116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - MANGANESE ANALYSES (CURRENT SCENARIO)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CLIENT NWIRP - BETHPAGE, NY		JOB NUMBER	
SUBJECT SITE 3 - CONTAMINATED SOIL VOLUME CALCULATIONS			
BASED ON FUTURE SCENARIO EXCEPT VOA's		DRAWING NUMBER	
BY GND	CHECKED BY	APPROVED BY LEK	DATE 8/30/93

① FOR SURFACE SOILS : 0 TO 1 FT. DEPTH
BASED ON BERYLLIUM AND PAH CONTAMINATION

$$\text{AREA} = (297.3 + 5.3 + 12.1) \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 21{,}854\ YD^2$$

$$\text{VOLUME} = 21{,}854\ YD^2 \times 1\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{7285\ CY}$$

② FOR SHALLOW SUB-SOILS : 1 TO ~~5~~ 7 FT DEPTH
BASED ON PAH CONTAMINATION

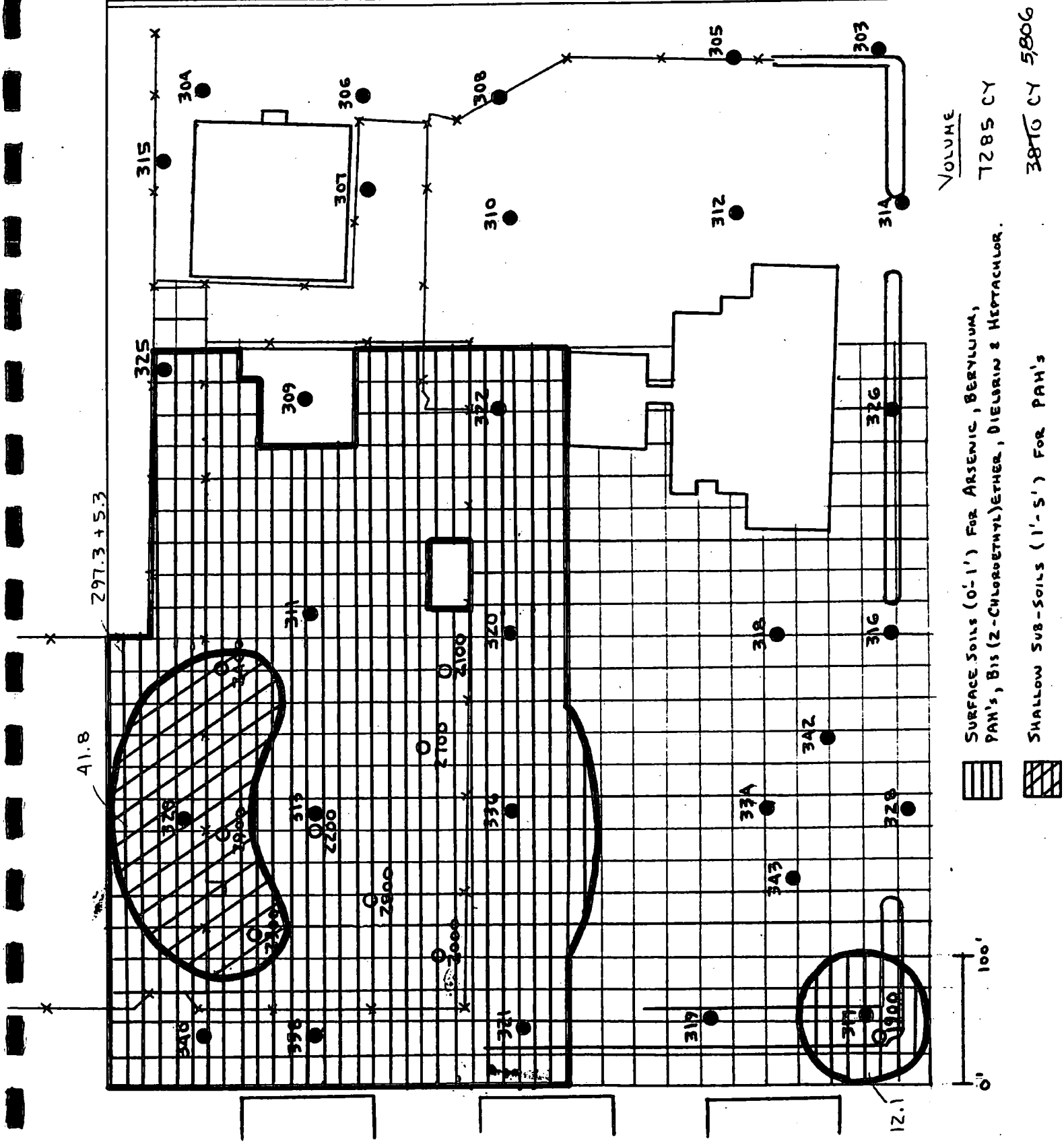
$$\text{AREA} = 41.8 \times 625\ \cancel{FT^2} \times \frac{YD^2}{9\ \cancel{FT^2}} = 2903\ YD^2$$

$$\text{VOLUME} = 2903\ YD^2 \times (\cancel{5-1}\ 7-1)\ \cancel{FT} \times \frac{YD}{3\ \cancel{FT}} = \boxed{\cancel{3870}\ 5{,}806\ CY}$$

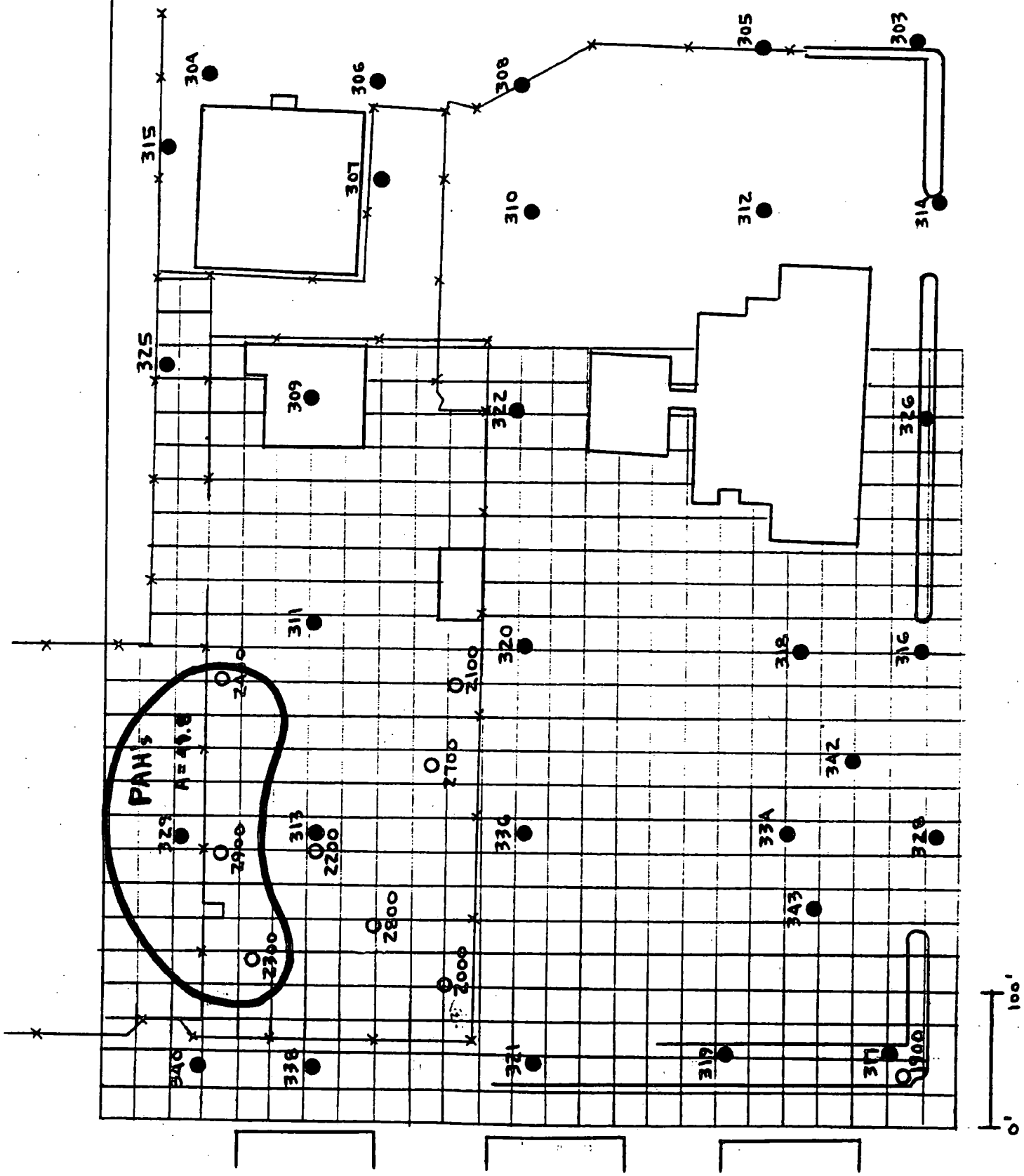
CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - ARSENIC, BERYLLIUM, PAH's, BIS (2-CHLOROETHYL)ETHER	
BASED ON SURFACE SOILS / SHALLOW SUB-SOILS	~~DRAWING NUMBER~~ DIELDRIN & HEPTACHLOR (FUTURE)
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



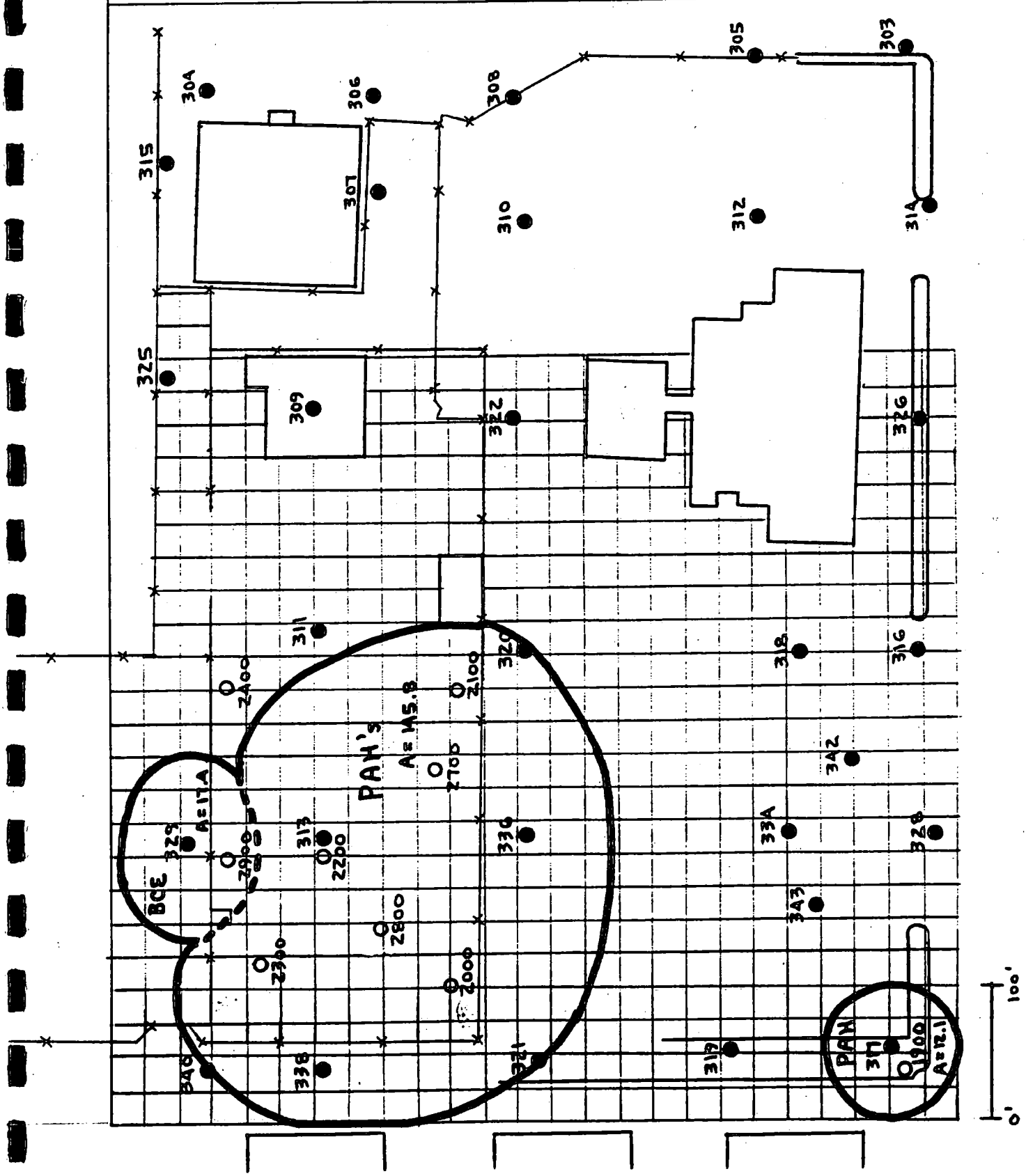
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SHALLOW SUB-SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

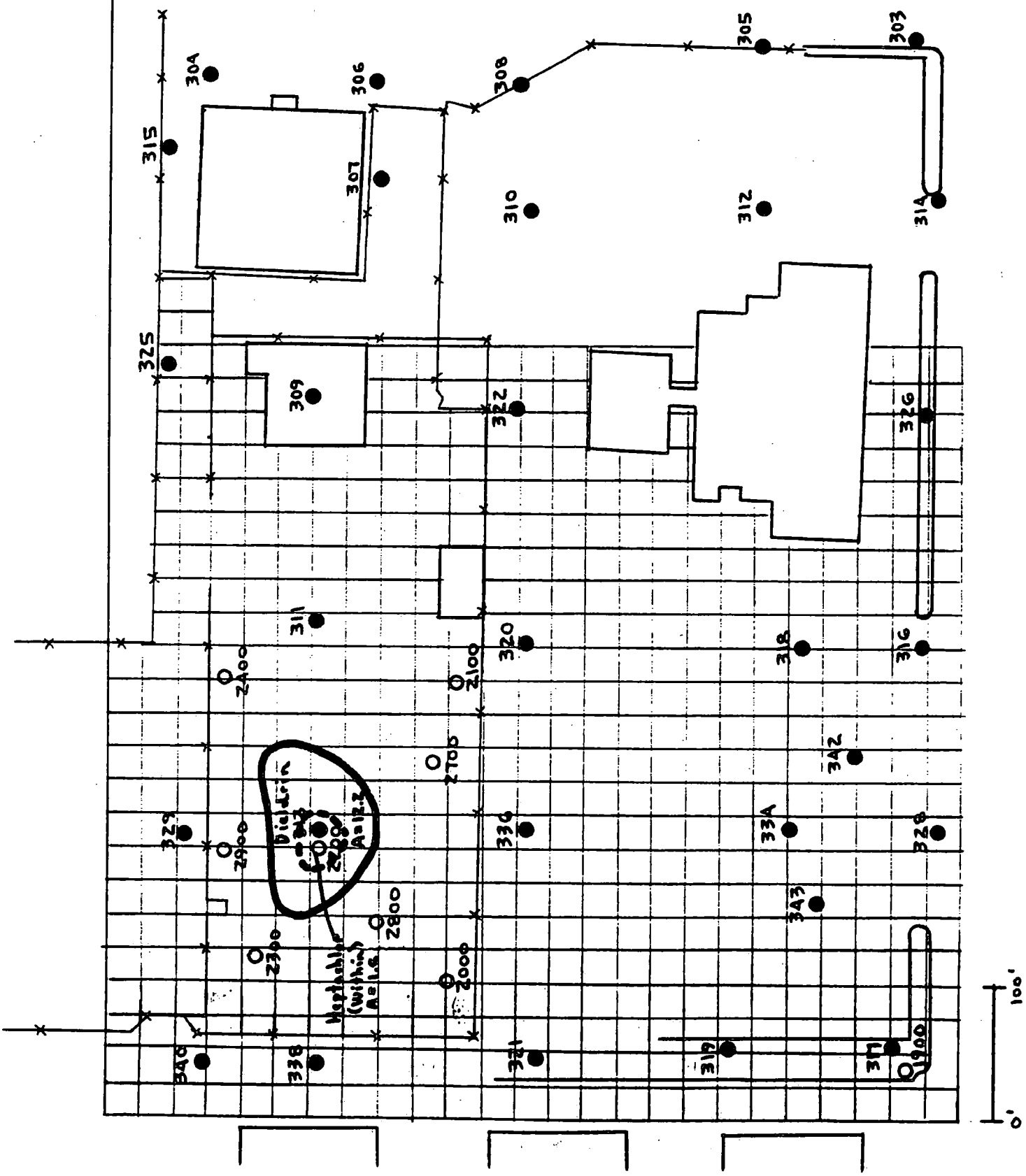
CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - PAH's (CURRENT & FUTURE SCENARIOS)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

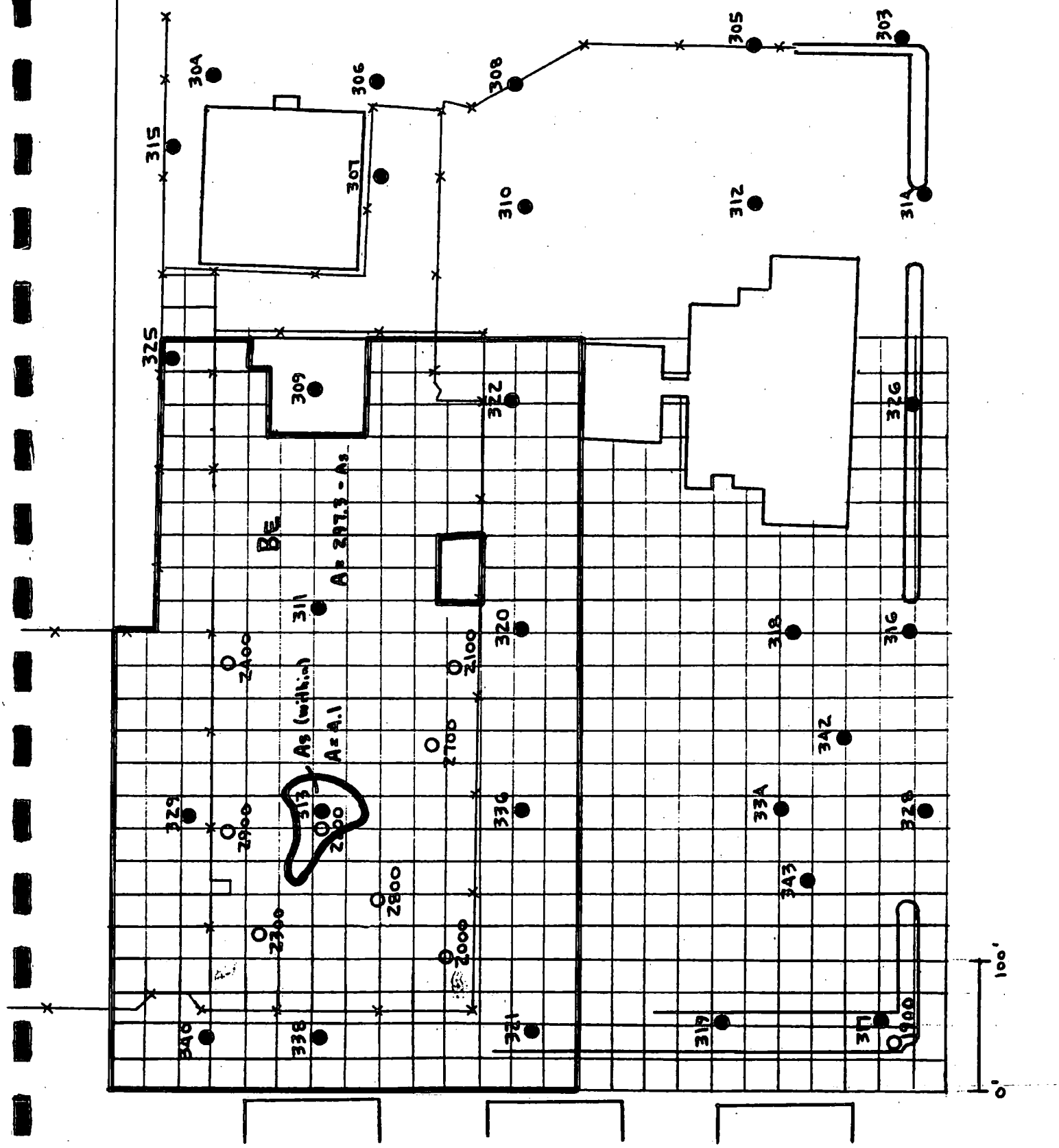
CLIENT: NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT: SITE 3 AREA MAP - PESTICIDES (CURRENT & FUTURE SCENARIO)	
BASED ON: SURFACE SOILS	DRAWING NUMBER
BY: GND / CHECKED BY	APPROVED BY: LEK / DATE: 8/30/93



CALCULATION WORKSHEET

Order No. 19116 (01-91)

CLIENT NWIRP - BETHPAGE, NY	JOB NUMBER
SUBJECT SITE 3 AREA MAP - ARSENIC / BERYLLIUM ANALYSES (FUTURE SCENARIO)	
BASED ON SURFACE SOILS	DRAWING NUMBER
BY GND / CHECKED BY	APPROVED BY LEK / DATE 8/30/93



SITES 1, 2, AND 3

LIMITED VOC SOIL VOLUME CALCULATIONS

LEK 8/30/93
pg 1 of 2

NWIRP Bethpage VOA in Soil Calculations
Limited VOA remediation.

Approach: Set a new VOA action level at three times the action level originally developed for VOA-contaminated soils.

Basis: New action level is intended to reduce volume of VOA-contaminated soils requiring treatment. Alternative action levels are potentially justified because long term pump and treat of the groundwater will be required, and limited recontamination of the soils from the groundwater is expected to occur during remediation. The long term pump and treat would capture the VOAs from untreated soils which would be discharged into the groundwater.

Soil Action Level for VOAs (based on groundwater protection)

	Soil Action Level (based on MCLs) (ug/kg)	Soil Action Level X 3 (ug/kg)	Soil Gas Equivalent X 3 (ug/l)
Site 1			
TCE	9.3	28	246
PCE	27	81	1199
TCA	1.1	3	95
Site 2			
TCE	12	36	317
PCE	34	102	1510
TCA	1.4	4	121
Site 3			
TCE	10	30	264
PCE	28	84	1243
TCA	1.2	4	104

Comparison of revised action levels versus measured concentrations.

Site 1	Total VOAs (ug/kg)
SB119 (TCE, PCE, and TCA)	5072
SB120 (TCA)	44
SB121 (PCE and TCE)	74
Plant 3 SG (PCE, TCE, and TCA)	375
Plant 3 SG (PCE)	73
Average	1,128

Affected Area:

Site 1 (180' x 180' x 50')	60,000	CY
Plant 3 (120' x 120' x 50')	26,667	CY
Total	86,667	CY

Quantity of Solvents in Soils:	293	lbs
Quantity of Solvents in upper 10 feet of water (16 mg/l, 30% porosity):	453	lbs
Total:	746	lbs

Site 2

No locations above action levels.

Site 3

No locations above action levels.

NWIRP Bethpage
Estimation of Time Requirements for Limited Action VOC Concentrations to Reach Action Level VOC Concentrations

Approach: Estimate the time required for the residual VOC concentration (after insitu treatment) to decrease from 3 times the action level to the action level. The assumed primary mechanism for removal of residual VOCs in the soils is precipitation infiltration flushing.

Basis: Use a column 50' high by 1' wide by 1' long.

Net infiltration is 13.65 inches per year.

Assume that TCE, PCE, and TCA are present at a maximum concentration of three times the action levels.

	3 Times Action Level		Kd
TCE	0.03	mg/kg	0.23
PCE	0.08	mg/kg	0.67
TCA	0.0033	mg/kg	0.028

Soil Bulk Density: 100 lb/cf

Quantity of solvents in this soil column (Year 0) can be calculated as follows.

= density * 50 feet * concentration

TCE	0.00015	lbs
PCE	0.0004	lbs
TCA	0.000017	lbs

Quantity of solvent removed in first year is as follows. This calculation assumes that relatively small quantities of solvent are removed per year.

= Infiltration rate * concentration (soil) / Kd

TCE	0.000009	lbs
PCE	0.000008	lbs
TCA	0.000008	lbs

The calculated solvents remaining in the soils (lbs) and percent of original solvent are as follows.

= Initial pounds minus pounds removed

TCE	0.000141	93.83	%
PCE	0.000392	97.88	%
TCA	0.000008	49.30	%

The percentage reduction per year would be constant. Once the percent reduction per year is determined, then residual concentrations can be used. Therefore after ten years of infiltration, the remaining concentration of solvents (mg/kg) and percent of original would be as follows.

= fixed percentage removal year for 10 years (percent ^{10})

TCE	0.016 mg/kg	52.88	%
PCE	0.065 mg/kg	80.72	%
TCA	<0.001 mg/kg	0.08	%

After 30 years, the remaining concentration of solvents would be as follows.

= fixed percentage removal year for 30 years

TCE	0.004 mg/kg	14.79	%
PCE	0.042 mg/kg	52.60	%
TCA	<0.001 mg/kg	0.00	%

Based on these estimates, at 30 years and at the most significant remaining solvent locations, TCE and TCA would be below the remediation action goals PCE would be slightly above the remedial action goals.

PCE may require additional consideration after 30 years (calculated to be for 50 years). However, because of uncertainties and the conservative nature of the approach, additional activities may not be required. Especially when considering that the average solvent concentrations for the site are less than the action levels.

APPENDIX C

GROUNDWATER CALCULATIONS

LEK 8/25/93
Pg 1 of 17

NWIRP Bethpage Groundwater Calculations

June 13, 1993

Input Parameters

Soil - SG:	2.6		
Porosity:	0.3		
TOC:	0.00184		
Layer 1 Thickness	50	feet	(shallow)
Layer 2 Thickness	100	feet	(intermediate)
Layer 3 Thickness	100	feet	(deep)
Layer 4 Thickness	150	feet	
Layer 5 Thickness	222.5	feet	

Chemical Characteristics

Parameter	Koc	Kd	Chemical name
TCE	126	0.23	trichloroethene
PCE	364	0.67	tetrachloroethene
TOL	300	0.55	toluene
XY	248	0.46	xylene
TCA	59	0.11	1,1,1-trichloroethane
11DCA	30	0.06	1,1-dichloroethane
11DCE	65	0.12	1,1-dichloroethene
12DCE	59	0.11	1,2-dichloroethene
VC	8.2	0.02	vinyl chloride

Shallow (Layer 1) Groundwater Calculations

Shallow (Layer 1) GW - Solvent concentration greater than 1000 ug/l (All areas)

	HN-29S	HN-29S	HN-28S	TW-110	TW-115	TW-119	TW-121	TW-123	Average
TCE	780	340	1100	950	260	280	1800	1900	926
PCE	3600	1400	430	5200	2000	1100	7700	780	2,776
TOL	39	0	0						13
XY	19	2.5	2.5						8
TCA	10000	690	230	5400	180	240	1100	200	2,255
11DCA	880	120	31	630	43	22	110	22	232
11DCE	250	30	9.5	0	0	0	0	7	37
12DCE	3600	220	170	25	150	85	540	48	605
VC									
Total	19,168	2,803	1,973	12,205	2,633	1,727	11,250	2,957	6,853

Area of contamination (acres): 9
Vol of contamination (gal): 41,839,043

Quantity of water soluble contaminants (pounds):

TCE	322
PCE	964
TOL	5
XY	3
TCA	783
11DCA	81
11DCE	13
12DCE	210
VC	0
Total	2,380

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	455	776
PCE	3,937	4,901
TOL	15	20
XY	8	11
TCA	518	1,301
11DCA	27	108
11DCE	9	22
12DCE	139	349
VC	0	0
Total	5,109	7,488

Shallow (Layer 1) GW - Solvent concentration greater than 100 ug/l (All areas)

	USGS	USGS	TW-104	TW-328	HN-24	Average
TCE	100	12	370	76	120	135.6
PCE	26	11	18	57	75	37.4
TOL	0			0	0	0
XY	0			0	0	0
TCA	31		94	7	9	35.25
11DCA	4			0	6	3
11DCE	0	0		0	0	0
12DCE	15	0			100	23
VC	0	0	0	0	0	0
Total	176	23	482	140	310	235

Area of contamination (acres): 53
Vol of contamination (gal): 260,640,600

Quantity of water soluble contaminants (pounds):

TCE	293
PCE	81
TOL	0
XY	0
TCA	76
11DCA	7
11DCE	0
12DCE	50
VC	0
Total	507

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	415	708
PCE	330	411
TOL	0	0
XY	0	0
TCA	50	127
11DCA	2	10
11DCE	0	0
12DCE	33	83
VC	0	0
Total	831	1,338

Shallow (Layer 1) GW - Solvent concentration less than 100 ug/l (All areas)
Set concentrations equal to 10% of solvent concentration in Layer 1, > 100 ug/l Area.
Area is based on actual field measurements only.

	Average
TCE	14
PCE	4
TOL	0
XY	0
TCA	4
11DCA	0
11DCE	0
12DCE	2
VC	0
Total	23

Area of contamination (acres): 130
Vol of contamination (gal): 636,847,200

Quantity of water soluble contaminants (pounds):

TCE	72
PCE	20
TOL	0
XY	0
TCA	19
11DCA	2
11DCE	0
12DCE	12
VC	0
Total	124

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	101	173
PCE	81	101
TOL	0	0
XY	0	0
TCA	12	31
11DCA	1	2
11DCE	0	0
12DCE	8	20
VC	0	0
Total	203	327

Intermediate (Layer 2) Groundwater Calculations

Intermediate (Layer 2) GW - Solvent concentration greater than 10,000 ug/l (All areas)
Area is based on monitoring well data.

	HN-24I	HN-24I	HN-24I2	Average
TCE	58000	9000	12000	26,333
PCE	9	0	0	3
TOL	9	0	0	3
XY	0	0	0	0
TCA	6	0	0	2
11DCA	0	0	0	0
11DCE	0	0	0	0
12DCE	0	0	0	0
VC	0	0	1	
Total	58,024	9,000	12,000	26,341

Area of contamination (acres): 7
Vol of contamination (gal): 70,686,000

Quantity of water soluble contaminants (pounds):

TCE	15,450
PCE	2
TOL	2
XY	0
TCA	1
11DCA	0
11DCE	0
12DCE	0
VC	0
Total	15,454

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	21,840	37,290
PCE	7	9
TOL	6	8
XY	0	0
TCA	1	2
11DCA	0	0
11DCE	0	0
12DCE	0	0
VC	0	0
Total	21,854	37,309

Intermediate (Layer 2) GW - Solvent concentration greater than 1000 ug/l (All areas)
Area is based on monitoring well data.

	GM-12I	GM-14I			Average
TCE	3100	770			1,935
PCE	0	700			350
TOL	0	0			0
XY	0	0			0
TCA	0	210			105
11DCA	0	49			25
11DCE	0	86			43
12DCE	0	130			65
VC	0	0			
Total	3,100	1,945	0	0	2,523

Area of contamination (acres): 16
Vol of contamination (gal): 156,406,800

Quantity of water soluble contaminants (pounds):

TCE	2,512
PCE	454
TOL	0
XY	0
TCA	136
11DCA	32
11DCE	56
12DCE	84
VC	0
Total	3,275

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	3,551	6,063
PCE	1,856	2,310
TOL	0	0
XY	0	0
TCA	90	227
11DCA	11	43
11DCE	41	97
12DCE	56	140
VC	0	0
Total	5,604	8,879

Intermediate (Layer 2) GW - Solvent concentration greater than 100 ug/l (All areas)
Area is based on monitoring well data.

	GM-13I			Average
TCE	36			36
PCE	110			110
TOL	0			0
XY	0			0
TCA	52			52
11DCA	8			8
11DCE	5			5
12DCE	23			23
VC	0			
Total	234	0	0	234

Area of contamination (acres): 72
Vol of contamination (gal): 702,147,600

Quantity of water soluble contaminants (pounds):

TCE	210
PCE	641
TOL	0
XY	0
TCA	303
11DCA	47
1.1DCE	29
12DCE	134
VC	0
Total	1,364

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	297	506
PCE	2,618	3,259
TOL	0	0
XY	0	0
TCA	201	504
11DCA	16	62
11DCE	21	50
12DCE	89	223
VC	0	0
Total	3,241	4,605

Intermediate (Layer 2) GW - Solvent concentration greater than 10 ug/l (All areas)
Use computer modeling maps for areas and monitoring well results for concentrations.

		Average
TCE		8
PCE		11
TOL		0
XY		0
TCA		16
11DCA		0
11DCE		0
12DCE		7
VC		0
Total	0	42

Area of contamination (acres): 166
Vol of contamination (gal): 1,626,900,000

Quantity of water soluble contaminants (pounds):

TCE	108
PCE	149
TOL	0
XY	0
TCA	216
11DCA	0
11DCE	0
12DCE	95
VC	0
Total	567

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	153	261
PCE	607	755
TOL	0	0
XY	0	0
TCA	143	359
11DCA	0	0
11DCE	0	0
12DCE	63	157
VC	0	0
Total	965	1,532

Intermediate (Layer 2) GW - Solvent concentration less than 10 ug/l (All areas)

Use computer modeling maps for areas and set concentrations equal to 10% of Layer 2, > 100 ug/l area.

	Average
TCE	4
PCE	11
TOL	0
XY	0
TCA	5
11DCA	1
11DCE	1
12DCE	2
VC	0
Total	23

Area of contamination (acres): 212
Vol of contamination (gal): 2,069,192,400

Quantity of water soluble contaminants (pounds):

TCE	62
PCE	189
TOL	0
XY	0
TCA	89
11DCA	14
11DCE	9
12DCE	40
VC	0
Total	402

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	87	149
PCE	772	960
TOL	0	0
XY	0	0
TCA	59	148
11DCA	5	18
11DCE	6	15
12DCE	26	66
VC	0	0
Total	955	1,357

Deep (Layer 3) Groundwater Calculations

Deep (Layer 3) GW - Solvent concentration greater than 100 ug/l (All Sites)
Area is based on monitoring data and computer modeling results.

	GM-13D		Average
TCE	260		260
PCE	37		37
TOL	0		0
XY	0		0
TCA	82		82
11DCA	36		36
11DCE	73		73
12DCE	140		140
VC	1		
Total	628	0	628

Area of contamination (acres): 60
Vol of contamination (gal): 583,440,000

Quantity of water soluble contaminants (pounds):

TCE	1,259
PCE	179
TOL	0
XY	0
TCA	397
11DCA	174
11DCE	354
12DCE	678
VC	0
Total	3,041

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	1,780	3,039
PCE	732	911
TOL	0	0
XY	0	0
TCA	263	660
11DCA	59	233
11DCE	258	611
12DCE	449	1,127
VC	0	0
Total	3,540	6,581

LEK 8/26/93
pg 11 of 17

Deep (Layer 3) GW - Solvent concentration greater than 10 ug/l (All areas except Grumman)

Area is based on monitoring well data and computer modeling results.

	HN-25D	GM-7D	HN-8D	HN-29D	HN-29D	Average
TCE	7	8	5	11	13	9
PCE	2	0	0	10	26	8
TOL	0	0	0	0	0	0
XY	0	0	0	0	0	0
TCA	0	2	0	48	0	10
11DCA	0	0	0	0	0	0
11DCE	0	0	0	0	0	0
12DCE	0	0	0	0	0	0
VC						
Total	9	10	5	69	39	26

Area of contamination (acres): 241
Vol of contamination (gal): 2,356,200,000

Quantity of water soluble contaminants (pounds):

TCE	172
PCE	149
TOL	0
XY	0
TCA	196
11DCA	0
11DCE	0
12DCE	0
VC	0
Total	516

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	243	415
PCE	607	756
TOL	0	0
XY	0	0
TCA	129	325
11DCA	0	0
11DCE	0	0
12DCE	0	0
VC	0	0
Total	980	1,496

Deep (Layer 3) GW - Solvent concentration less than 10 ug/l (All areas except Grumman)

Area is based on monitoring well data and computer modeling results.
Assign concentration at 50% of Layer 3, >10 ug/l area

		Average
TCE		4
PCE		4
TOL		0
XY		0
TCA		5
11DCA		0
11DCE		0
12DCE		0
VC		
Total	0	13

Area of contamination (acres): 195
Vol of contamination (gal): 1,902,912,000

Quantity of water soluble contaminants (pounds):

TCE	69
PCE	60
TOL	0
XY	0
TCA	79
11DCA	0
11DCE	0
12DCE	0
VC	0
Total	208

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	98	168
PCE	245	305
TOL	0	0
XY	0	0
TCA	52	131
11DCA	0	0
11DCE	0	0
12DCE	0	0
VC	0	0
Total	396	604

Production-well (Layer 4) Depth Groundwater

Production Well (Layer 4) Depth GW - Solvent concentration greater than 100 ug/l with vinyl chloride (Onsite only)
Based on PW data only.

	PW-8	PW-8	PW-8	PW-9	PW-9	PW-9	PW-10	PW-10	PW-10	PW-14	PW-14	PW-14	Avg
TCE	95	106	160	18	67	30	25	92	13	1	72	57	61
PCE	85	99	190	3	9	9	3	14	0	1	5	24	37
TOL	0	0	0	0	0	0	0	3	0	0	0	3	0
XY	0	0	0	0	0	0	0	0	0	0	0	3	0
TCA	100	182	300	7	9	12	3	22	3	3	12	0	54
11DCA	0	0	0	0	0	0	0	0	0	0	0	0	0
11DCE	57	245	250	3	5	7	2	7	0	1	4	0	48
12DCE	0	0	0	0	0	0	0	0	0	0	6	57	5
VC	0	0	0	0	0	0	0	0	0	1	4	1400	370
Total	337	632	900	31	90	58	33	138	16	7	103	1,543	577

Area of contamination (acres): 7
Vol of contamination (gal): 102,663,000

Quantity of water soluble contaminants (pounds):

TCE	52
PCE	31
TOL	0
XY	0
TCA	46
11DCA	0
11DCE	41
12DCE	4
VC	315
Total	492

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	74	126
PCE	128	160
TOL	1	2
XY	0	1
TCA	31	77
11DCA	0	0
11DCE	30	71
12DCE	3	0
VC	29	344
Total	297	781

Production Well (Layer 4) Depth GW - Solvent concentration greater than 100 ug/l, without vinyl chloride (Onsite only)
Based on PW data only.

	PW-8	PW-8	PW-8	PW-9	PW-9	PW-9	PW-10	PW-10	PW-10	PW-14	PW-14	PW-14	Avg
TCE	95	106	160	18	67	30	25	92	13	1	72	57	61
PCE	85	99	190	3	9	9	3	14	3	1	5	24	37
TOL	0	0	0	0	0	0	0	3	0	0	0	0	0
XY	0	0	0	0	0	0	0	0	0	0	0	0	0
TCA	100	182	300	7	9	12	3	22	3	3	12	0	54
11DCA	0	0	0	0	0	0	0	0	0	0	0	0	0
11DCE	57	245	250	3	5	7	2	7	0	1	4	0	48
12DCE	0	0	0	0	0	0	0	0	0	0	6	57	5
VC	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	337	632	900	31	90	58	33	138	19	6	99	138	207

Area of contamination (acres): 23
Vol of contamination (gal): 334,917,000

Quantity of water soluble contaminants (pounds):

TCE	170
PCE	103
TOL	1
XY	0
TCA	151
11DCA	0
11DCE	135
12DCE	15
VC	0
Total	575

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	241	412
PCE	421	524
TOL	2	3
XY	0	0
TCA	100	251
11DCA	0	0
11DCE	98	233
12DCE	10	0
VC	0	0
Total	872	1,423

LEK 8/26/93
pg 15 of 17

Production Well (Layer 4) Depth GW - Solvent concentration less than 100 ug/l (All areas except Grumman)
Based on PW data and computer modeling, set concentrations equal to 10% of Layer 4 >100 ug/l area .

	Average
TCE	6
PCE	4
TOL	0
XY	0
TCA	5
11DCA	0
11DCE	5
12DCE	1
VC	0
Total	21

Area of contamination (acres): 567
Vol of contamination (gal): 8,314,020,000

Quantity of water soluble contaminants (pounds):

TCE	423
PCE	256
TOL	2
XY	0
TCA	376
11DCA	0
11DCE	334
12DCE	36
VC	0
Total	1,427

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	598	1,022
PCE	1,045	1,301
TOL	6	8
XY	0	0
TCA	249	624
11DCA	0	0
11DCE	244	578
12DCE	24	0
VC	0	0
Total	2,165	3,532

Production-well (Layer 5) Depth GW - Solvent concentration greater than 100 ug/l (Onsite areas only)
Based on PW data only.

	PW-15	PW-15	Average
TCE	8	54	31
PCE	0	23	12
TOL	0	0	0
XY	0	0	0
TCA	3	12	8
11DCA	0	0	0
11DCE	1	3	2
12DCE	1	6	4
VC	0	4	2
Total	13	102	58

Area of contamination (acres): 10
Vol of contamination (gal): 207,704,640

Quantity of water soluble contaminants (pounds):

TCE	53
PCE	20
TOL	0
XY	0
TCA	13
11DCA	0
11DCE	3
12DCE	6
VC	3
Total	99

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	76	129
PCE	81	101
TOL	0	0
XY	0	0
TCA	9	21
11DCA	0	0
11DCE	3	6
12DCE	4	0
VC	0	4
Total	172	261

Production-well (Layer 5) Depth GW - Solvent concentration less than 100 ug/l (All areas except Grumman)
Based on PW data and computer modeling. Set concentration equal to 10% of Layer 5, >100 ug/l area.

			Average
TCE			3
PCE			1
TOL			0
XY			0
TCA			1
11DCA			0
11DCE			0
12DCE			0
VC			0
Total	0	0	6

Area of contamination (acres): 886
Vol of contamination (gal): 19,264,605,360

Quantity of water soluble contaminants (pounds):

TCE	496
PCE	184
TOL	0
XY	0
TCA	120
11DCA	0
11DCE	32
12DCE	56
VC	32
Total	919

In addition to the contaminants dissolved in the water, contaminants are also adsorbed onto soil particles. Use the Kd relationship to calculate total contaminants.

	Soil Contaminants (pounds)	Soil & GW Contaminants (pounds)
TCE	701	1,196
PCE	751	935
TOL	0	0
XY	0	0
TCA	79	199
11DCA	0	0
11DCE	23	55
12DCE	37	0
VC	3	35
Total	1,594	2,421

APPENDIX D

GROUNDWATER COMPUTER MODELING

1.0 INTRODUCTION

This Appendix of the FS report presents the approach and results of the Computer Modeling efforts performed at Bethpage Naval Weapons Industrial Reserve Plant (NWIRP) at Bethpage New York, which were conducted for the U. S. Navy.

Bethpage NWIRP is located on 108 acres in Nassau County of Long Island, approximately 20 miles east of New York City in a highly industrialized area. Grumman Aerospace Corp. (Grumman) leases property from the U. S. Navy as part of its Aerospace manufacturing activities. The histories of the NWIRP and Grumman facilities are discussed in detail in the Initial Assessment Study of the NWIRP, the RI/FS Work Plan prepared by Geraghty & Miller, and the RI report prepared by Halliburton NUS.

Grumman utilizes 14 high capacity production wells located on the facility for air conditioning and non-contact cooling purposes. Water pumped from these wells is returned to the aquifer via several recharge basins located across the site. The Bethpage Water District (BWD) operates water supply wells to the east and south of the Bethpage NWIRP.

1.1 OBJECTIVES OF THE COMPUTER MODELING

The modeling investigation is part of an overall RI/FS program designed to determine the locations of any potential sources of contamination on U. S. Navy property, and provide remedial alternatives for potential sources which may be present.

The objective of the computer modeling conducted for the RI report was to provide data on groundwater flow in the area of the NWIRP and the potential flow directions of contaminants. Computer modeling was conducted for the FS report to determine the location of extraction wells for groundwater remediation, and to estimate the approximate time remediation activities will be necessary. The specific objectives of the FS phase of the computer modeling at Bethpage NWIRP are listed below:

FS computer modeling objectives:

- To utilize the calibrated flow model and particle tracking to evaluate remedial alternatives for the facility,
- To determine potential contaminant transport directions and contaminant concentrations under a variety of pumping and remediation scenarios, and,

- To determine the approximate amount time remedial actions will be necessary in and around the NWIRP facility.

This report will present a brief review of the computer modeling results of the RI phase, and will focus on the results of the FS phase of the computer modeling. A detailed description of groundwater flow, hydrogeologic conditions at the facility, as well as the procedures and results of the RI phase of the computer modeling are presented in Appendix F of the RI Report, prepared by Halliburton NUS (HNUS, 1993).

1.2 ORGANIZATION OF COMPUTER MODELING REPORT

This appendix summarizes the development of the FS computer modeling efforts and presents their results. The report is organized into four sections. Section 1 provides an introduction to the computer modeling. Section 2 summarizes the RI phase of modeling. Section 3 discusses the design of the groundwater extraction system. Section 4 discusses contaminant transport modeling.

2.0 SUMMARY OF RI PHASE COMPUTER MODELING

This section presents a brief summary of the RI modeling approach and the modeling results. A detailed discussion of this phase of modeling is provided in the RI report prepared by Halliburton NUS (HNUS, 1993). Computer modeling was performed for the RI phase of the investigation at the NWIRP as part of an integrated investigation to determine the locations of any potential sources of contamination on U.S. Navy property. The objectives of the RI modeling are listed below.

RI computer modeling objectives:

- To provide a general characterization of the subsurface conditions underlying Bethpage NWIRP;
- To develop a localized flow model which accurately represents groundwater flow in the area around the Grumman site, with an emphasis on the groundwater flow in and around the NWIRP; and,
- To model the flow directions and rate of travel for simulated contaminant releases under a variety of production well and recharge basin pumping conditions.

2.1 RI MODELING APPROACH

Data Collection / Analysis:

The first portion of the modeling process is to compile the existing data. The available, relevant data regarding site hydrogeologic conditions and groundwater quality was collected and reviewed. Groundwater elevation data, meteorological conditions, pumping and recharge data, and well location data that was required for model activities was identified and obtained from Grumman, state, and Federal sources. To more fully define the aquifer parameters at the site, two pumping tests were conducted at the NWIRP.

Conceptual Model:

A conceptual model of the groundwater system was developed from information gathered after the data collection phase. The conceptual model identified and incorporated the key hydrogeologic characteristics at the site, potential contaminant source information, and locations of the BWD water supply wells in the

area. In addition, the rationale for assumptions and simplifications made to the natural site conditions were reported and described in the conceptual model.

Computer Code Selection:

A groundwater flow modeling code was selected for the modeling project. The MODFLOW model, developed by the U. S. G. S. was selected for the project. This flow model was able to incorporate the key aspects of the conceptual model, and has been well tested and verified. In addition, particle tracking and contaminant transport applications are supported by this groundwater flow model.

Flow Model Calibration:

The site wide flow model was developed by configuring the conceptual model into a format which is compatible for input into the flow model and entering initial values for aquifer parameters into the flow model. The model was then calibrated for two steady-state pumping conditions, and two transient pumping test simulations. The flow model was calibrated by adjusting initial values of parameters, such as, vertical and horizontal hydraulic conductivities, storage and boundary conditions. Calibration continued until the water level elevations at 61 monitoring wells (in steady-state simulations) and the modeled drawdowns (in transient pump test simulations) were adequately comparable to measured values.

Flow Model Validation:

The calibrated model was validated using two steady-state pumping conditions and resulting water elevations which were not previously used in calibration. For each month of water elevation data used for validation, the pumping/recharge rates of Grumman production wells and recharge basins were input into the model, and the model results were compared against the measured water level elevations at 61 monitoring wells.

Particle Tracking:

Particle tracking was performed to determine the possible directions and rates of contaminant movement following a simulated contaminate release from potential sources. Particle tracking was performed under a variety of pumping and recharge conditions, from a variety of potential sources. This approach allows for several potential release scenarios to be examined. An analysis of the rate of particle movement and the three dimensional movement of particles throughout the aquifer was also conducted.

Sensitivity Analysis:

Sensitivity analyses was performed to determine how sensitive the model output is to changes in aquifer parameters. The sensitivity analyses involved changing aquifer parameters by incremental amounts and evaluating these effects on model predictions. The results were used to quantify model accuracy and model assumptions.

2.2 SUMMARY OF RI MODELING RESULTS

The computer modeling performed for the NWIRP site accurately simulated water levels in 56 of 61 monitoring wells in the February, 1992 pumping condition and accurately simulated water levels in 55 of 61 monitoring wells in the August, 1992 pumping condition. The wells which fell outside the calibration criteria of +/- 2.0 ft are in the immediate vicinity of active production wells or recharge basins, which may account for these disparities. Statistical analysis (linear regression and residual contour plots) performed on the calibrated steady-state model data indicates a nearly direct correlation in modeled and measured values of head, and that no significant trends exist in the distribution of model error.

Model simulation of pumping test #1 showed very similar results to data measured during the pumping test. A comparison of measured and modeled drawdowns (in the pumping well and the observation wells) shows very close agreement of measured and modeled data. In addition, the time-drawdown curves for modeled and measured data exhibit very similar results. The simulation of pumping test #2 was more difficult because of the small amounts of drawdown produced in the observation wells and due to the size of the model grid-blocks. Model simulations were within 1.0 ft of measured drawdowns for pumping test #2.

During model validation, the model was used to simulate water elevations for two months of data. The model accurately predicted water levels in 59 of 61 monitoring wells in the January, 1992 pumping condition and accurately simulated water levels in 54 of 61 monitoring wells in the August, 1992 pumping condition.

Sensitivity analysis was conducted for all aquifer parameters. Results indicate that the model is not highly sensitive to increases in horizontal or vertical hydraulic conductivity of up to 50% of calibrated values. The model showed significantly increased error if horizontal or vertical hydraulic conductivity were decreased more than 25% from calibrated values. Time-drawdown curves for shallow monitoring wells indicate that the model is sensitive to and increase in storage of 25%. Recharge and porosity exhibit linear (predictable) effects on model output. Sensitivity analysis indicates that moving the north constant head boundary 1400 ft to the north does not have a significant effect on the capture zones of the BWD wells BP-07, BP-08 and BP-09.

Particle tracking indicates that under current pumping conditions particles released from Site 1 will be captured by Grumman production wells, and BWD wells will not capture particles from the NWIRP recharge basins. Under high pumping (past) conditions at Grumman and average BWD rates, Site 1 particles are captured by Grumman production wells. A small number of particles may effect BWD well BP-08, and to a lesser extent, BWD well BP-09. If Grumman production wells and BWD wells pump at a high rate for sustained periods (as simulated by the steady-state model), all Site 1 particles are captured by Grumman production wells, and 19% of the particles released may move from the NWIRP recharge basins to BWD wells. These pumping conditions may have occurred for short time periods in the past, although the high pumping conditions may not have continued for extended periods of time as simulated in the steady-state model runs. Assuming no Grumman production well or recharge basin activity and average pumping conditions at the BWD wells, Site 1 particles move to the southern constant head boundary, and the capture zone of the BWD wells is not effected by NWIRP recharge basins. Under high BWD well pumping rates, particles released from Site 1 are captured by BWD wells BP-10 and BP-11.

3.0 GROUNDWATER EXTRACTION SYSTEM

The first portion of the FS phase of computer modeling was to determine the location of extraction wells. The remediation system will capture and remediate the groundwater contamination which may be present in and around the NWIRP, and the surrounding area. The particle tracking program MODPATH was used to determine the capture zones of each extraction well in order to design a remediation system that will capture contamination which may be present.

3.1 CONTAMINANT CONCENTRATIONS

Contaminant concentration contour maps were developed for the on-site and off-site area, around the NWIRP. These contaminant concentration contour maps (Figures 3-1 to 3-5) illustrate the maximum concentration of the three main chemicals of concern, TCE, TCA and DCE for each layer of the model. Two contaminant concentration contours are shown, the 5 ppb contour and the 100 ppb contour.

The primary source of data used for constructing these maps was analytical data derived from sampling activities at shallow, intermediate and deep HNUS wells, Grumman monitoring wells, and Grumman production wells. In addition to analytical data, particle tracking results from the RI phase of computer modeling were used to estimate the extent of contamination which may be present in each model layer. Particle tracking data was used to fill in data gaps, and to estimate if contamination was likely to be present in an area where groundwater data was not available.

3.2 MODELING PROCEDURE

The groundwater extraction systems were designed using a combination of particle tracking and contaminant transport modeling simulations. Figure 3-6 shows the modeling procedure used to design the on-site/near-site and the off-site remediation systems. This iterative process is described below.

- Initial locations and pumping rates of extraction wells were determined, based on the extent of the contaminated groundwater plume present in each model layer.
- Particle tracking analysis was performed to determine the capture zone for each extraction well.
- Particle tracking results were compared to contaminant concentration contour maps to determine if the majority of contaminants were being captured by the remediation system.
- The contaminant transport model MT3D was run, utilizing the extraction well locations and pumping rates determined using particle tracking. Remediation times and contaminant concentrations were determined based on this remediation design.
- Areas of unacceptably high contaminant concentrations were determined, and extraction well

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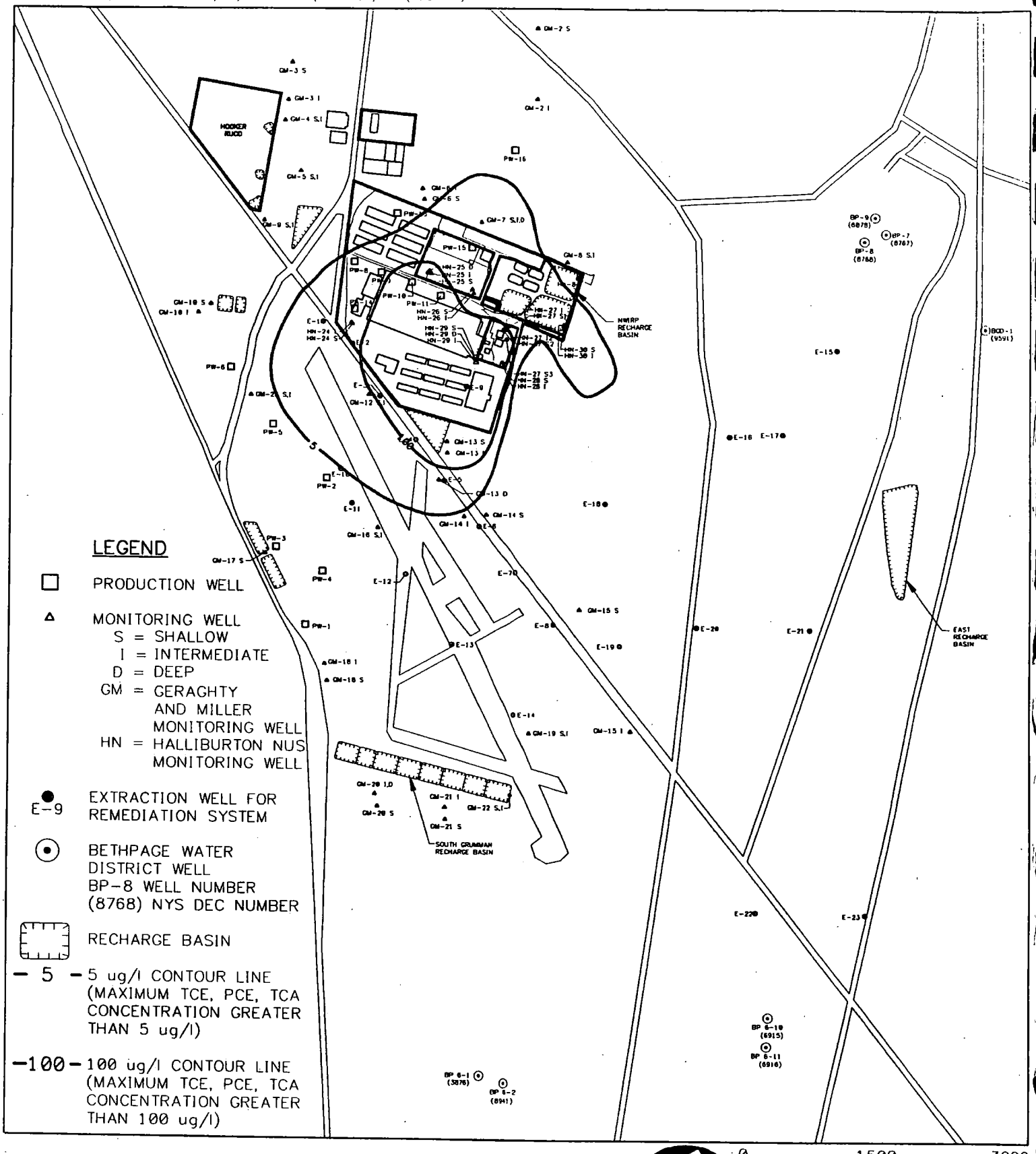
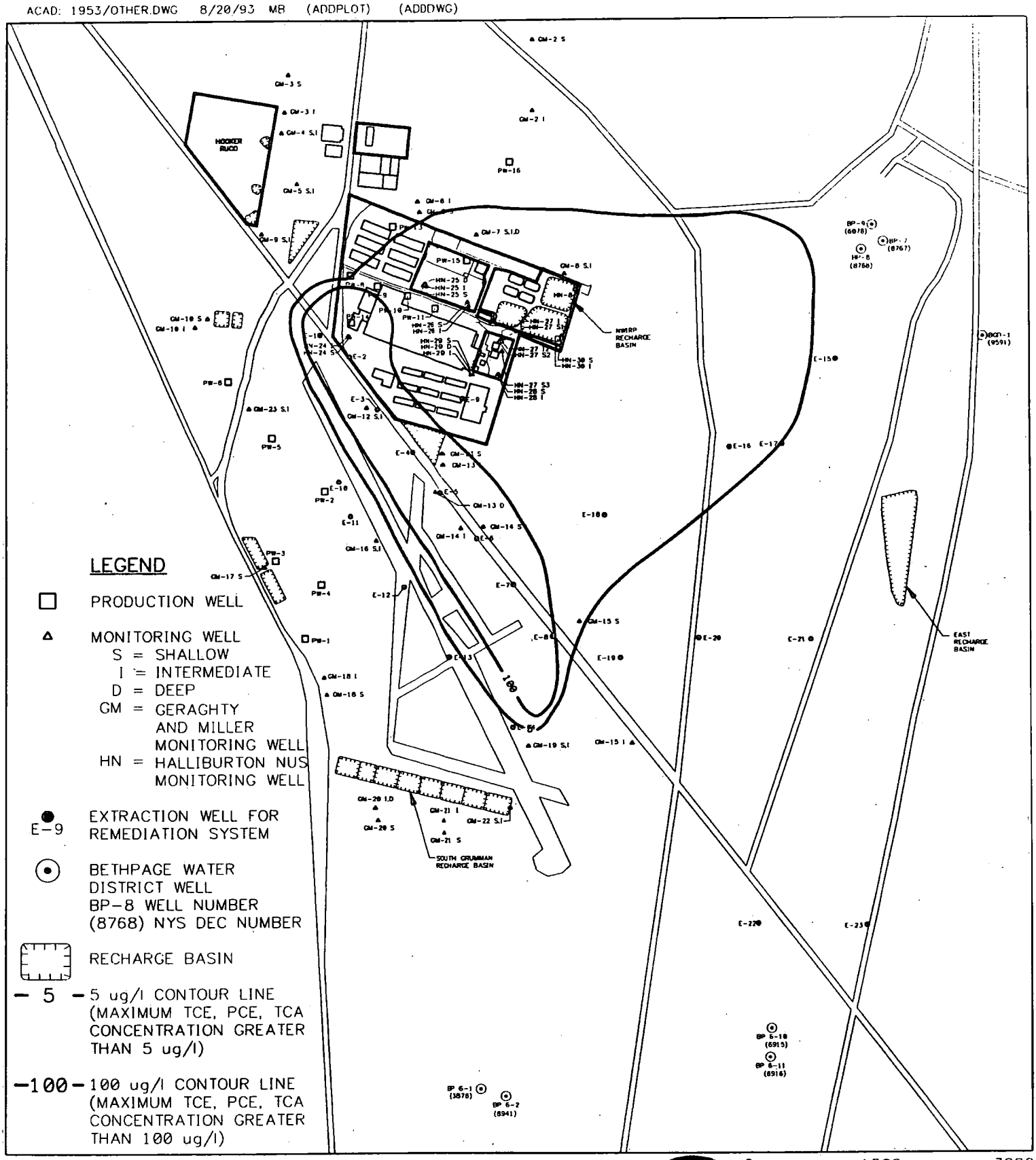


CURRENT CONTAMINANT CONCENTRATIONS
5 ppb AND 100 ppb CONTOURS
LAYER 1
BETHPAGE NWIRP

Figure 3-1

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953/OTHER.DWG 8/20/93 MB (ADDPLOT) (ADDDWG)

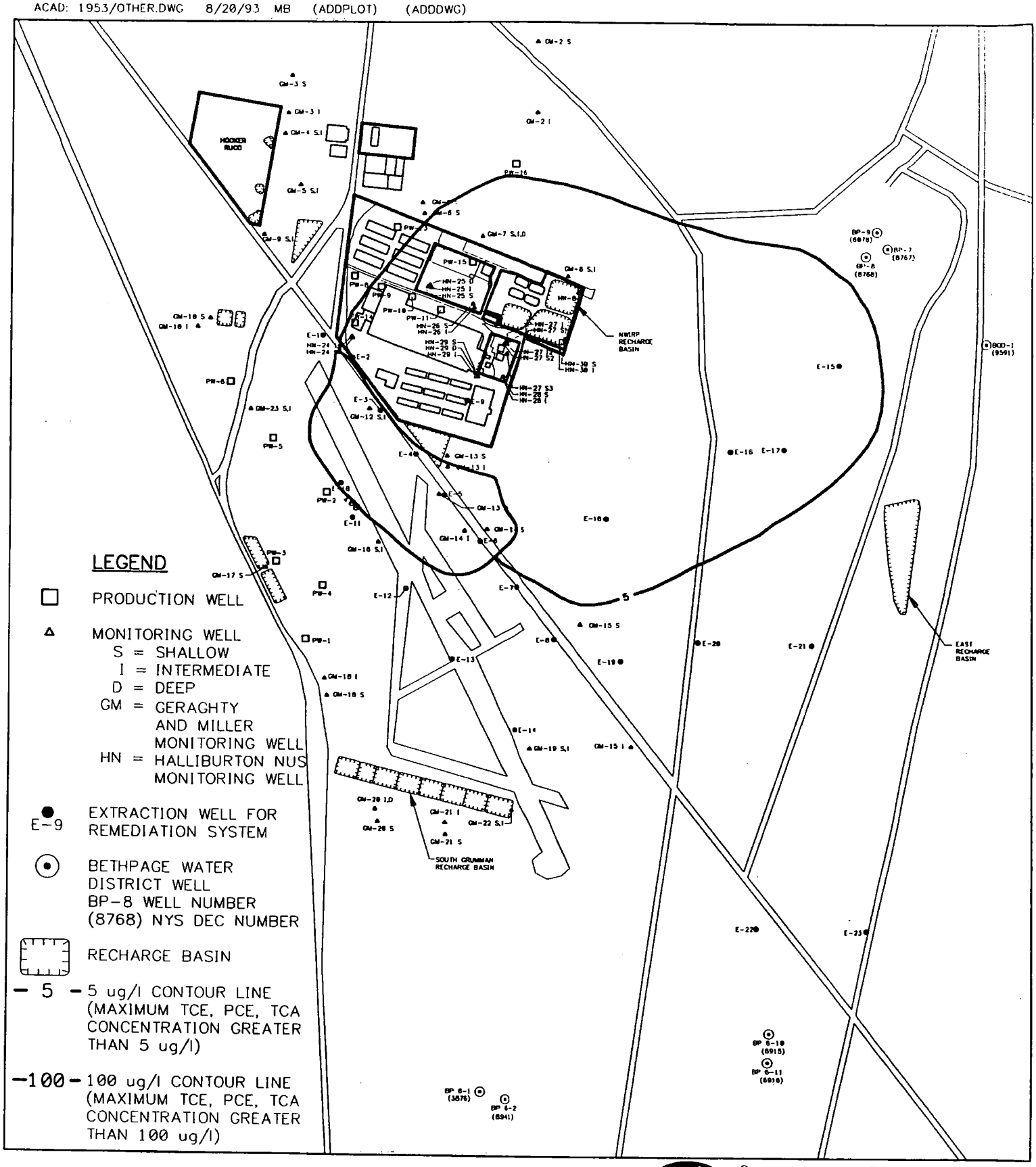


CURRENT CONTAMINANT CONCENTRATIONS
5 ppb AND 100 ppb CONTOURS
LAYER 2
BETHPAGE NWIRP

Figure 3-2

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953/OTHER.DWG 8/20/93 MB (ADDPLOT) (ADDDWG)



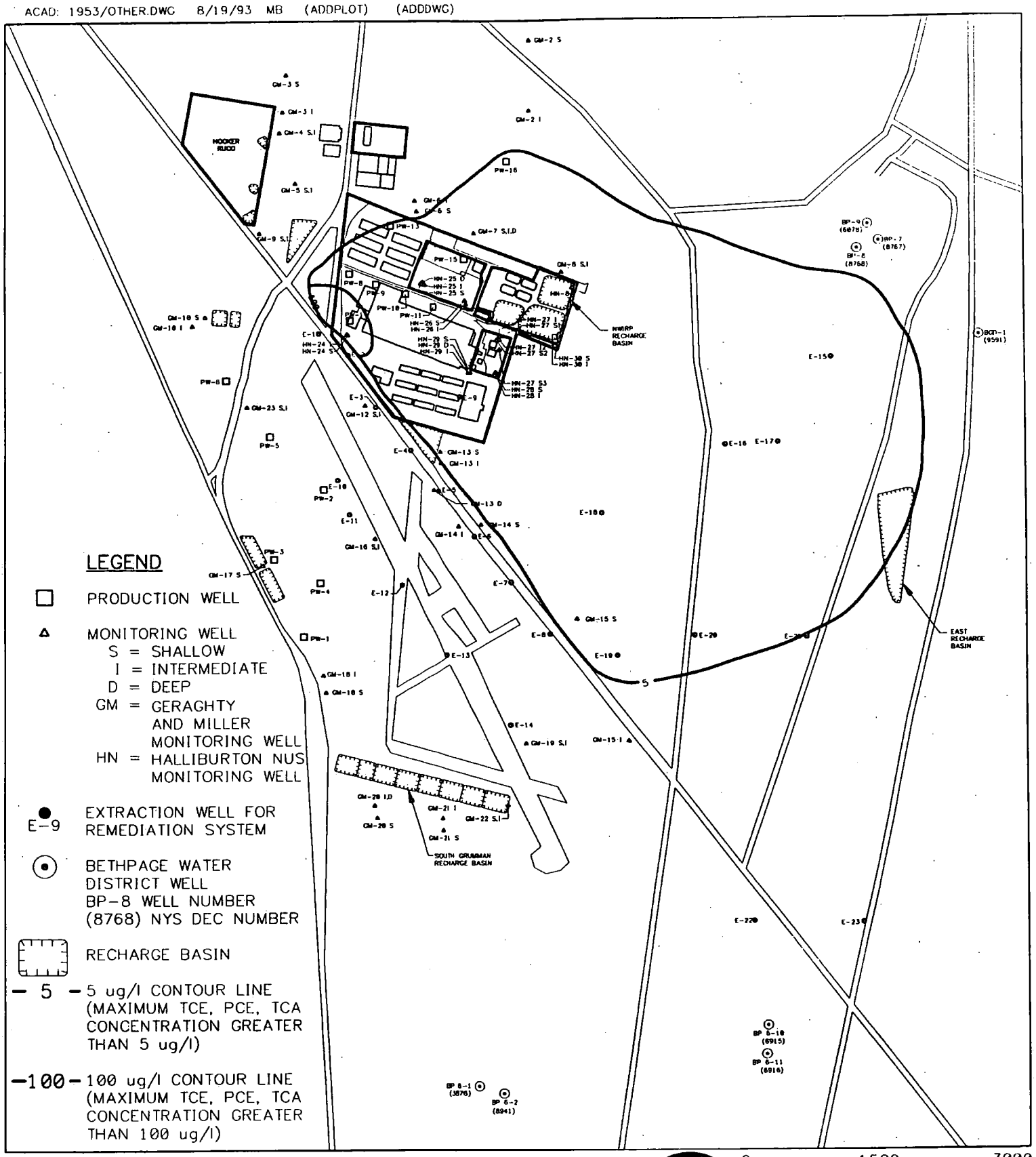
CURRENT CONTAMINANT CONCENTRATIONS
5 ppb AND 100 ppb CONTOURS
LAYER 3
BETHPAGE NWIRP

D-3-4

Figure 3-3

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



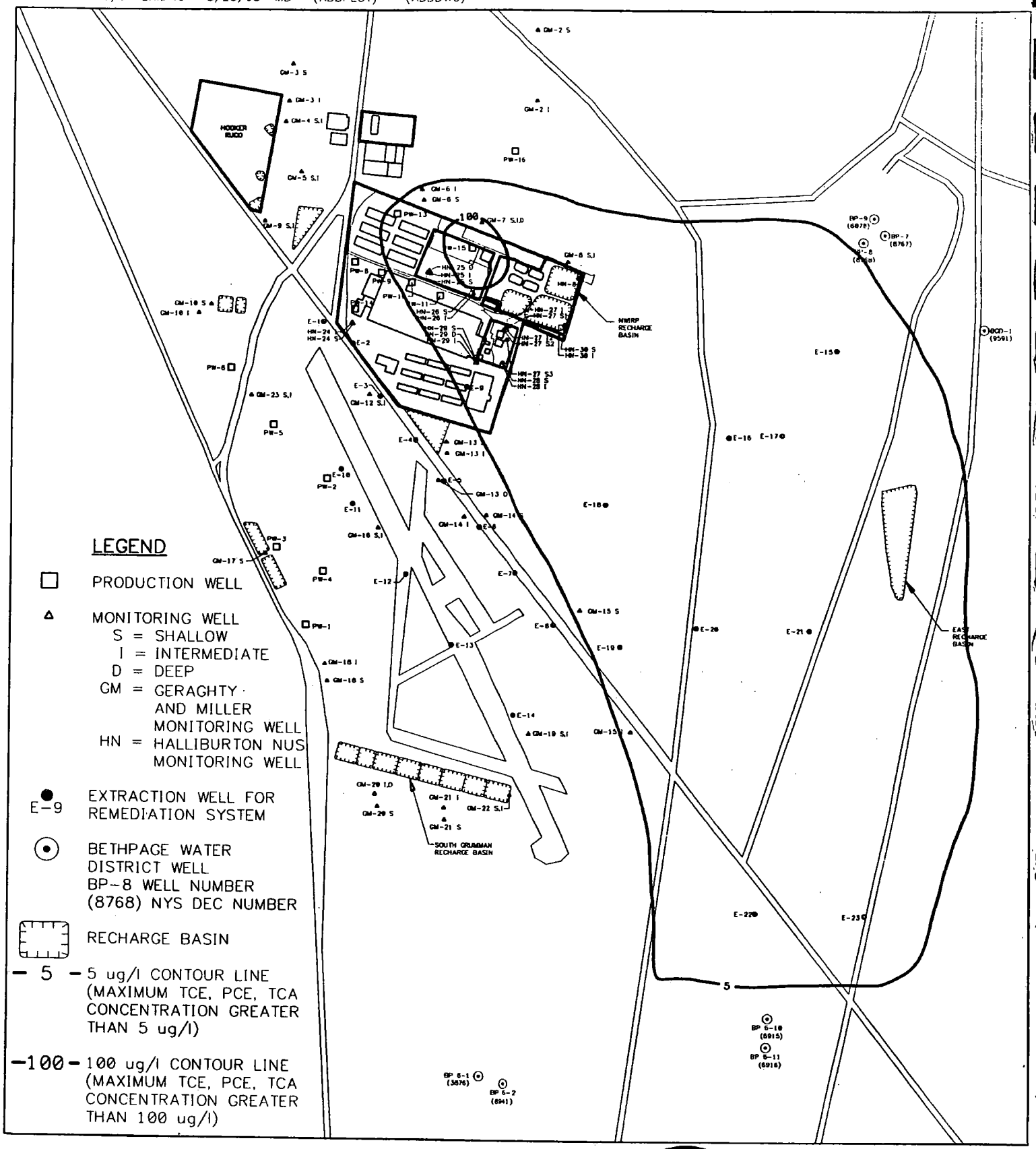
0 1500 3000
SCALE IN FEET

CURRENT CONTAMINANT CONCENTRATIONS
5 ppb AND 100 ppb CONTOURS
LAYER 4
BETHPAGE NWIRP

Figure 3-4

HALLIBURTON NUS
Environmental Corporation

ACAD: 1953/OTHER.DWG 8/20/93 MB (ADDPLOT) (ADDDWG)



0 1500 3000
SCALE IN FEET

CURRENT CONTAMINANT CONCENTRATIONS
5 ppb AND 100 ppb CONTOURS
LAYER 5
BETHPAGE NWIRP

Figure 3-5

HALLIBURTON NUS
Environmental Corporation

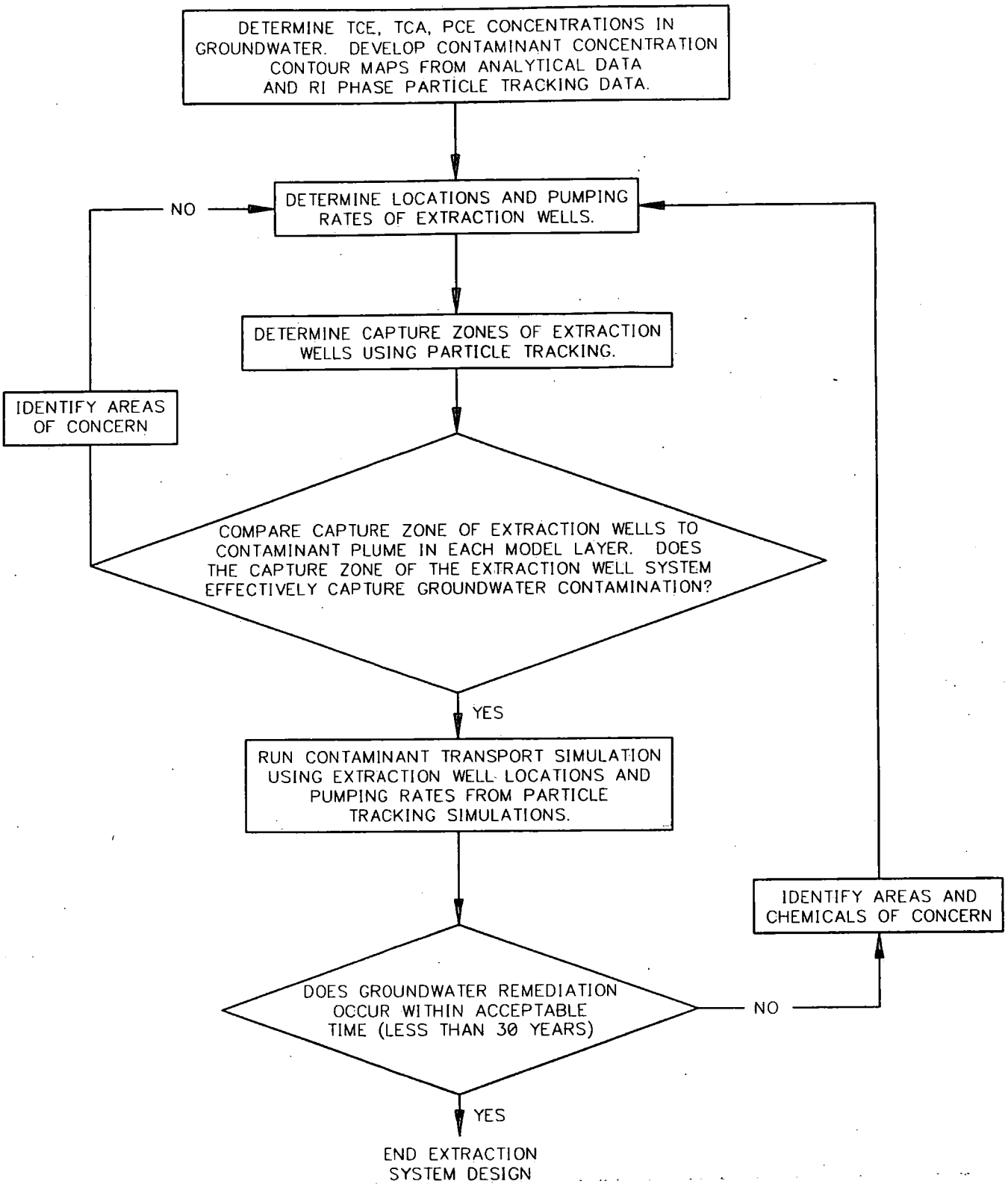


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Figure 3-6

FLOW CHART FOR FS PHASE OF MODELING
BETHPAGE NWIRP

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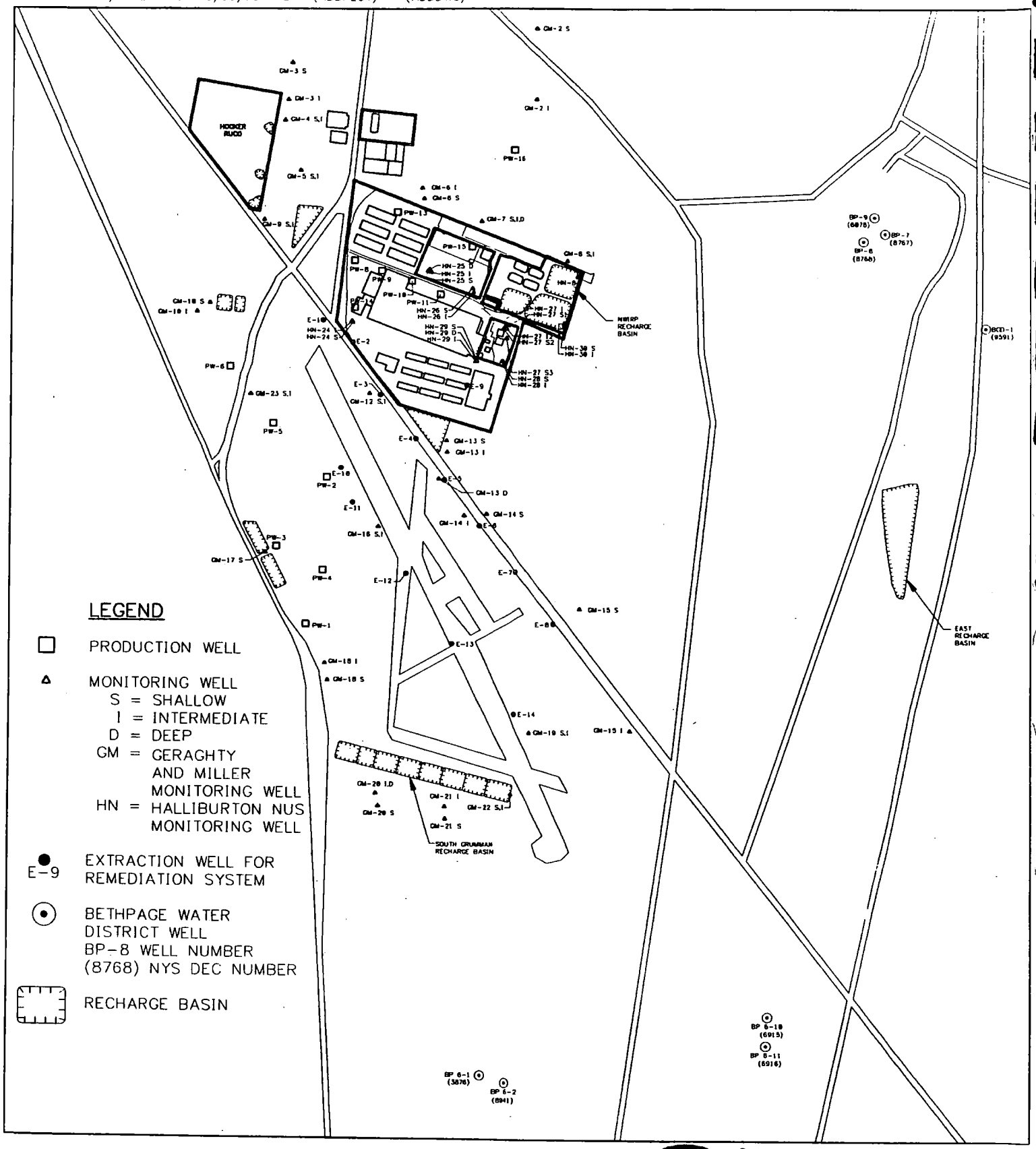
ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



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SCALE IN FEET

Figure 3-7

LOCATION OF ON-SITE/NEAR SITE EXTRACTION WELLS BETHPAGE NWIRP

D-3-9

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TABLE 3-1
WELLS USED IN ON-SITE / NEAR-SITE REMEDIATION SYSTEM

Remediation System	Well Number	Model Row, Column	Model Layer	Pumping Rate (gpm)	Recharge Basin Receiving Water
On-site	PW-08	15, 13	4 5	144 756	NWIRP Recharge Basins
	PW-09	16, 16	4	900	
	PW-10	18, 19	4	900	
	PW-14	21, 13	4 5	558 342	
On-site	E-1	22, 11	1 2 3	100 100 100	NWIRP Recharge Basin
	E-2	24, 13	1 2 3	100 100 100	
	E-3	29, 16	1 2 3	100 100 100	
	E-4	31, 20	1 2 3	100 100 100	
	E-5	34, 23	1 2 3 4	100 100 100 100	
	E-6	36, 27	2 3	100 100	
	E-7	39, 31	2	100	
	E-8	42, 35	2	100	
	E-9	28, 26	1 2	100 100	
	E-10*	33, 12	2 3	100 100	
	E-11*	35, 13	2 3	100 100	
	E-12*	39, 18	2 3	100 100	
	E-13*	43, 24	2	100	
	E-14*	47, 31	2	100	

Note: * indicates well was added during second on-site/near site transport simulation.

Figures 3-8 to 3-12 illustrate the extent of the 100 ppb contaminant contour and the capture zone of each extraction well, for each of the 5 model layers. As shown in these figures, the capture zone of the remediation wells is concurrent with the contamination present within the model layer. The majority of water reaching the extraction wells originates at the NWIRP recharge basins, which receive the treated groundwater from the extraction system.

Following the design of the on-site/near-site remediation system based on particle tracking analysis, a contaminant transport model was run to determine the effectiveness of the remediation system, and to estimate cleanup times for the contaminated groundwater. Results of the contaminant transport section of the FS computer modeling are summarized in Section 4.0.

3.3.2 Off-Site Extraction System

The off-site extraction system was designed to remediate the groundwater contamination which may be present on NWIRP property, and any contamination above MCL's (greater than 5 ppb) throughout the modeled area. Figures 3-1 to 3-5 show the extent of the 5 ppb contaminant plume in layer 1 through layer 5. As seen in these figures, the 5 ppb contaminate plume (for TCE, TCA, or PCE) covers a significantly larger area, extending well beyond the NWIRP facility boundary. The off-site extraction system was designed to remediate groundwater which may have been contaminated due to past activities at the NWIRP, with concentrations greater than 5 ppb and does not address contaminants which may be present from other sources.

The off-site remediation system consists of the 14 extraction wells (E-1 to E-14) and 4 Grumman production wells (PW-09, PW-09, PW-10, PW-14) used in the on-site/near-site remediation system, and includes 9 additional extraction wells (E-15 to E-23) which capture the contamination which may be present east and south of the NWIRP facility. Figure 3-13 illustrates the location of the extraction wells used in the off-site remediation system. Table 3-2 lists the pumping rates and depths of the proposed extraction wells and the Grumman production wells which are included in the off-site remediation system. The remaining northern Grumman production wells (PW-11, PW-13, PW-15, PW-16) were considered to be inactive. Southern Grumman production wells (PW-1 through PW-6) were assumed to be pumping at 1991/1992 average rates. The proposed extraction wells of the off-site system (E-15 through E-23) have pumping rates between 70 and 1150 gpm from each layer from which they are pumping. The water pumped from extraction wells E-1 to E-14, and PW-08, PW-09, PW-10, PW-14 (ie., the wells included in the on-site/near-site system) was assumed to be returned to the aquifer through the NWIRP recharge basins (via outfalls 001/004). The water pumped from extraction wells E-15 to E-21 was assumed to be returned through the east recharge basin and water from E-22 and E-23 was returned through the south Grumman recharge basins (outfall 005). All water pumped from the extraction wells used in the off-site system was assumed to be returned to the aquifer near the extraction well after being passed through an air stripper, or other device which removes the volatile organic chemicals.

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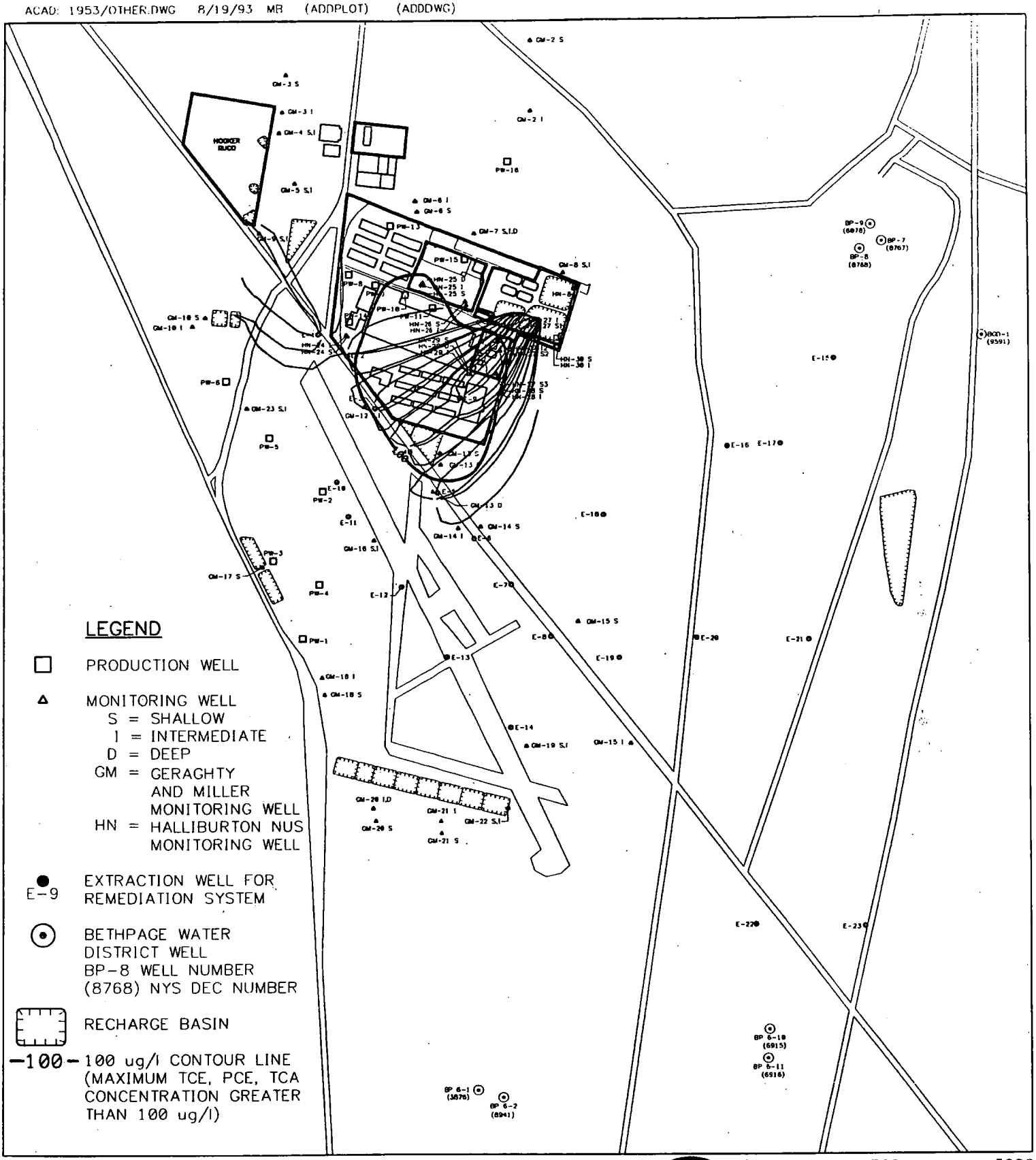

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SCALE IN FEET

ON SITE/NEAR SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 1 BETHPAGE NWIRP

Figure 3-8

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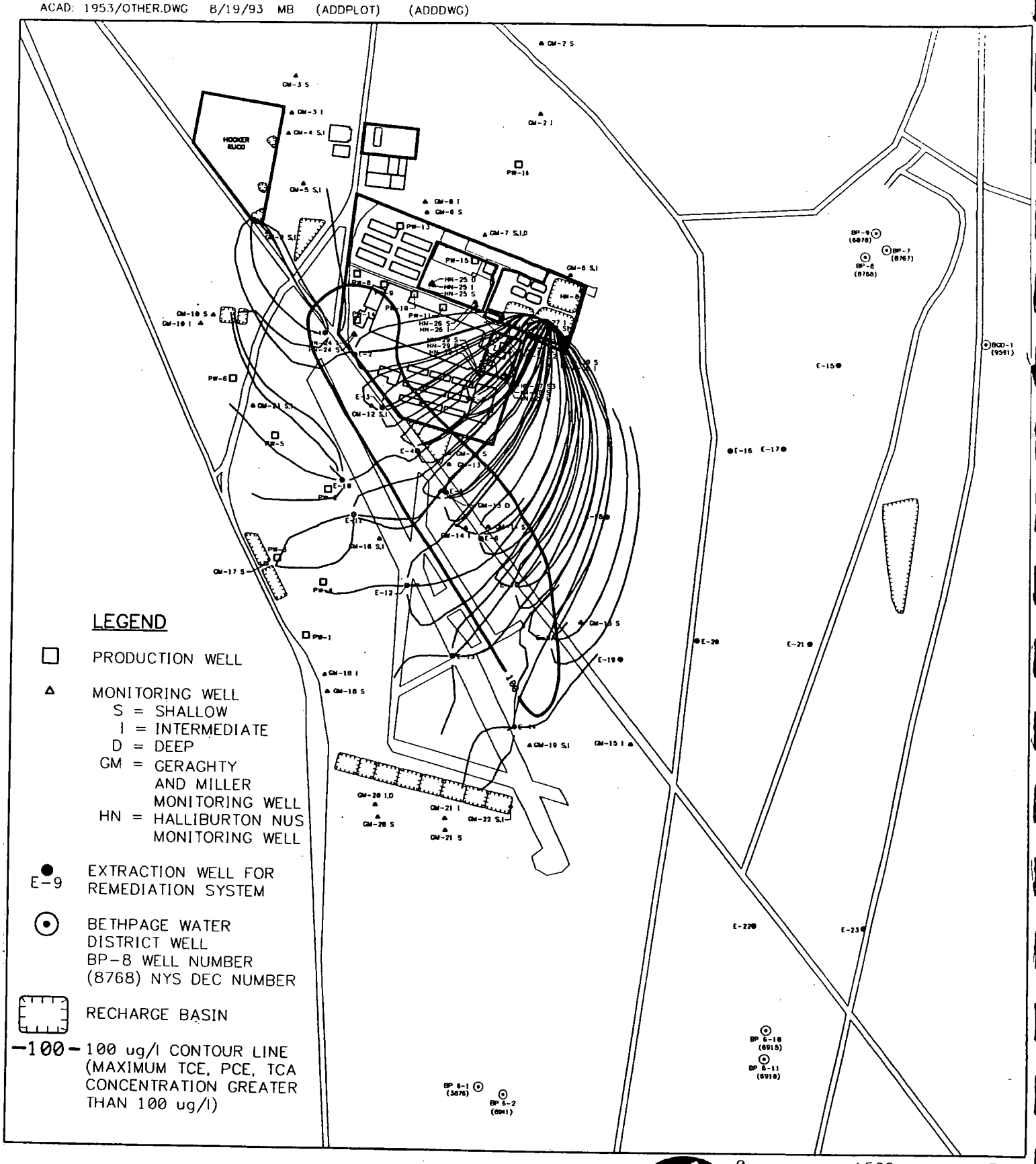
ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)

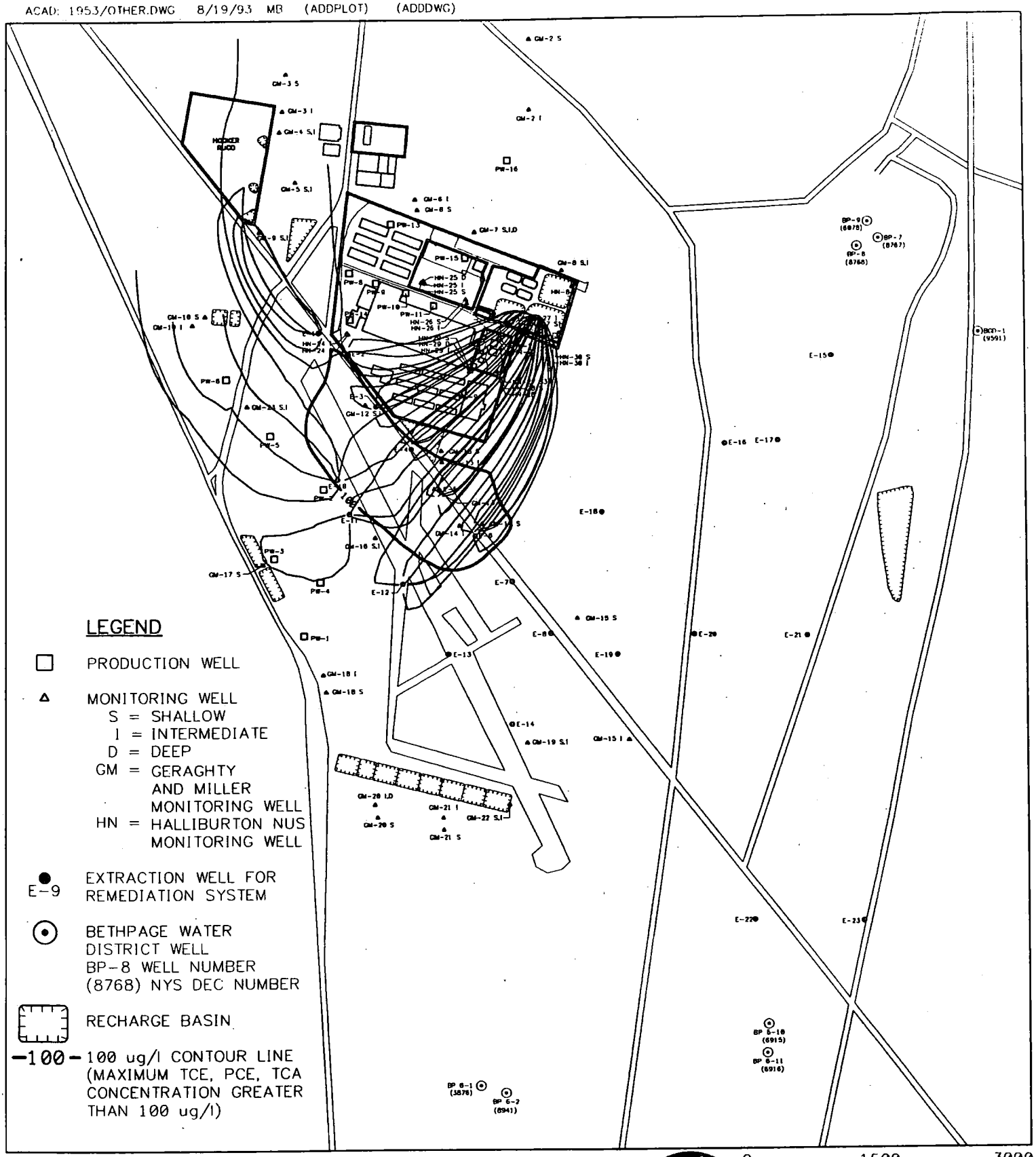


ON SITE/NEAR SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 2 BETHPAGE NWIRP

Figure 3-9

HALLIBURTON NUS Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)

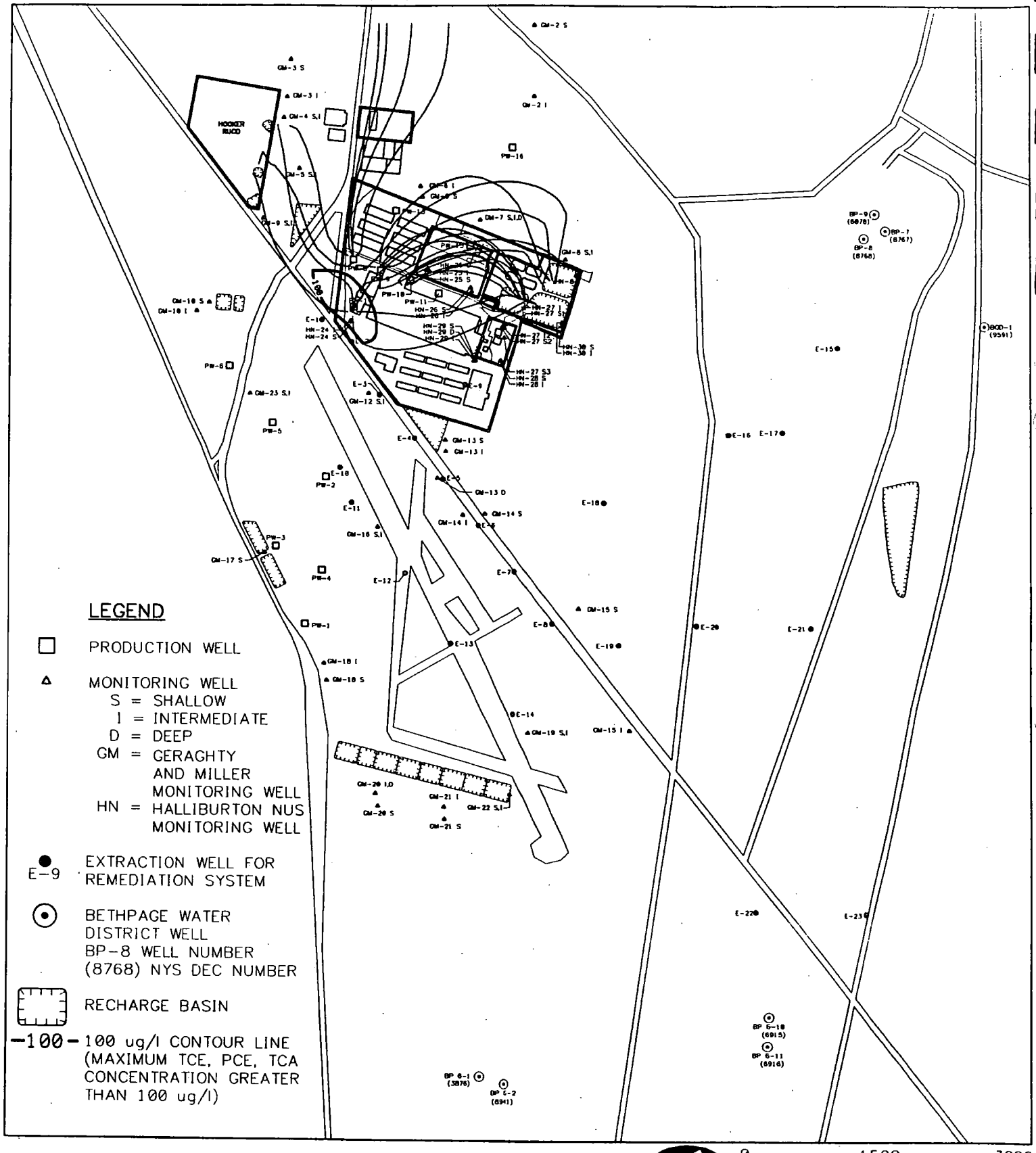


ON SITE/NEAR SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 3 BETHPAGE NWIRP

Figure 3-10

HALLIBURTON NUS Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



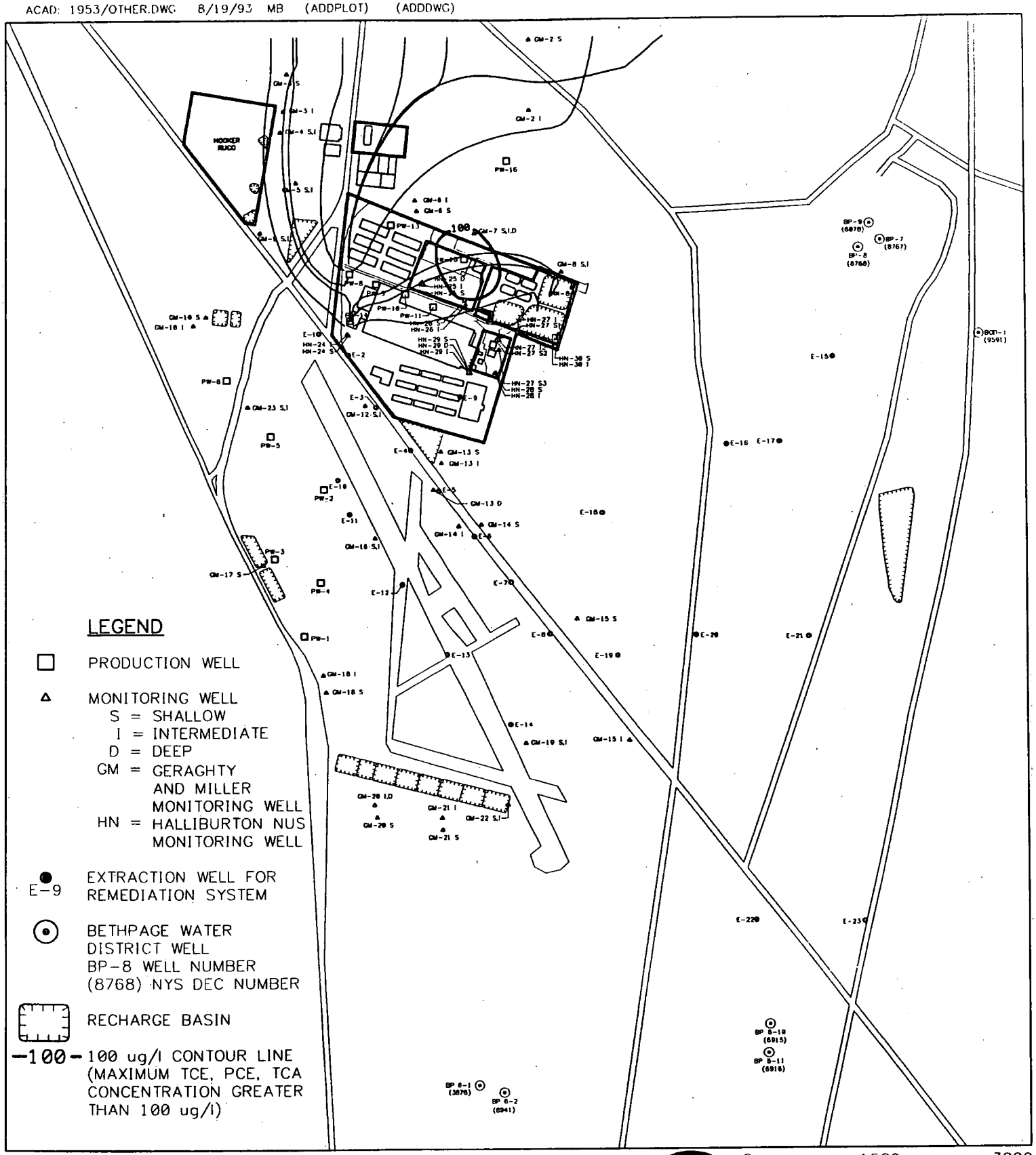
0 1500 3000
SCALE IN FEET

ON SITE/NEAR SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 4 BETHPAGE NWIRP

Figure 3-11

HALLIBURTON NUS Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)

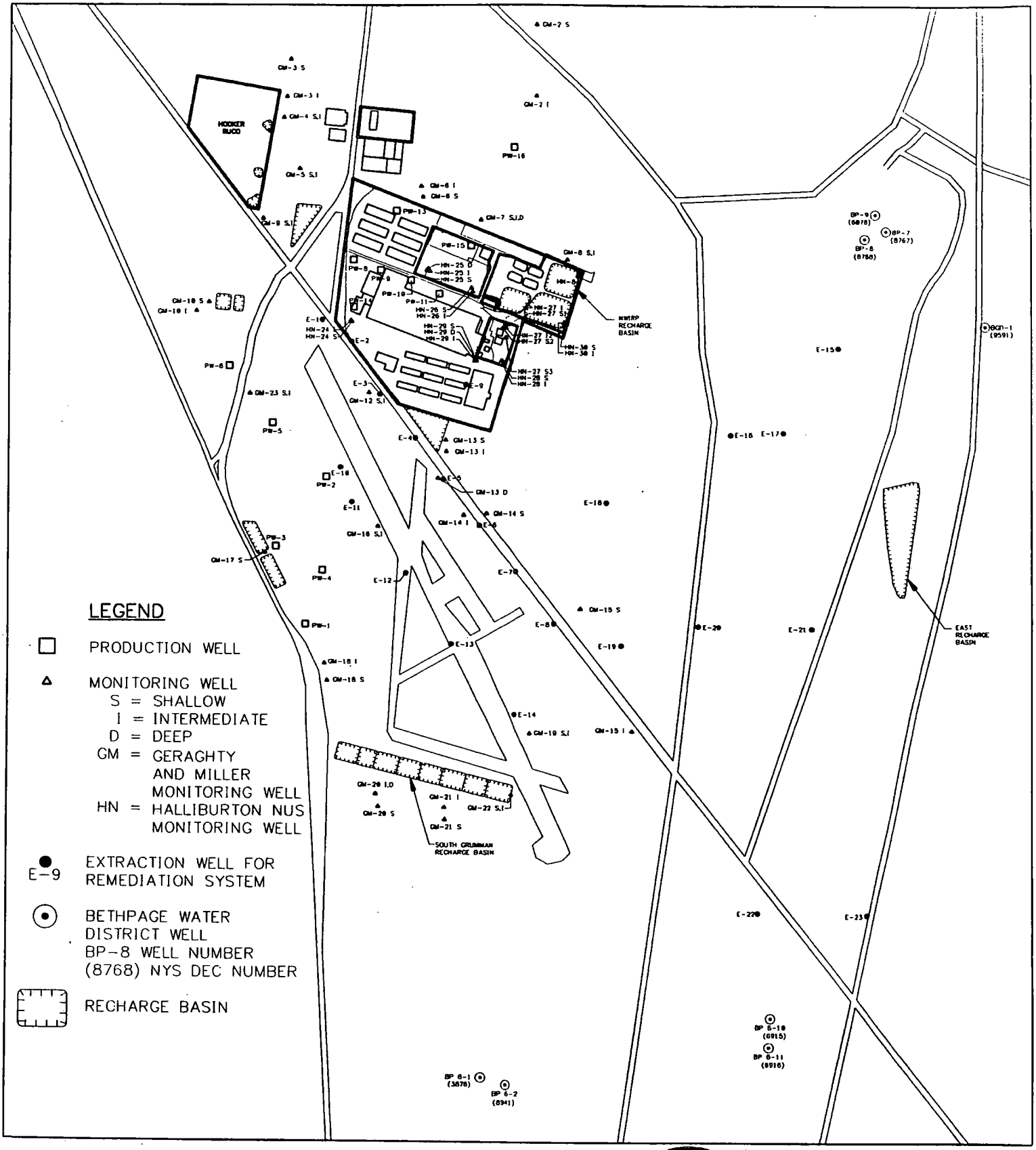


ON SITE/NEAR SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 5 BETHPAGE NWIRP

Figure 3-12

HALLIBURTON NUS Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



0 1500 3000

SCALE IN FEET

Figure 3-13

LOCATION OF OFF-SITE EXTRACTION WELLS BETHPAGE NWIRP

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TABLE 3-2
WELLS USED IN OFF-SITE REMEDIATION SYSTEM

Remediation System	Well Number	Model Row, Column	Model Layer	Pumping Rate (gpm)	Recharge Basin Receiving Water
Off-site	PW-08	15, 13	4 5	144 756	NWIRP Recharge Basins
	PW-09	16, 16	4	900	
	PW-10	18, 19	4	900	
	PW-14	21, 13	4 5	558 342	
Off-site	E-1	22, 11	1 2 3 4	100 100 100 100	NWIRP Recharge Basin
	E-2	24, 13	1 2 3 4	100 100 100 100	
	E-3	29, 16	1 2 3 4	100 100 100 100	
	E-4	31, 20	1 2 3 4	100 100 100 100	
	E-5	34, 23	1 2 3 4	100 100 100 100	
	E-6	36, 27	2 3 4	100 100 100	
	E-7	39, 31	2 3 4	100 100 100	
	E-8	42, 35	2 3 4	100 100 100	
	E-9	28, 26	1 2 3 4	100 100 100 100	

Table 3-2, page 2

Remediation System	Well Number	Model Row, Column	Model Layer	Pumping Rate (gpm)	Recharge Basin Receiving Water
Off-site	E-15	25, 48	2 3 4 5	100 141 200 700	East Recharge Basin
	E-16	31, 44	2 3 4 5	100 141 200 700	
	E-17	31, 46	2 3 4 5	100 141 200 700	
	E-18	35, 39	2 3 4	100 150 100	
	E-19	43, 40	4	100	
	E-20	42, 43	4 5	71 1,000	
	E-21	42, 47	5	1,000	
	E-22	55, 45	5	1,158	South Recharge Basin
	E-23	55, 49	5	1, 158	

The capture zone of each extraction well used in the off-site extraction system was determined using the particle tracking portion of the computer modeling. During the FS phase of modeling, the location and pumping rate of each extraction well was adjusted to maximize the capture of the contaminant plume. Figures 3-14 to 3-18 illustrates the extent of the 5 ppb contaminant contour and the capture zone of each extraction well, for each of the 5 model layers. As shown in these figures, the capture zone of the remediation wells is concurrent with the contamination present within the model layer. In model layers 1, 2 and 3, the majority of water reaching the extraction wells originates at the NWIRP recharge basins. The capture zones of layers 4 and 5 extraction wells show increased recharge from the eastern recharge basins.

Following the design of the on-site/near-site remediation system based on particle tracking analysis, a contaminant transport model was run to determine the effectiveness of the remediation system, and to estimate cleanup times for the contaminated groundwater. Results of the contaminant transport section of the FS computer modeling are summarized in Section 4.0.

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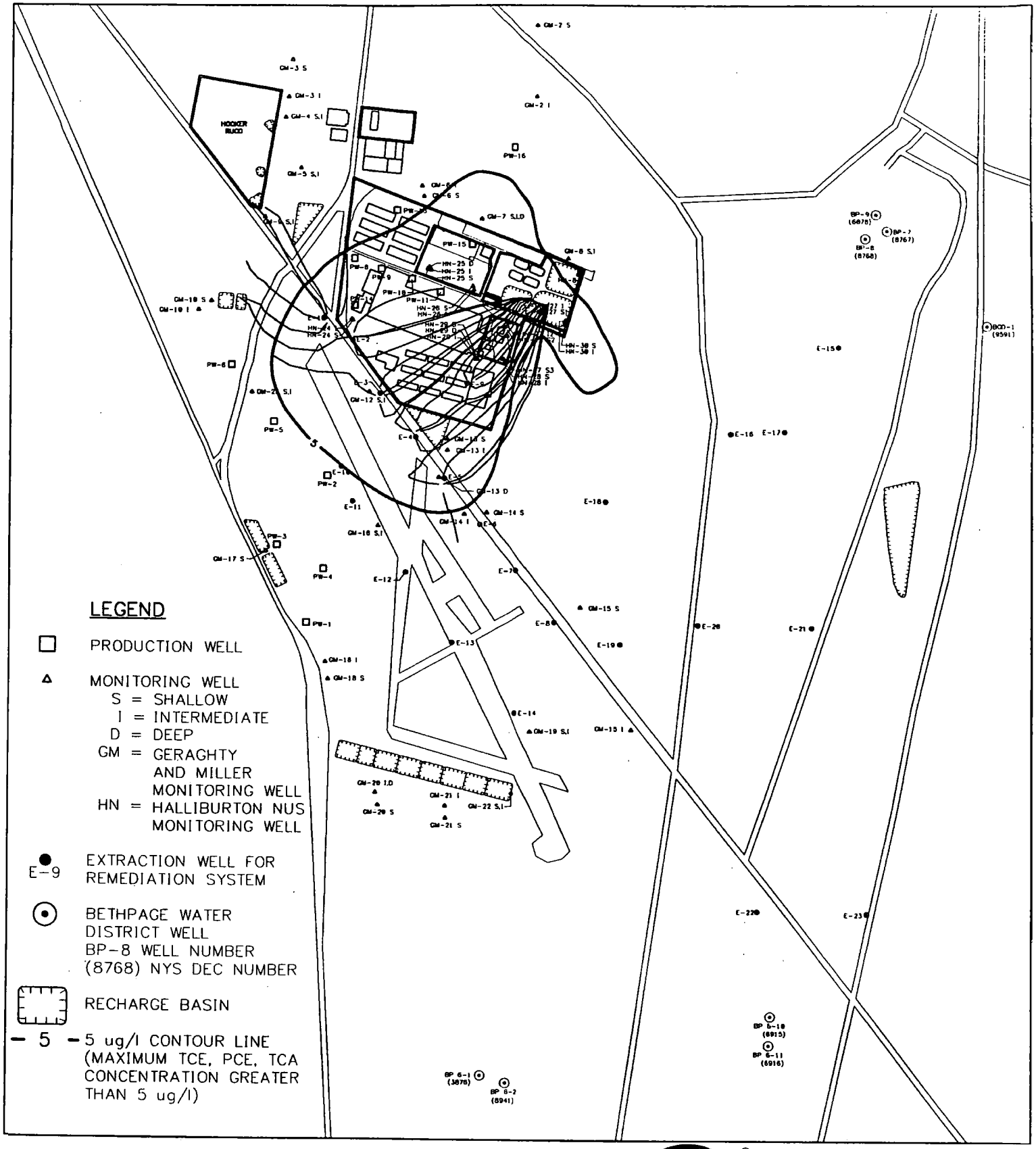

OFF SITE REMEDIATION SYSTEM
INITIAL CONTAMINANT CONCENTRATIONS
WITH CAPTURE ZONE OF EXTRACTION WELLS
LAYER 1
BETHPAGE NWIRP

Figure 3-14

HALLIBURTON NUS
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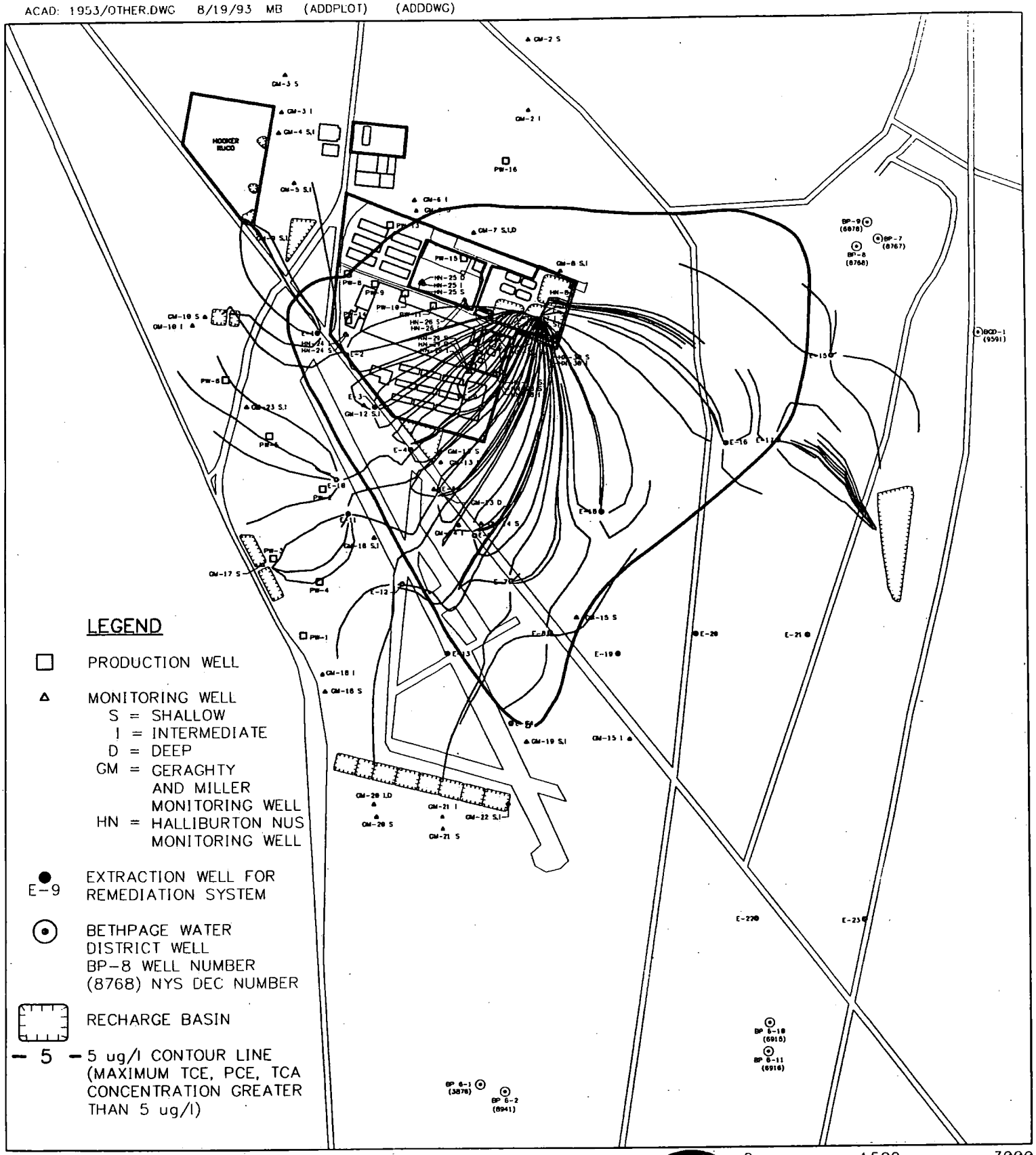
ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)

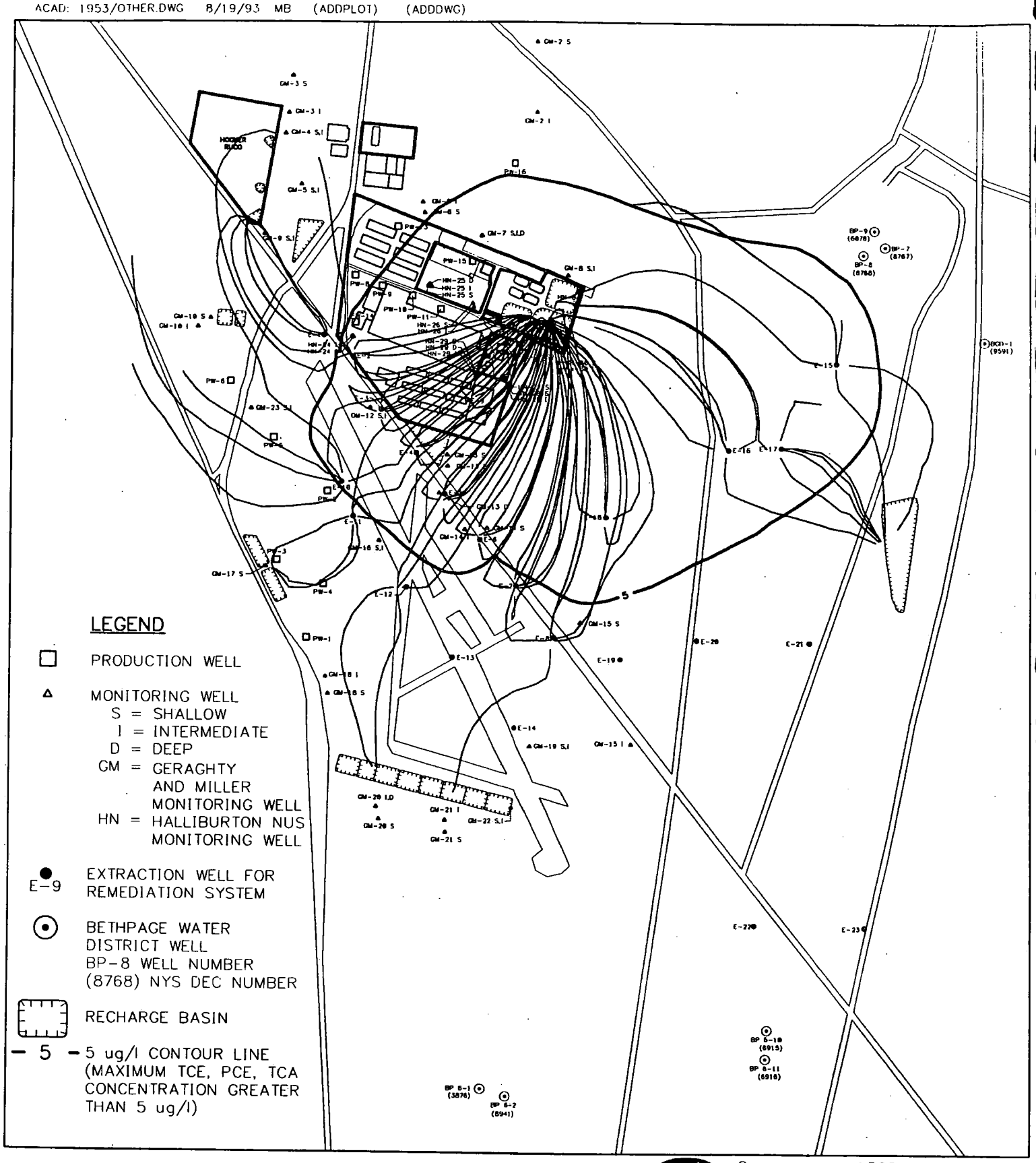


OFF SITE REMEDIATION SYSTEM INITIAL CONTAMINANT CONCENTRATIONS WITH CAPTURE ZONE OF EXTRACTION WELLS LAYER 2 BETHPAGE NWIRP

Figure 3-15

HALLIBURTON NUS Environmental Corporation

ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



OFF SITE REMEDIATION SYSTEM
INITIAL CONTAMINANT CONCENTRATIONS
WITH CAPTURE ZONE OF EXTRACTION WELLS
LAYER 3
BETHPAGE NWIRP

Figure 3-16

HALLIBURTON NUS
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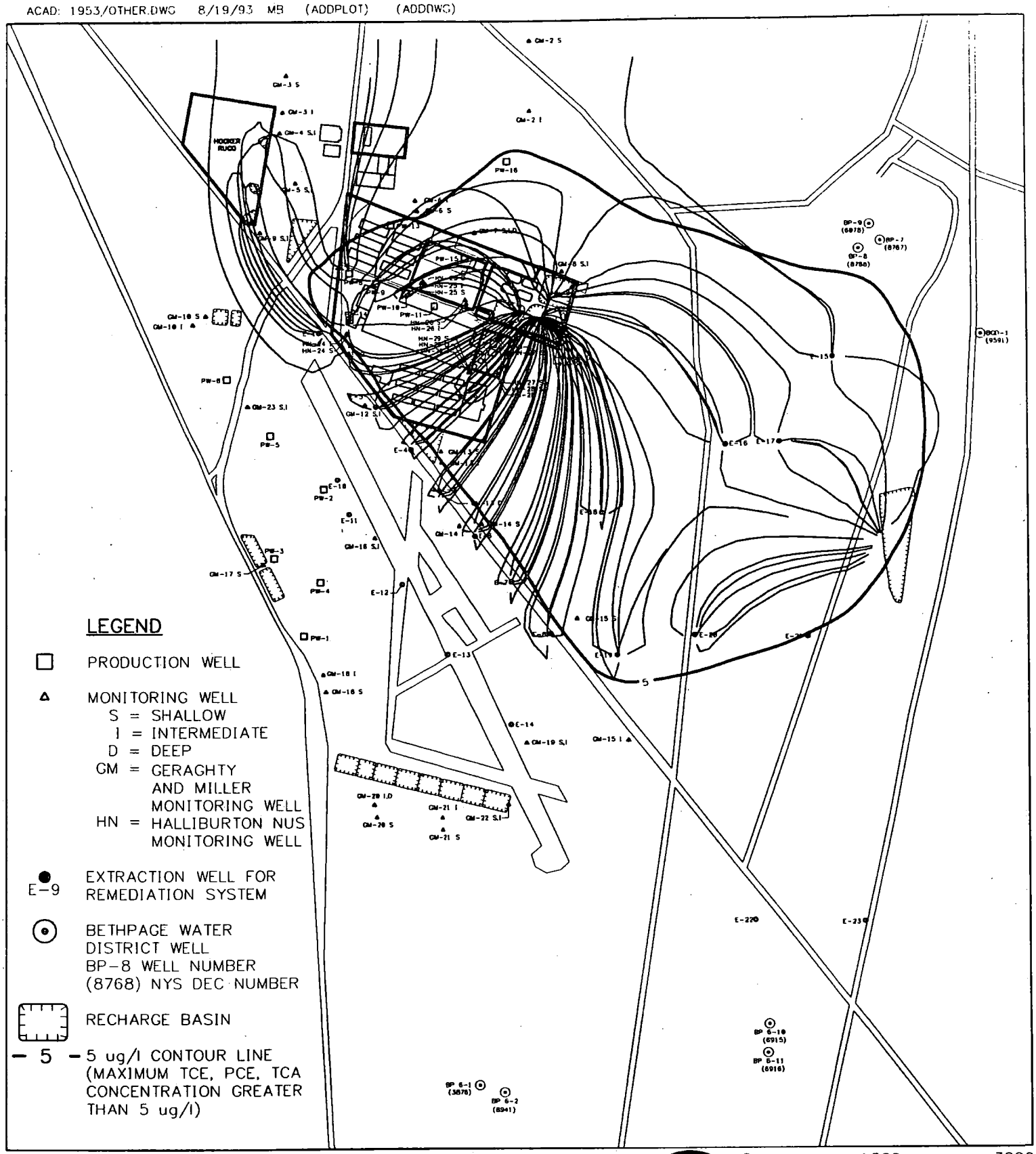
ACAD: 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



OFF SITE REMEDIATION SYSTEM
INITIAL CONTAMINANT CONCENTRATIONS
WITH CAPTURE ZONE OF EXTRACTION WELLS
LAYER 4
BETHPAGE NWIRP

Figure 3-17

HALLIBURTON NUS
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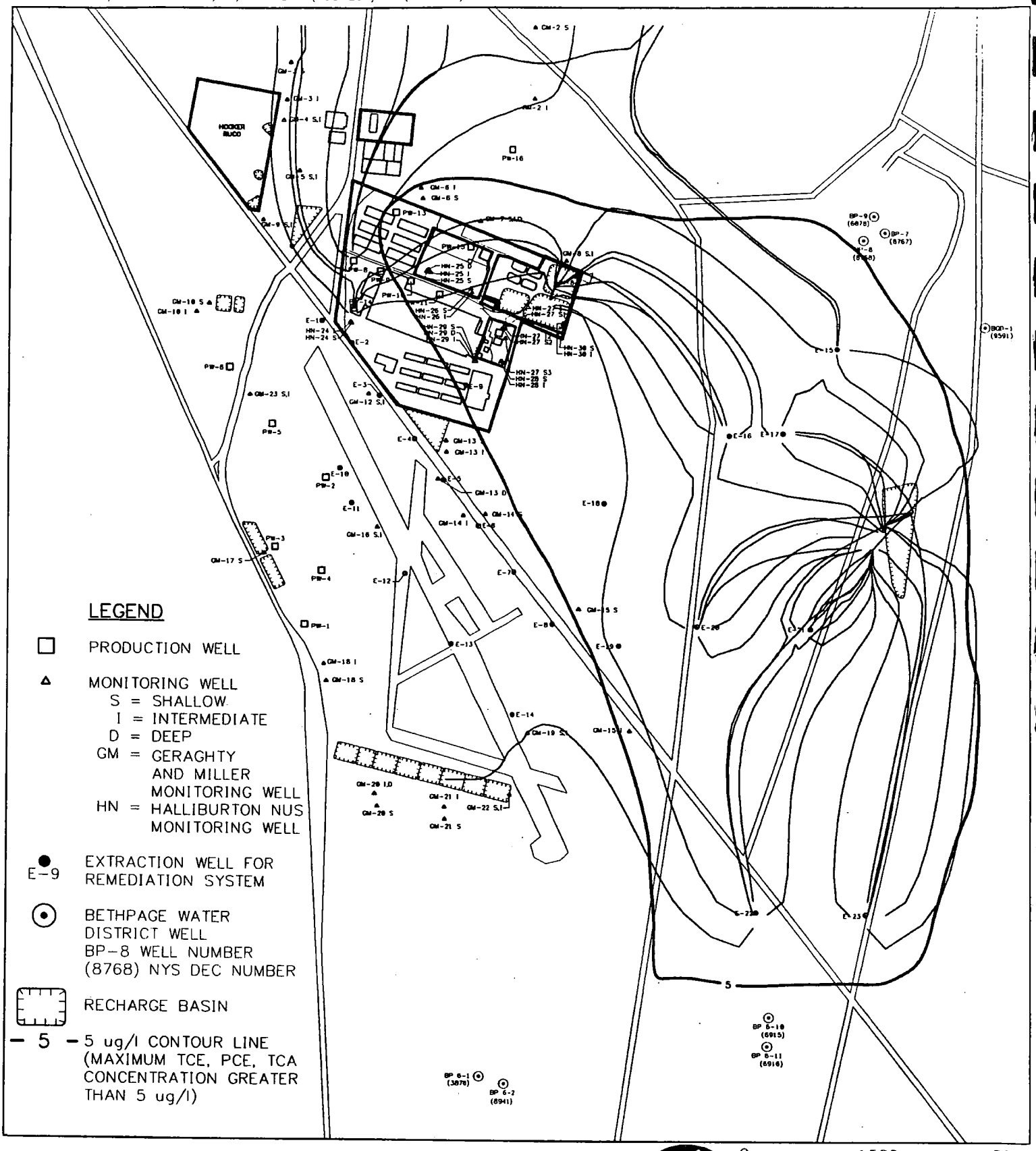
ACAD. 1953/OTHER.DWG 8/19/93 MB (ADDPLOT) (ADDDWG)



OFF SITE REMEDIATION SYSTEM
INITIAL CONTAMINANT CONCENTRATIONS
WITH CAPTURE ZONE OF EXTRACTION WELLS
LAYER 5
BETHPAGE NWIRP

Figure 3-18

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4.0 CONTAMINANT TRANSPORT MODELING

Contaminant transport modeling was performed following the particle tracking portion of the FS computer modeling. The three-dimensional transport model used for this project (MT3D) simulates advection, dispersion, and chemical reactions which effect contaminant movement and concentrations through time. Transport modeling was used to estimate contaminant concentrations in groundwater under a variety of extraction wells pumping condition order to determine the most effective remediation design. Note that contaminant transport calibration was not conducted because of limited knowledge of the historic disposal activities. As a result contaminant transport parameters were based on data collected on-site and literature values. All contaminant transport modeling results should be considered approximations.

4.1 CONTAMINANT TRANSPORT MODELING PROCEDURE

The contaminant transport model uses output data from the groundwater flow model, and incorporates data on aquifer parameters to determine chemical concentrations in groundwater at each grid-block of the model. Three chemicals (TCE, TCA, PCE) are present in groundwater in the vicinity of the NWIRP site in significantly high concentrations. Contaminant transport was simulated for these three chemicals of concern. Aquifer and chemical properties used in the MT3D model are listed in Table 4-1.

TABLE 4-1
AQUIFER PARAMETERS USED IN CONTAMINANT TRANSPORT MODEL

AQUIFER PARAMETERS:	
POROSITY	0.20
RATIO OF HORIZONTAL TO LONGITUDINAL DISPERSIVITY	0.10
RATIO OF HORIZONTAL TO VERTICAL DISPERSIVITY	0.01
CONTAMINANT DATA:	
CHEMICAL	PARTITION COEFFICIENT, Kd (L/Kg)
TCE	0.23
TCA	0.11
PCE	0.67

As illustrated in Figure 3-6, the remediation design is an iterative process with refinements in the remediation system being incorporated after each contaminant transport simulation. Transport modeling was initiated after an initial remediation design was developed, to determine the relative effectiveness of the remediation system and clean-up times which may be required. During the second round of contaminant transport modeling, additional extraction wells were added to the on-site and off-site systems to accelerate the remediation of groundwater.

4.2 CONTAMINANT TRANSPORT RESULTS

Contaminant transport modeling was performed using current chemical concentrations in groundwater as initial conditions, and simulating 50 years of pumping using the on-site and off-site remediation systems. Past activities which contributed to groundwater contamination at the site are unknown. For this reason, groundwater concentrations were simulated exclusively for future (predictive) conditions.

4.2.1 Current Groundwater Concentrations

The current concentrations of the three chemicals of concern in groundwater were derived from analytical data gathered during groundwater sampling events, and particle tracking data from the RI phase of computer modeling. Areas which contain no monitoring well data were assigned an initial concentration of 5 ppb, if particle tracking analysis indicated groundwater may have been influenced by recharge water from the NWIRP recharge basins. These basins may have contained the volatile organics in the past when pumping from the aquifer was occurring at an accelerated rate.

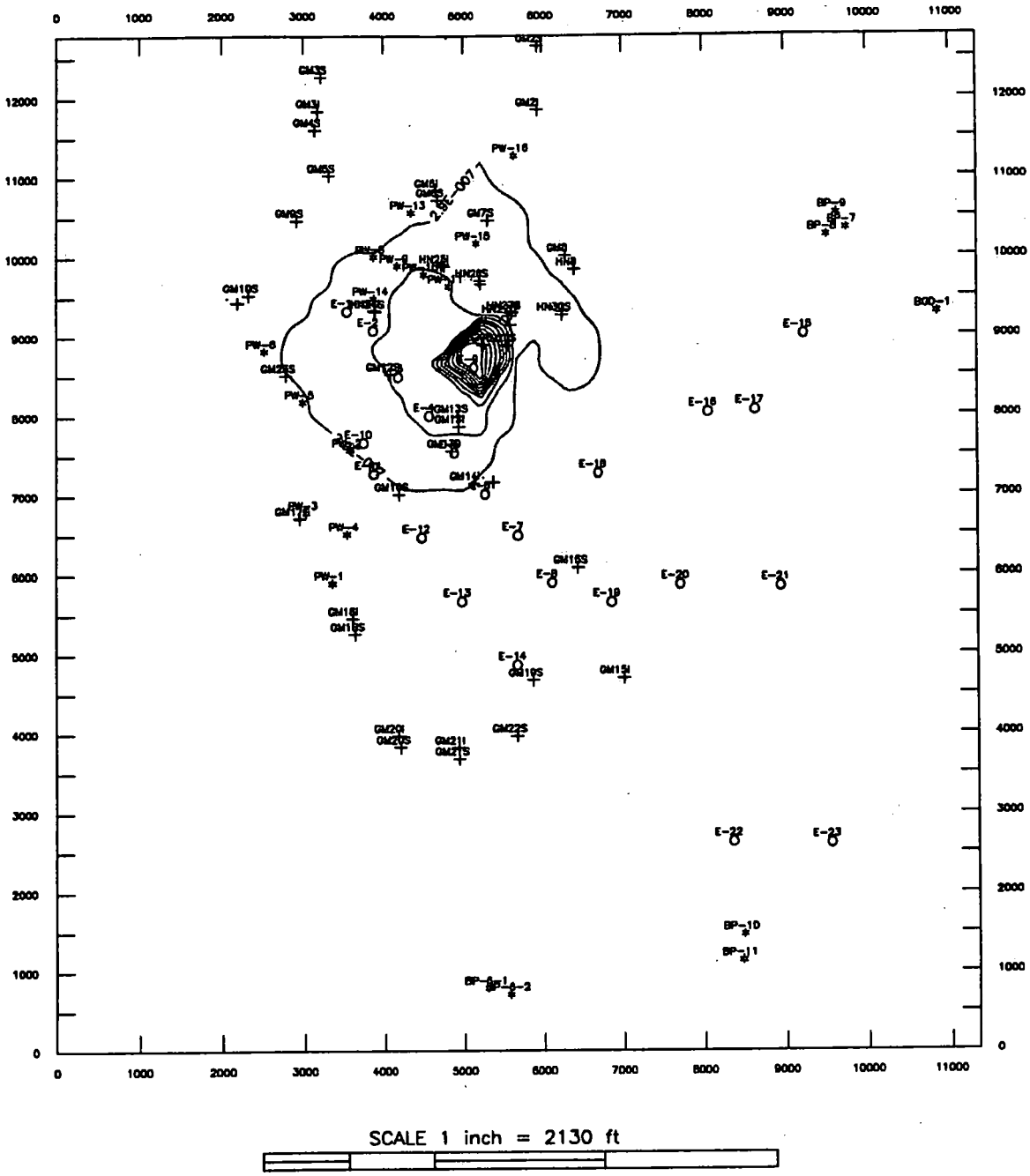
Current concentrations of TCE for model layer 1 to layer 5 are illustrated on Figures 4-1 to 4-5. Current concentrations of TCA for each model layer are illustrated on Figures 4-6 to 4-10. Current concentrations of PCE are illustrated on Figures 4-11 to 4-15.

4.2.2 Current Pumping Conditions (No Remedial Action)

Contaminant transport modeling was performed for current pumping conditions assuming no additional remediation wells were installed, and all Grumman production wells and BWD wells were pumping at 1991/1992 average rates. This no-action scenario is included to provide a frame of reference for the treatment options, by determining what level of contaminants will be present if no remediation system is installed. All water pumped from the north Grumman production wells was returned to the NWIRP recharge basins, and water from the south Grumman production wells was returned to the south Grumman recharge basins. Water returned to these basins was assumed to be free of contaminants.

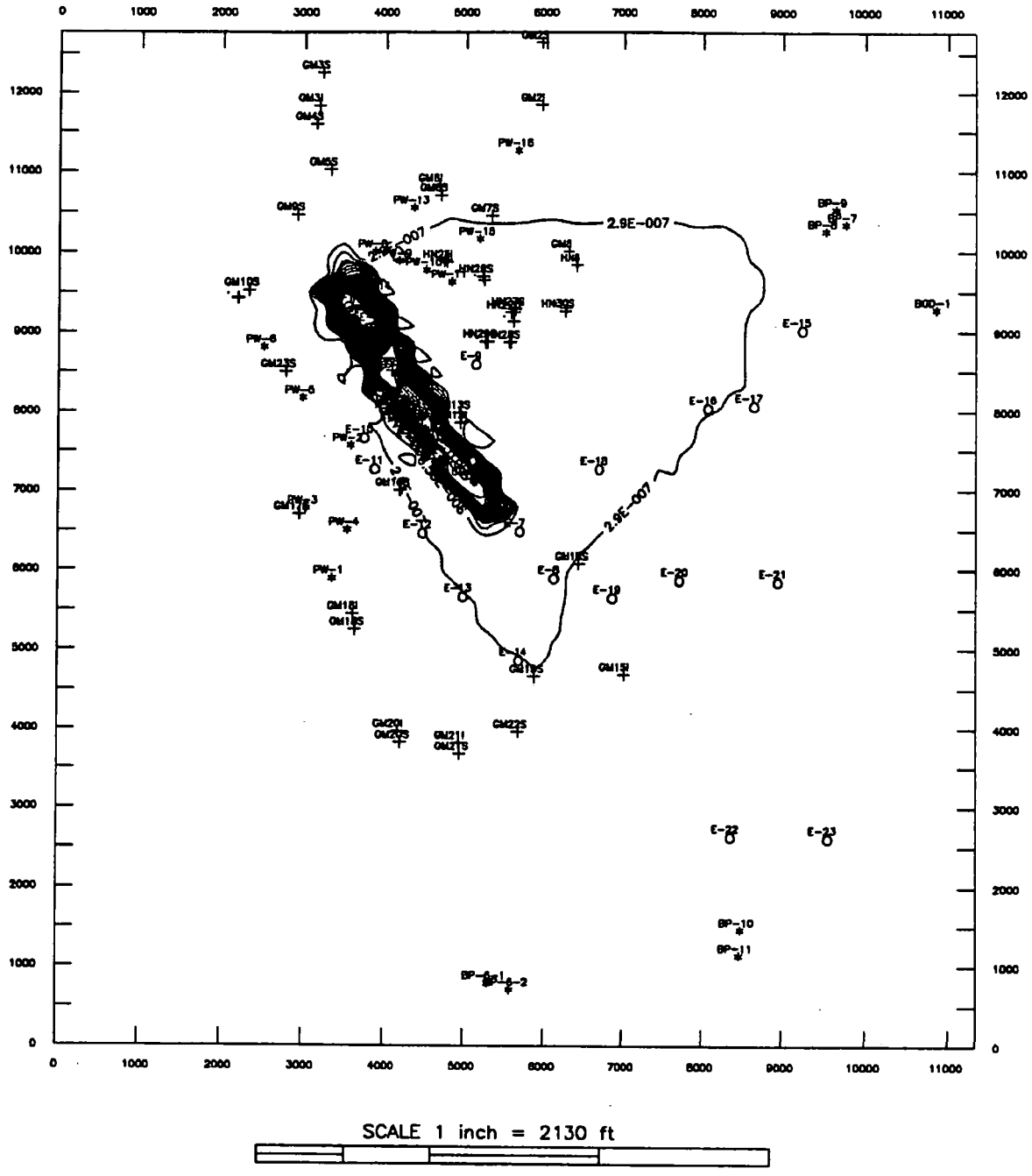
Figures 4-16 to 4-20 illustrate TCE concentrations in each model layer after 30 years of current pumping

Figure 4-1 Layer 1, TCE Current Conditions (0 years), Contour Interval = 100 ppb.



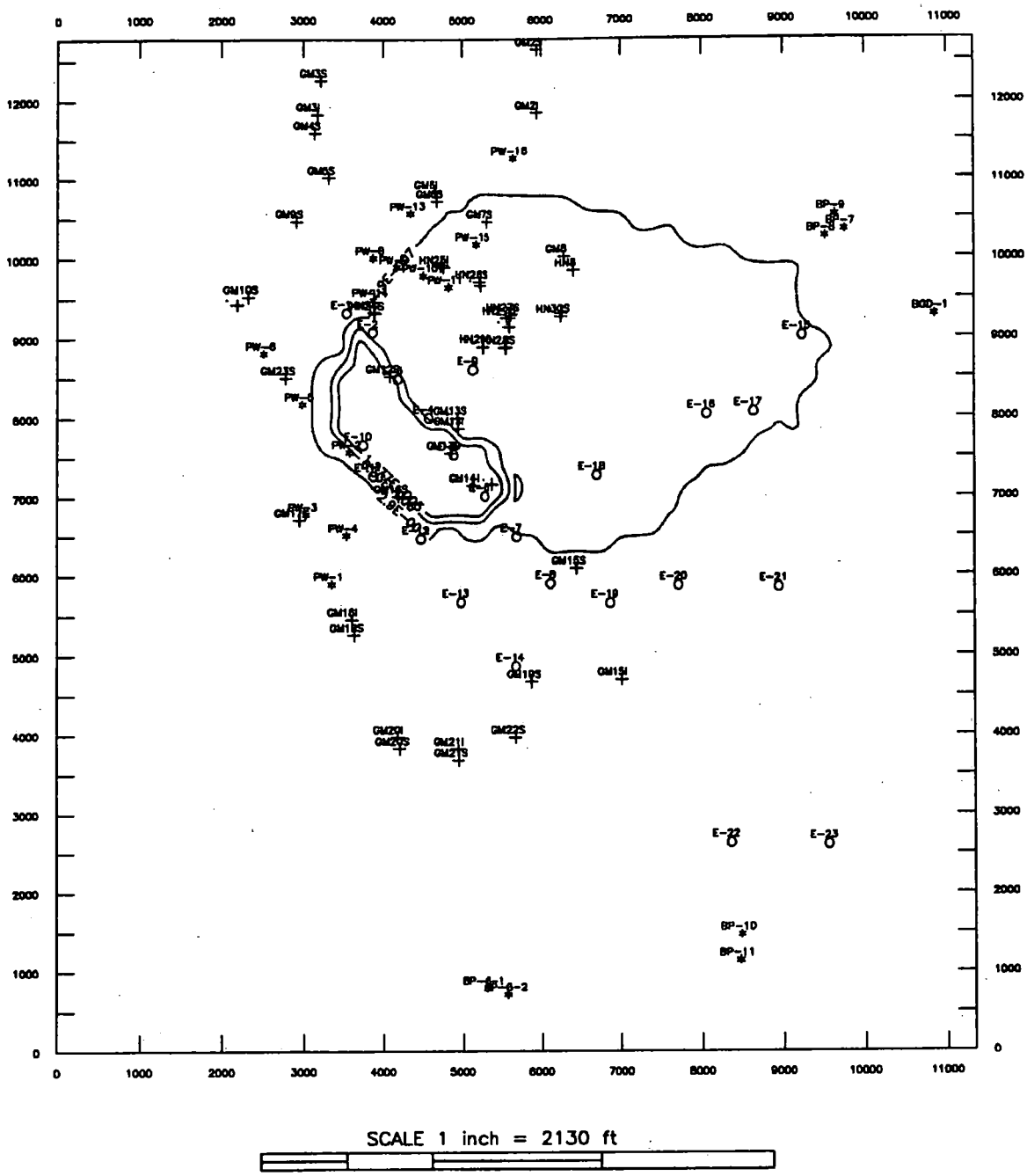
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-2 Layer 2, TCE Current Conditions (0 years), Contour Interval = 100 ppb.



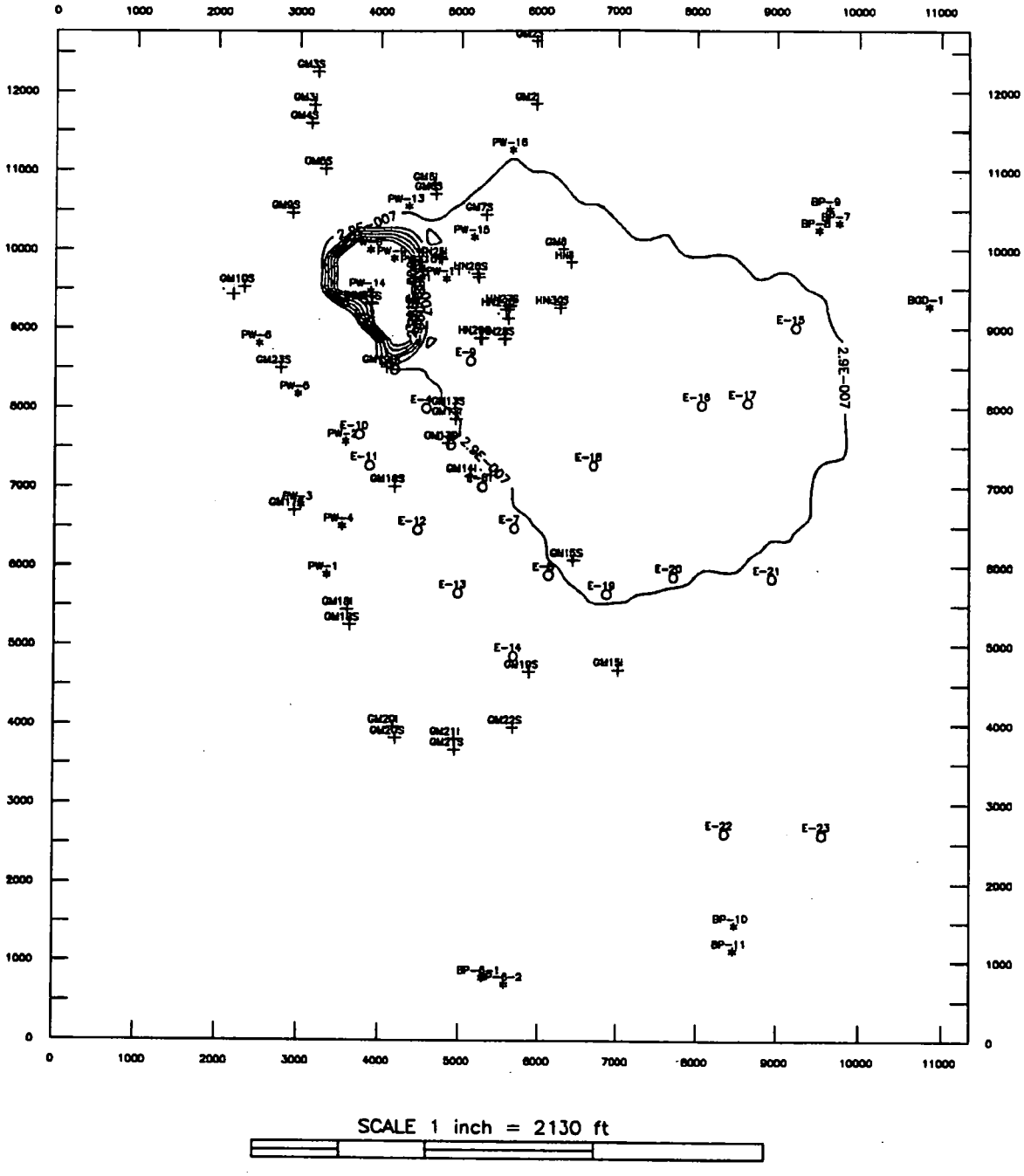
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-3 Layer 3, TCE Current Conditions (0 years), Contour Interval = 100 ppb.



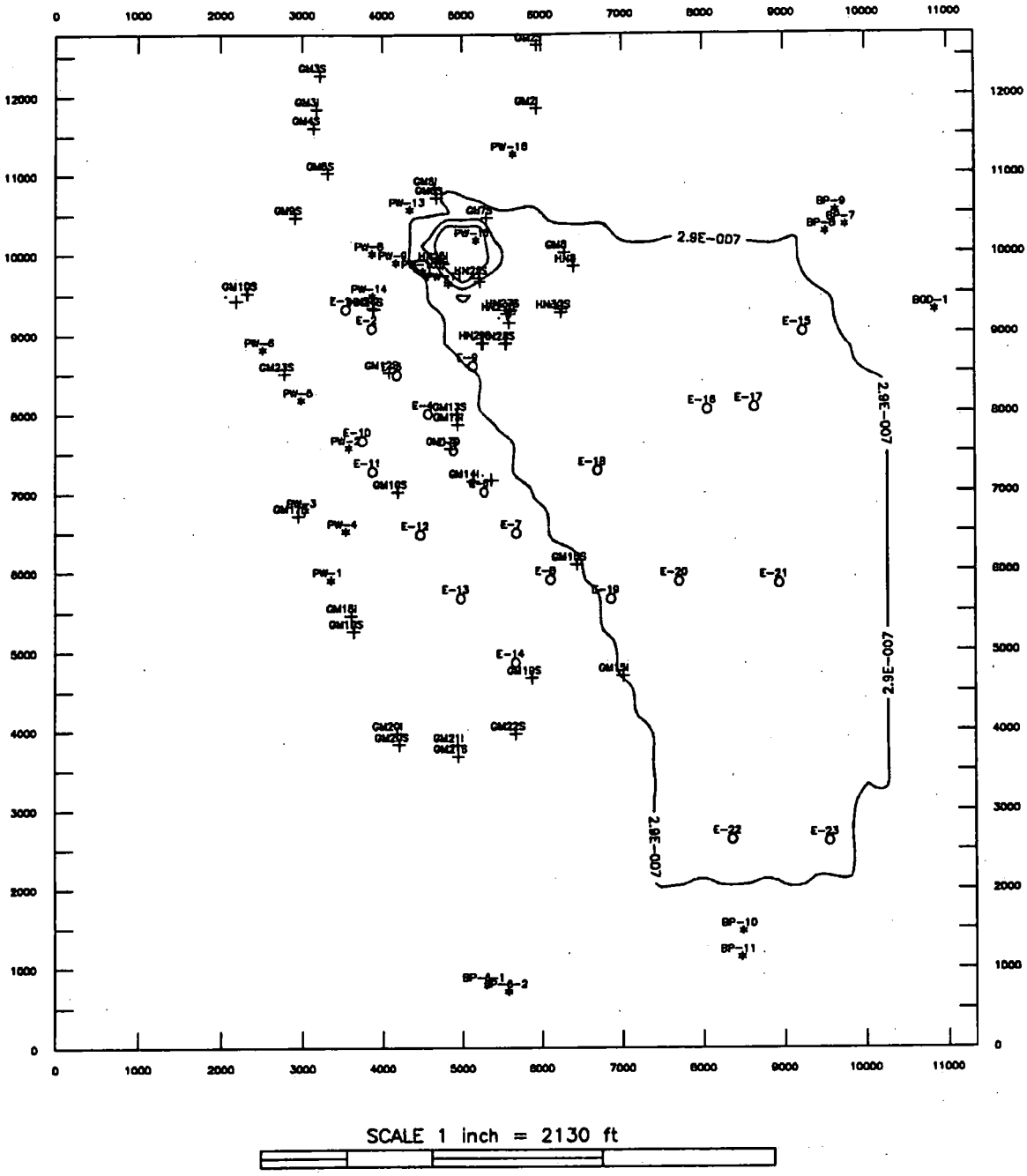
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-4 Layer 4, TCE Current Conditions (0 years), Contour Interval = 10 ppb.



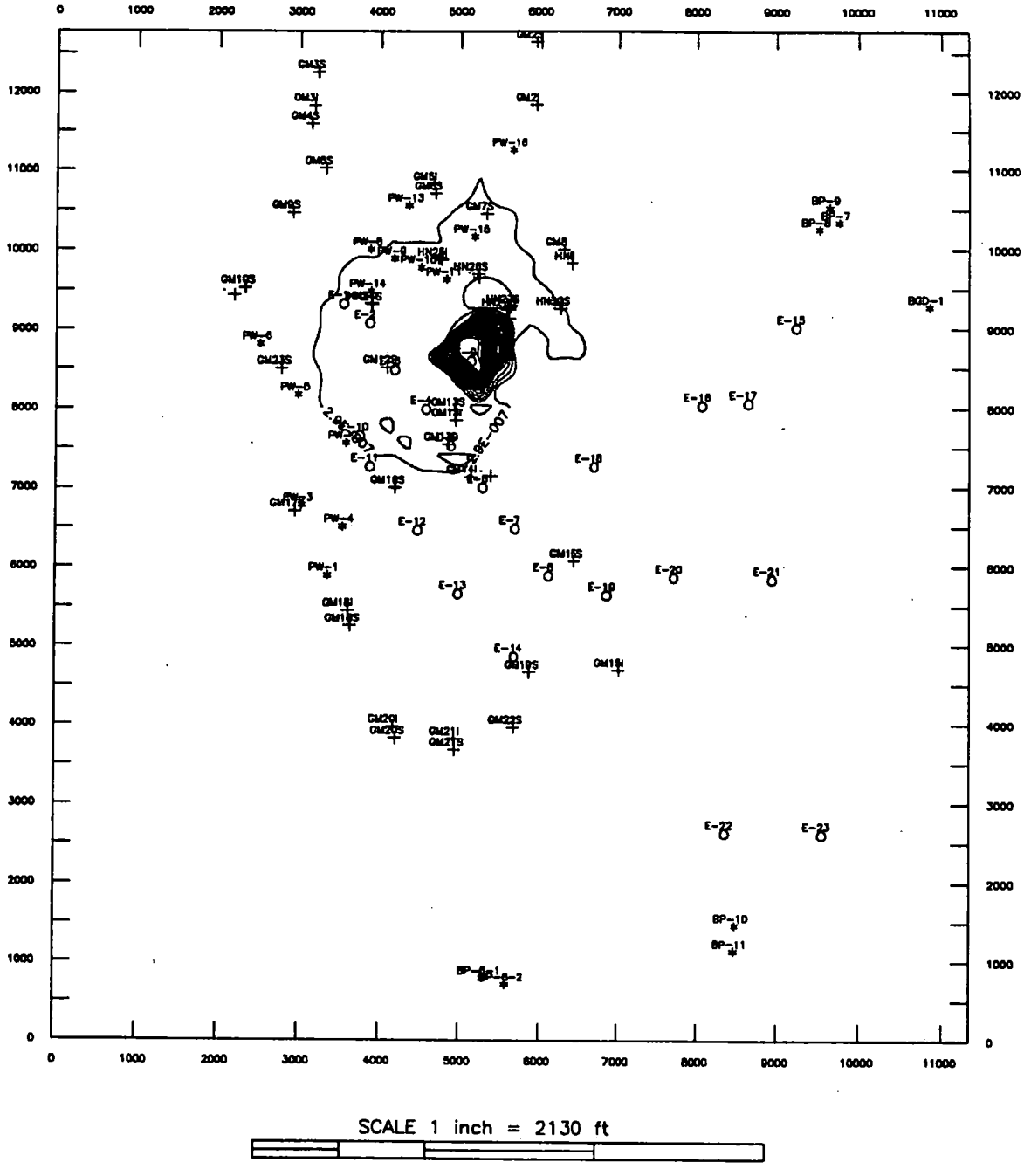
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-5 Layer 5, TCE Current Conditions (0 years), Contour Interval = 10 ppb.



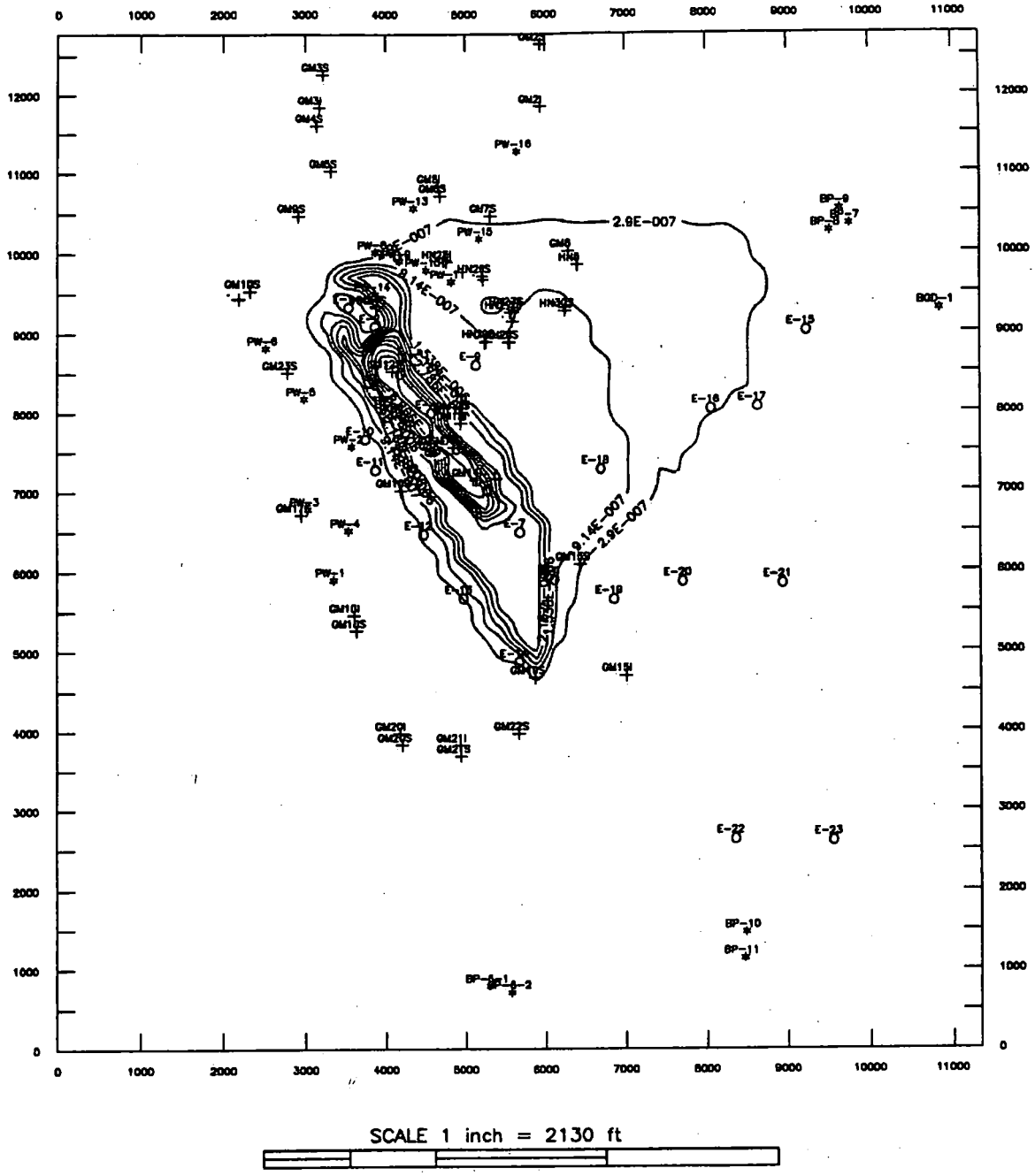
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-6 Layer 1, TCA Current Conditions (0 years), Contour Interval = 100 ppb.



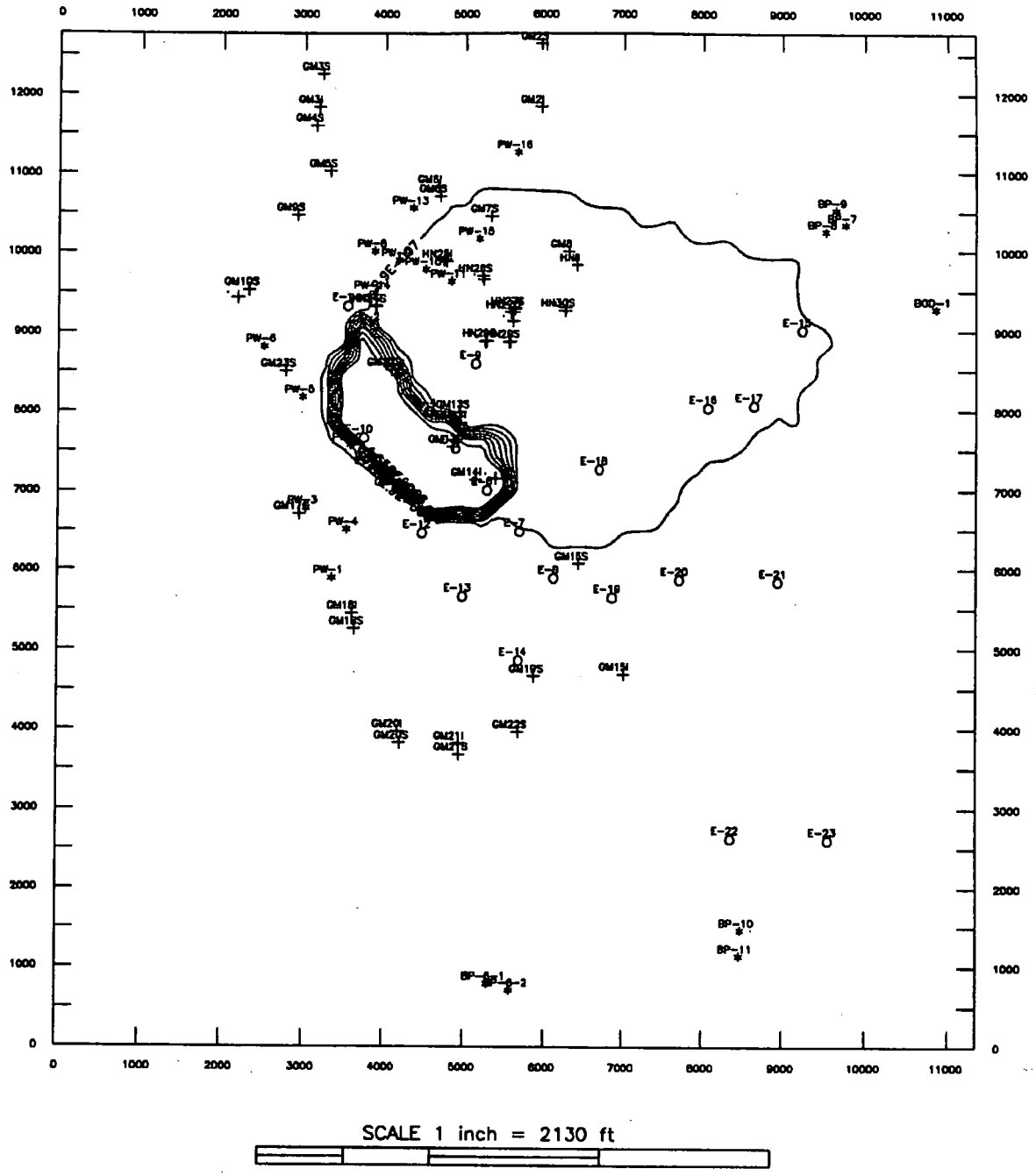
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-7 Layer 2, TCA Current Conditions (0 years), Contour Interval = 10 ppb.



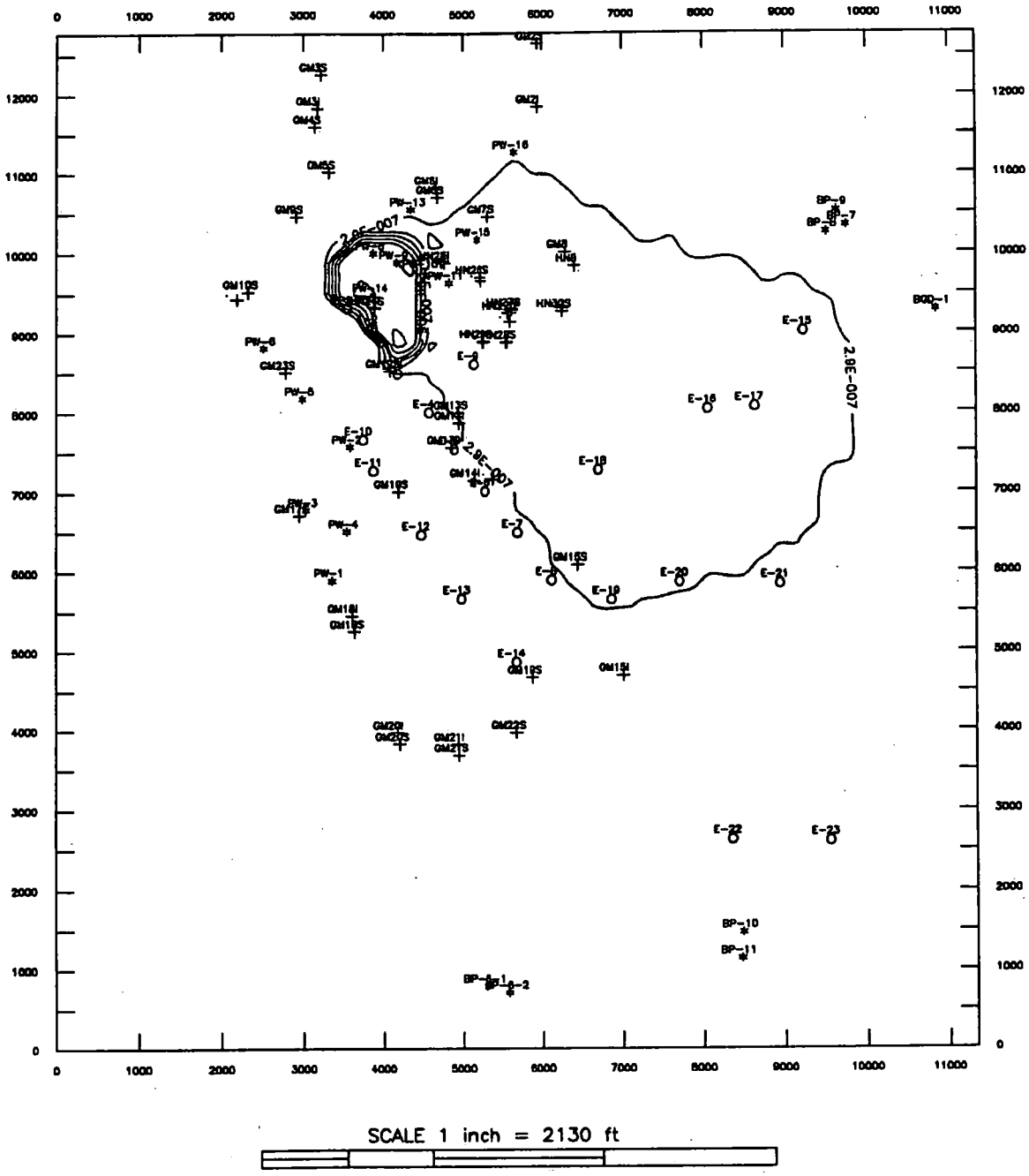
• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-8 Layer 3, TCA Current Conditions (0 years), Contour Interval = 10 ppb.



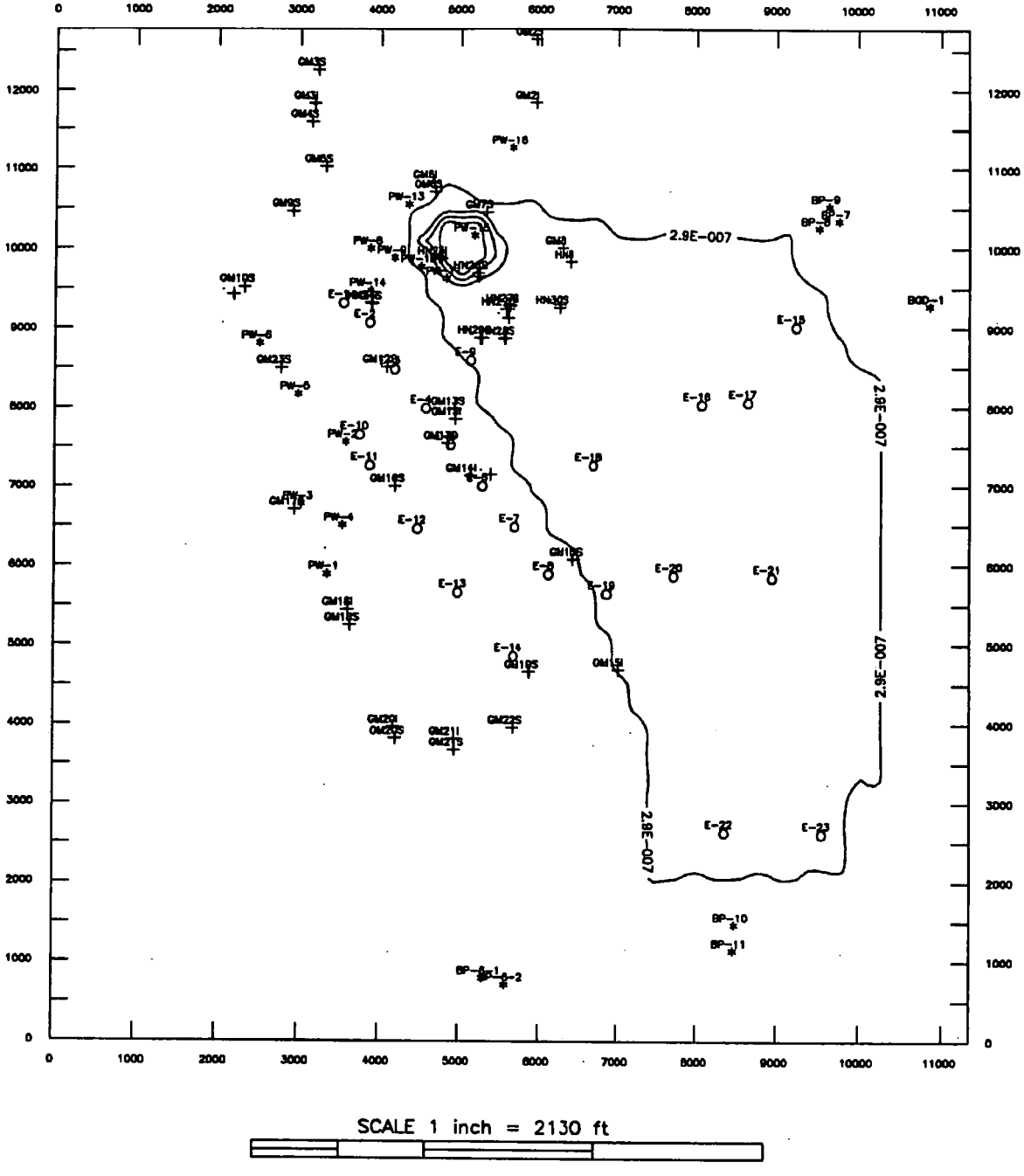
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-9 Layer 4, TCA current conditions (0 years), Contour Interval = 10 ppb.



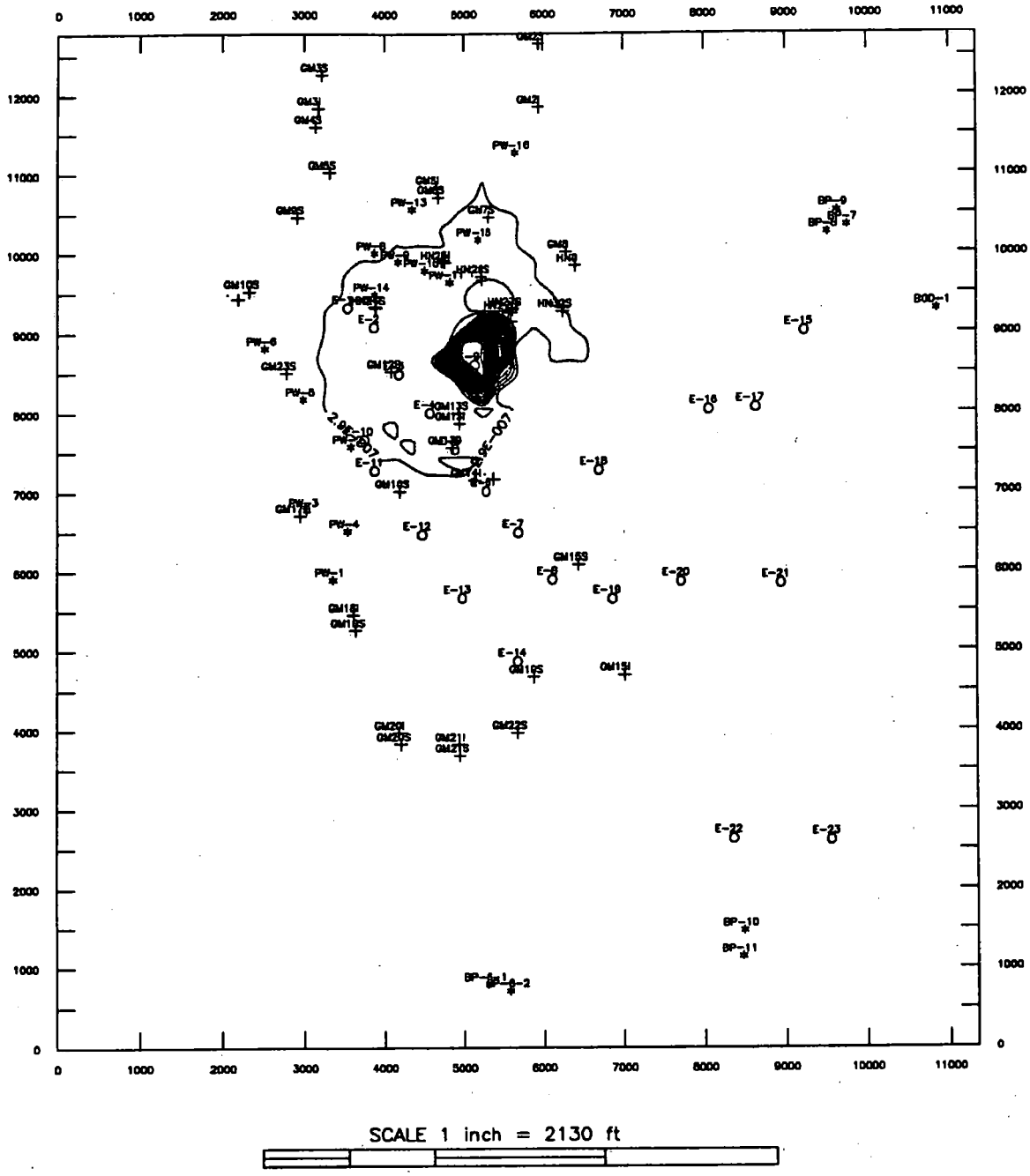
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-10 Layer 5, TCA Current Conditions (0 years), Contour Interval = 1 ppb.



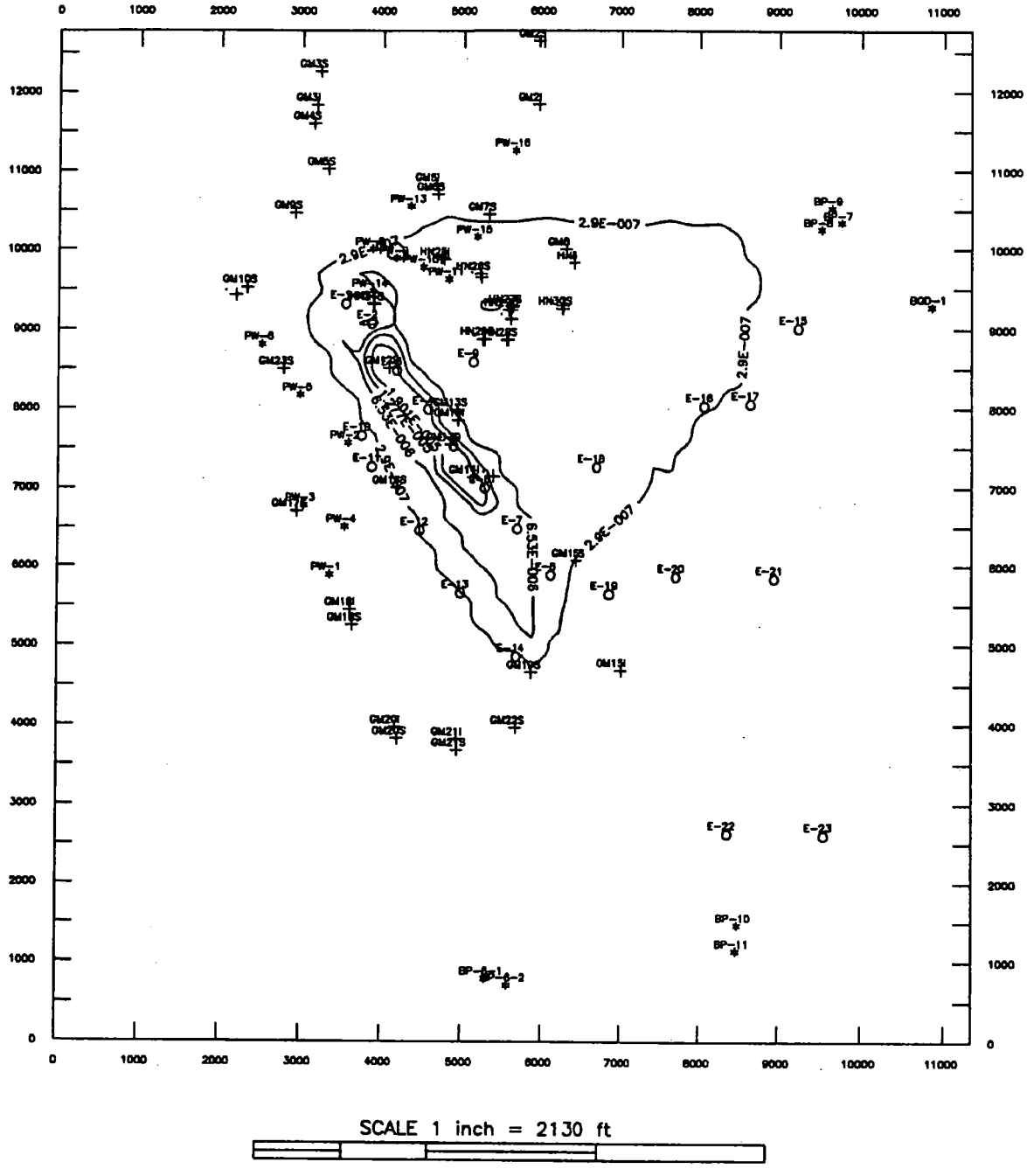
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-11 Layer 1, PCE Current Conditions (0 years), Contour Interval = 100 ppb.



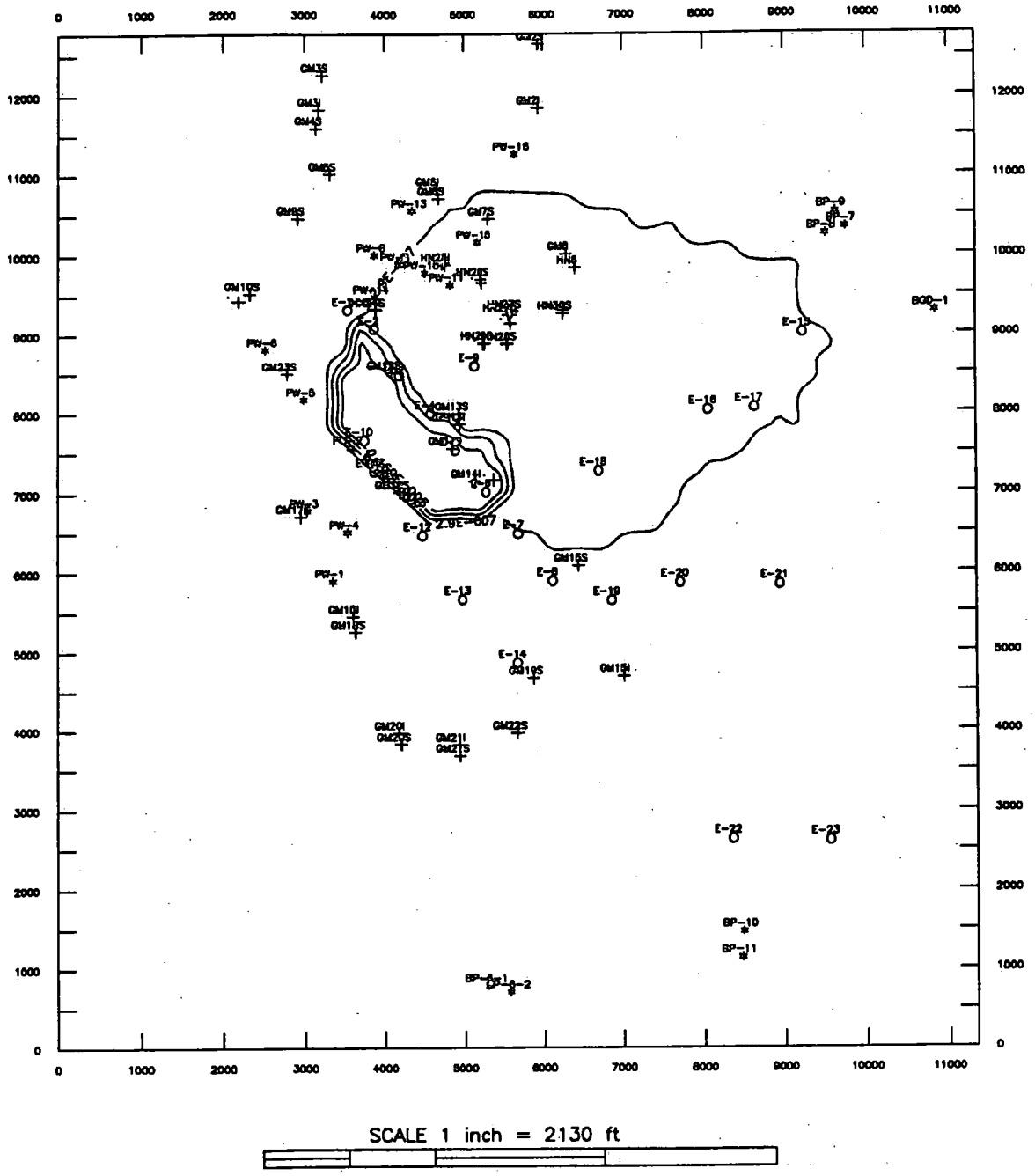
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-12 Layer 2, PCE Current Conditions (0 years), Contour Interval = 100 ppb.



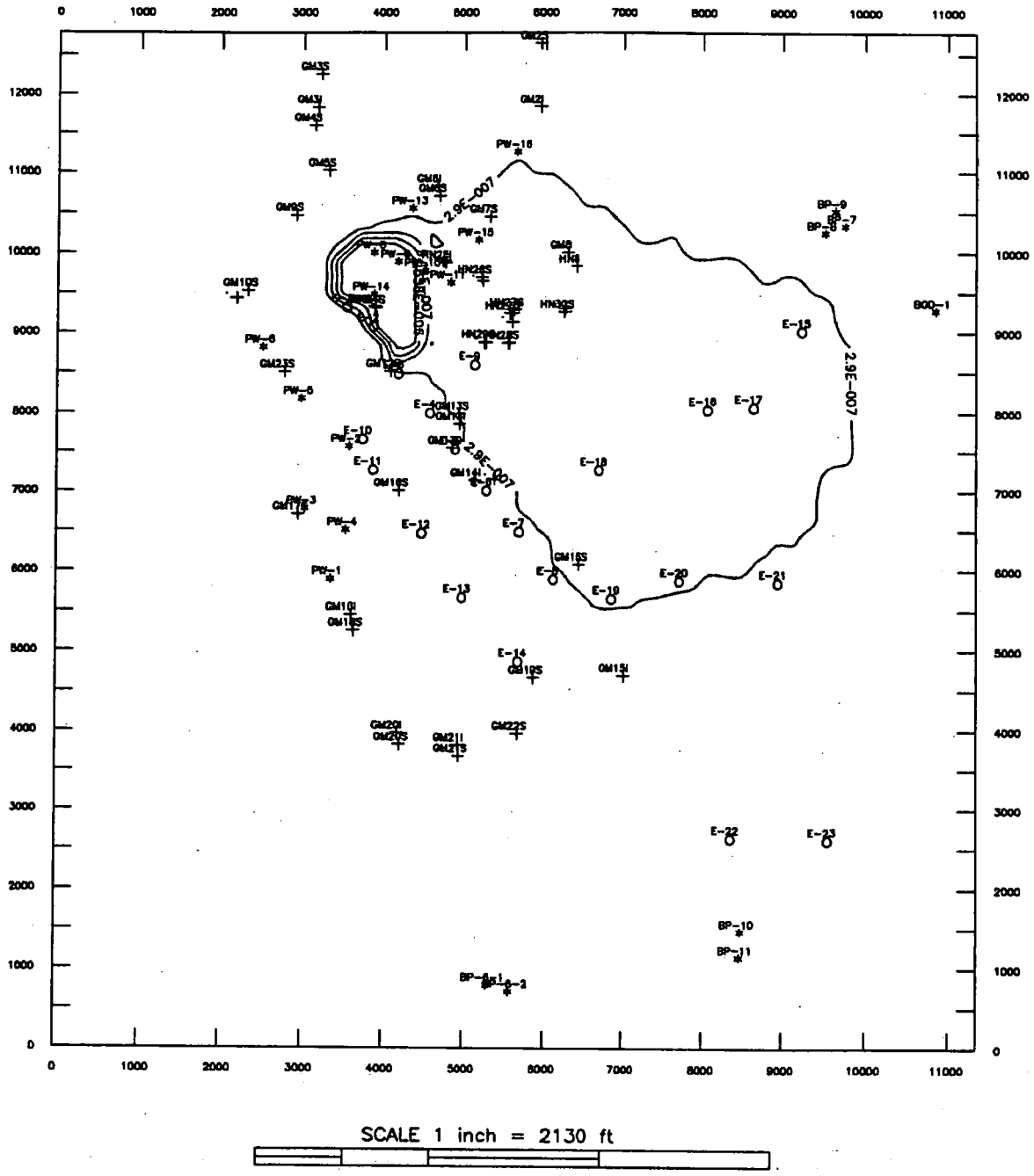
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-13 Layer 3, PCE Current Conditions (0 years), Contour Interval = 10 ppb.



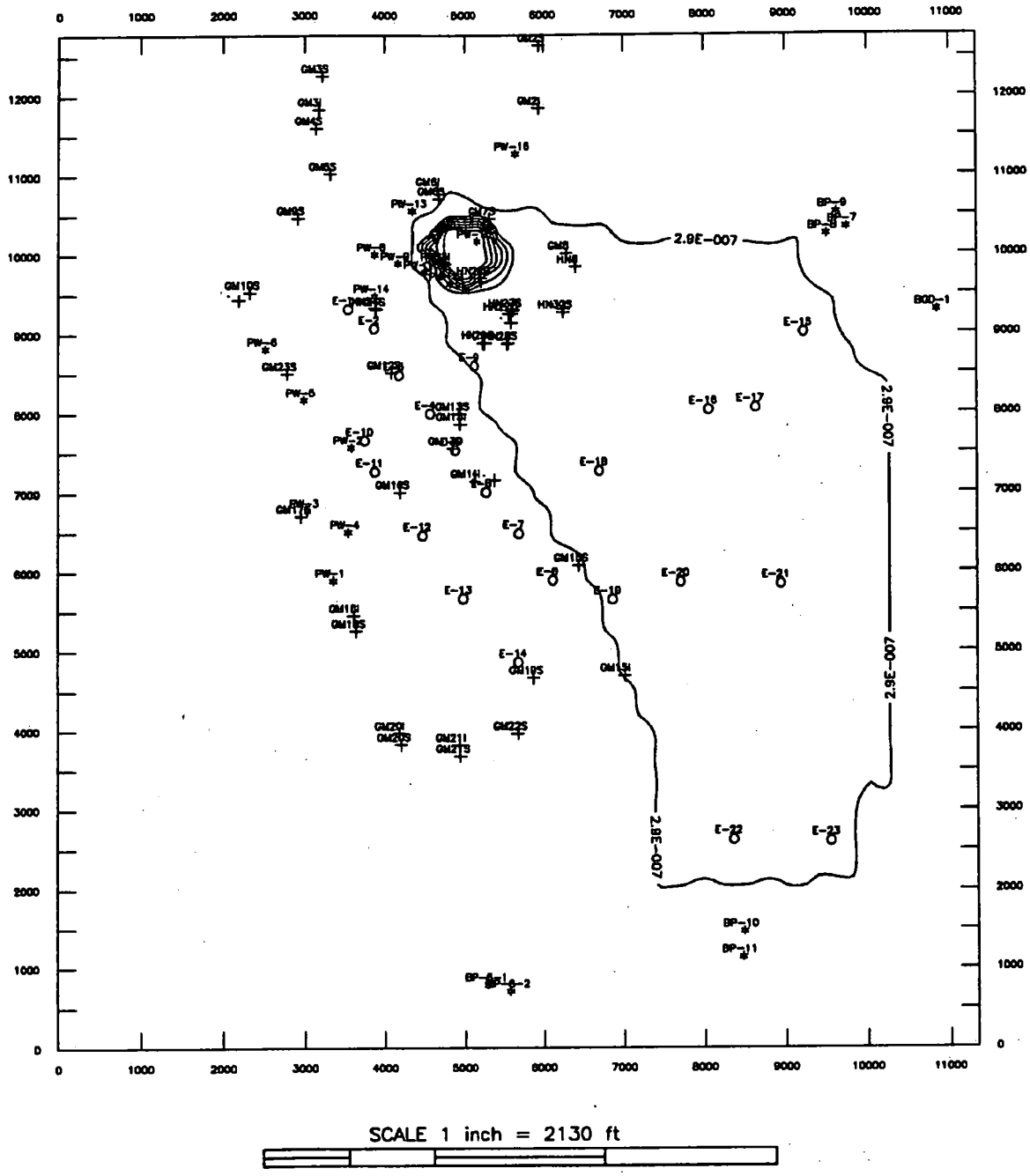
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-14 Layer 4, PCE Current Conditions (0 years), Contour Interval = 10 ppb.



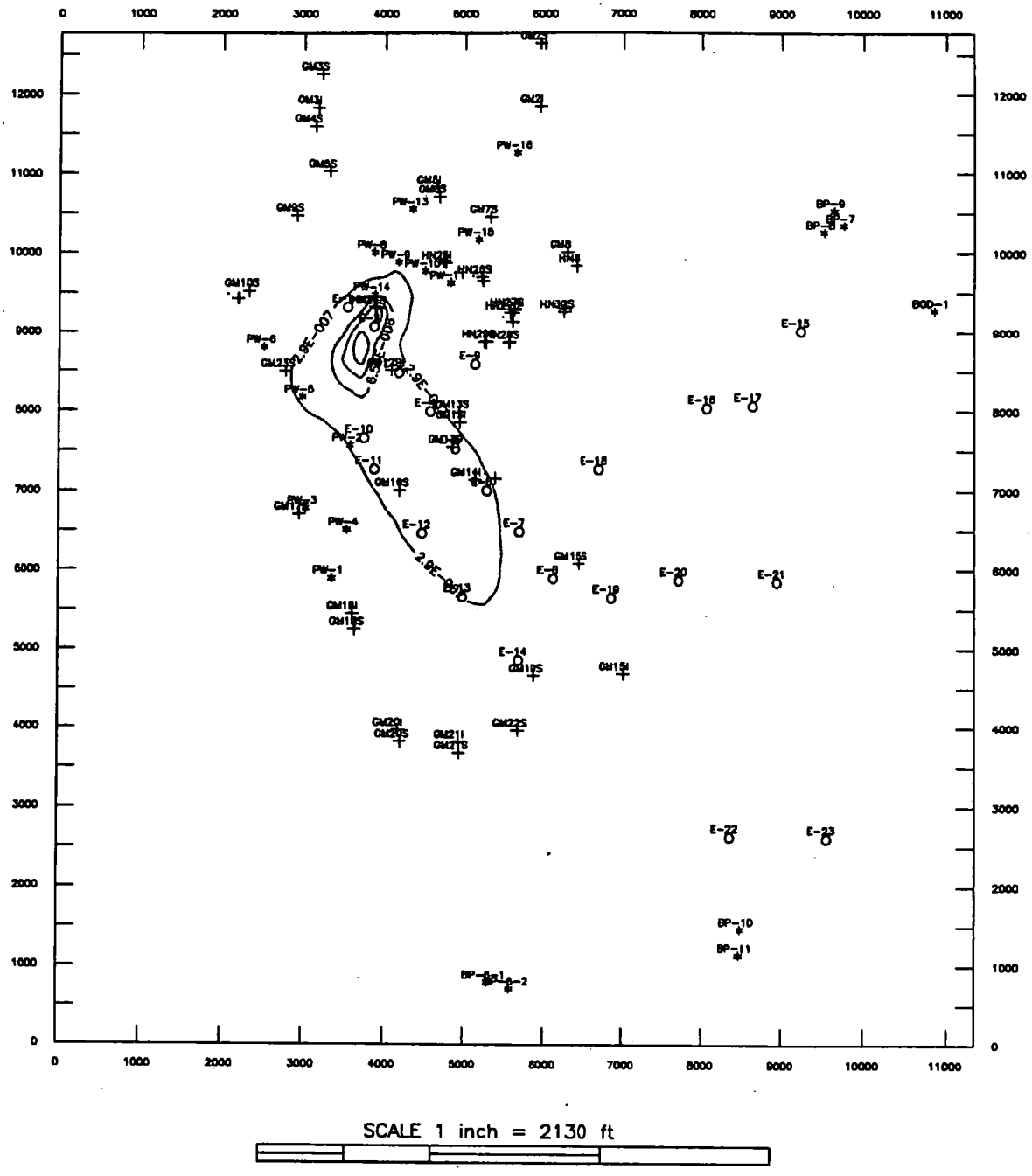
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-15 Layer 5, PCE Current Conditions (0 years), Contour Interval = 1 ppb.



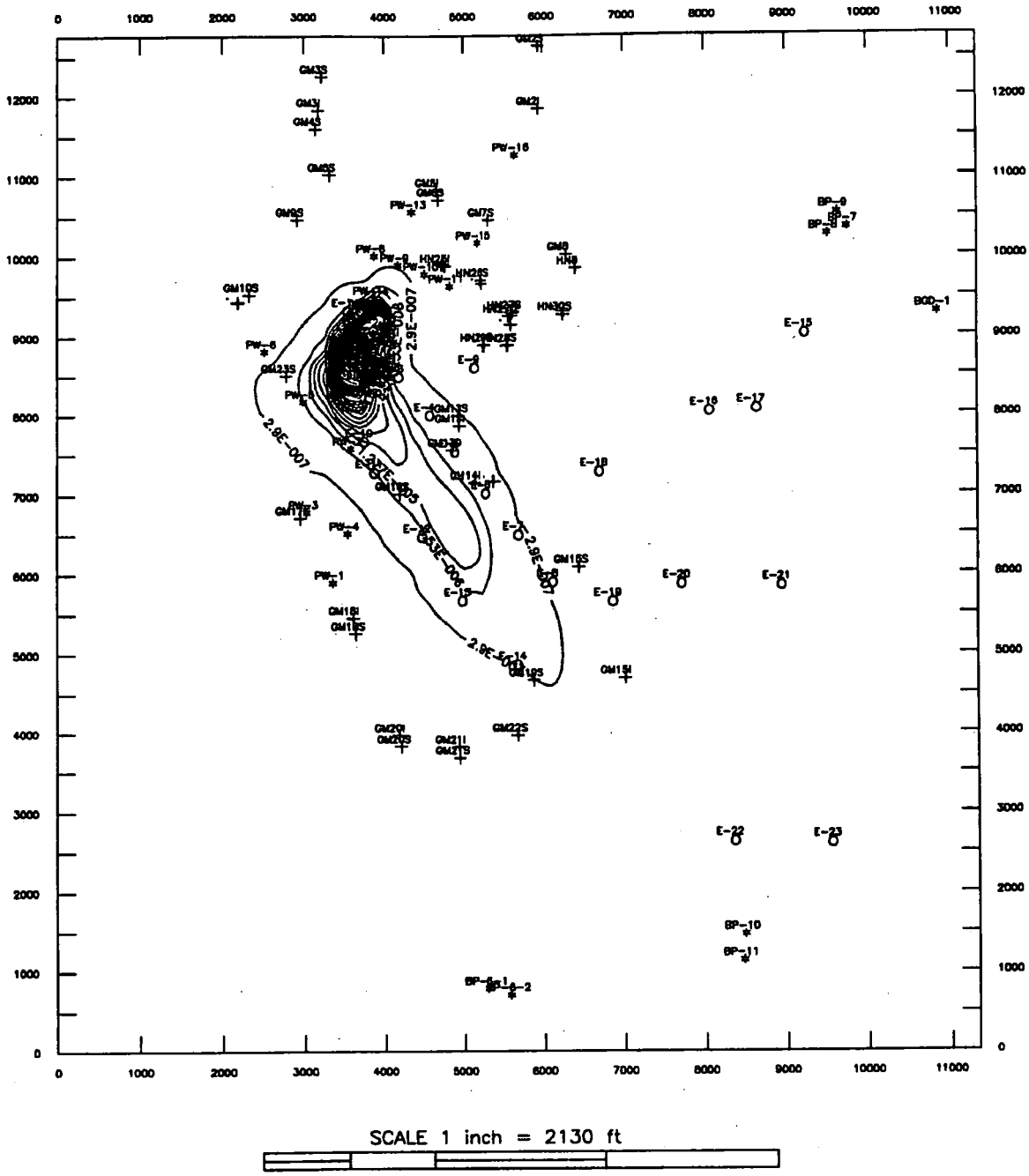
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-16 Layer 1, Average Pumping Conditions (No Action), TCE after 30 years, Contour Interval = 100 ppb.



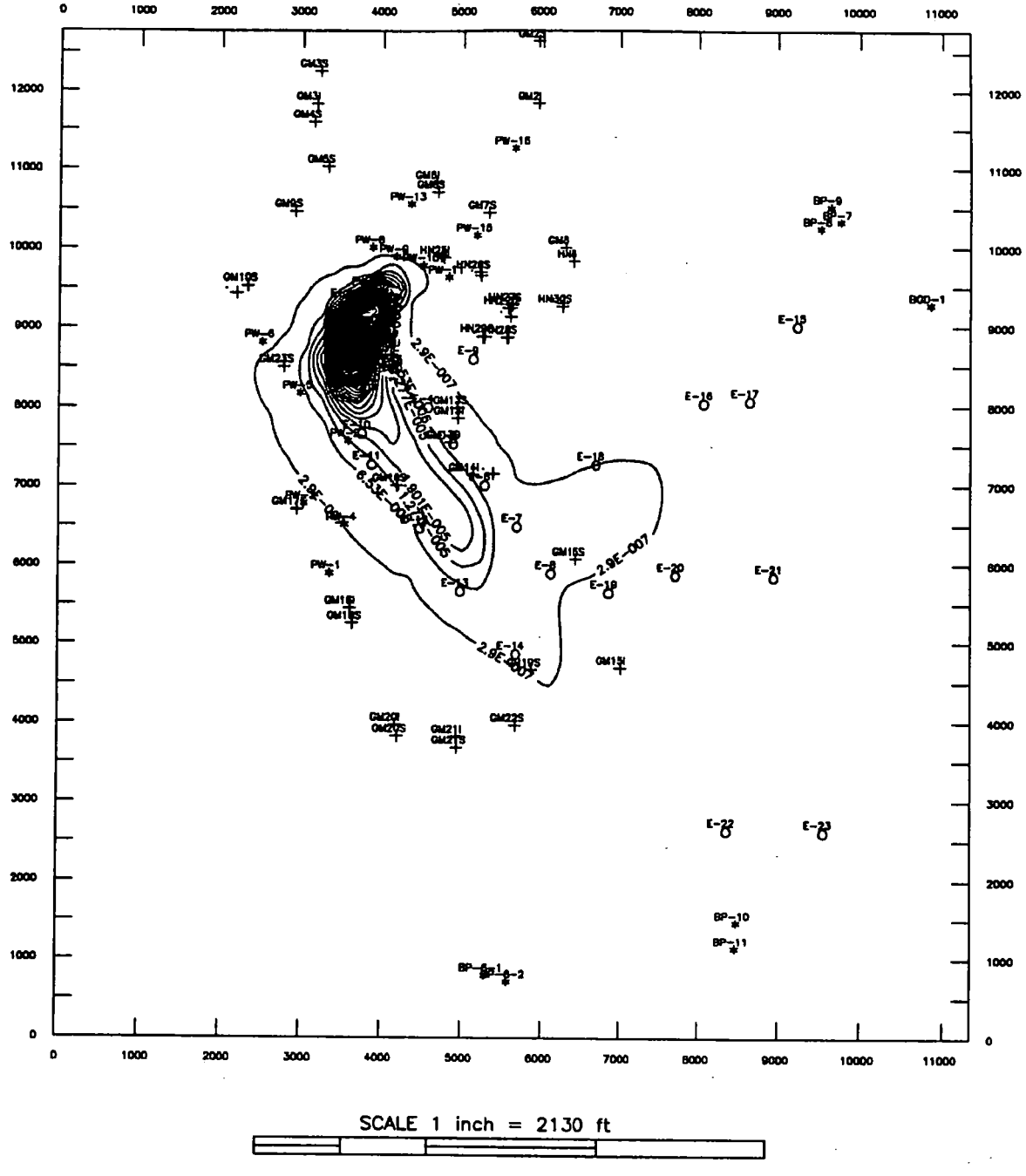
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-17 Layer 2, Average Pumping Conditions (No Action), TCE after 30 years, Contour Interval = 100 ppb.



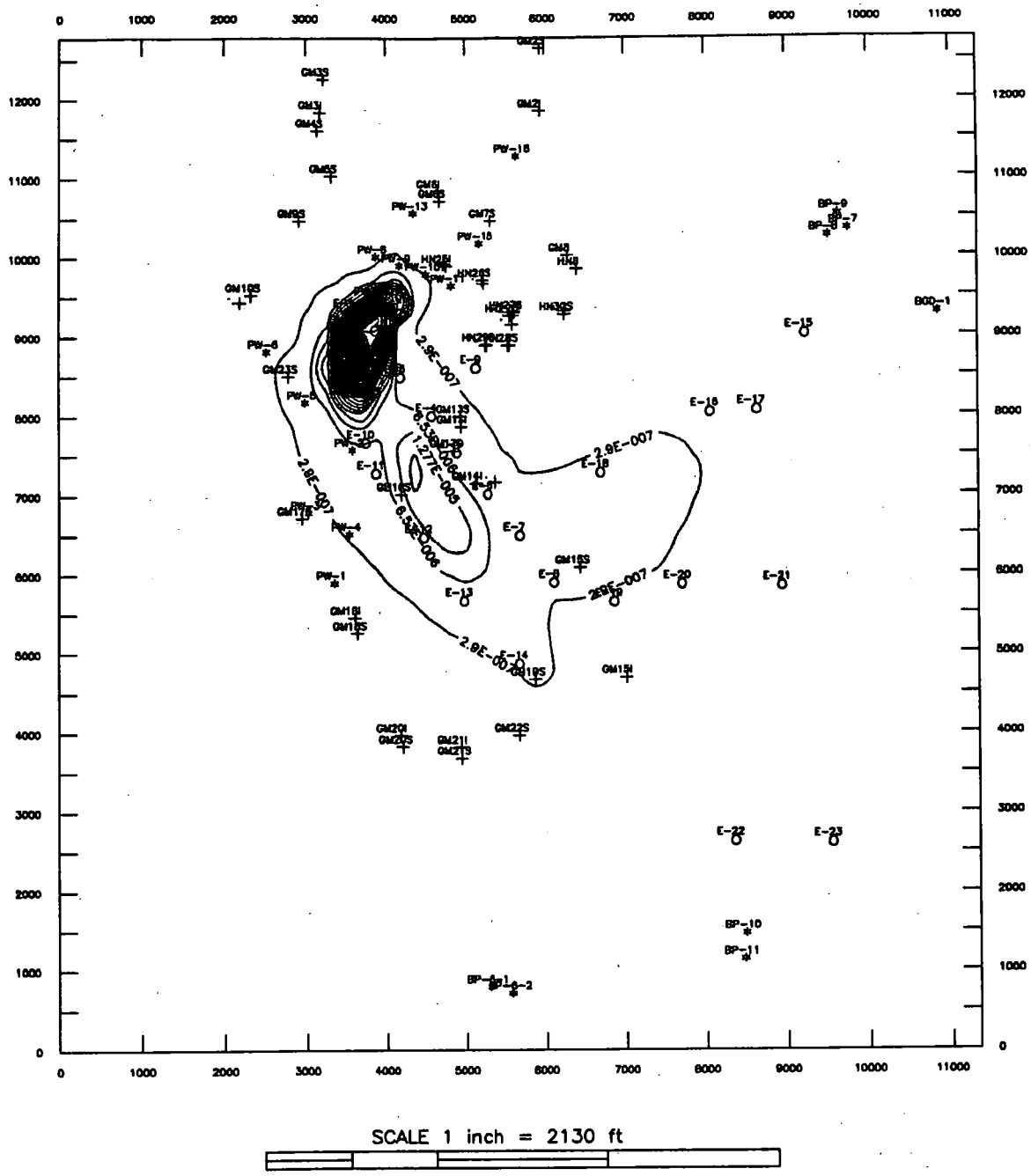
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-18 Layer 3, Average Pumping Conditions (No Action), TCE after 30 years, Contour Interval = 100 ppb.



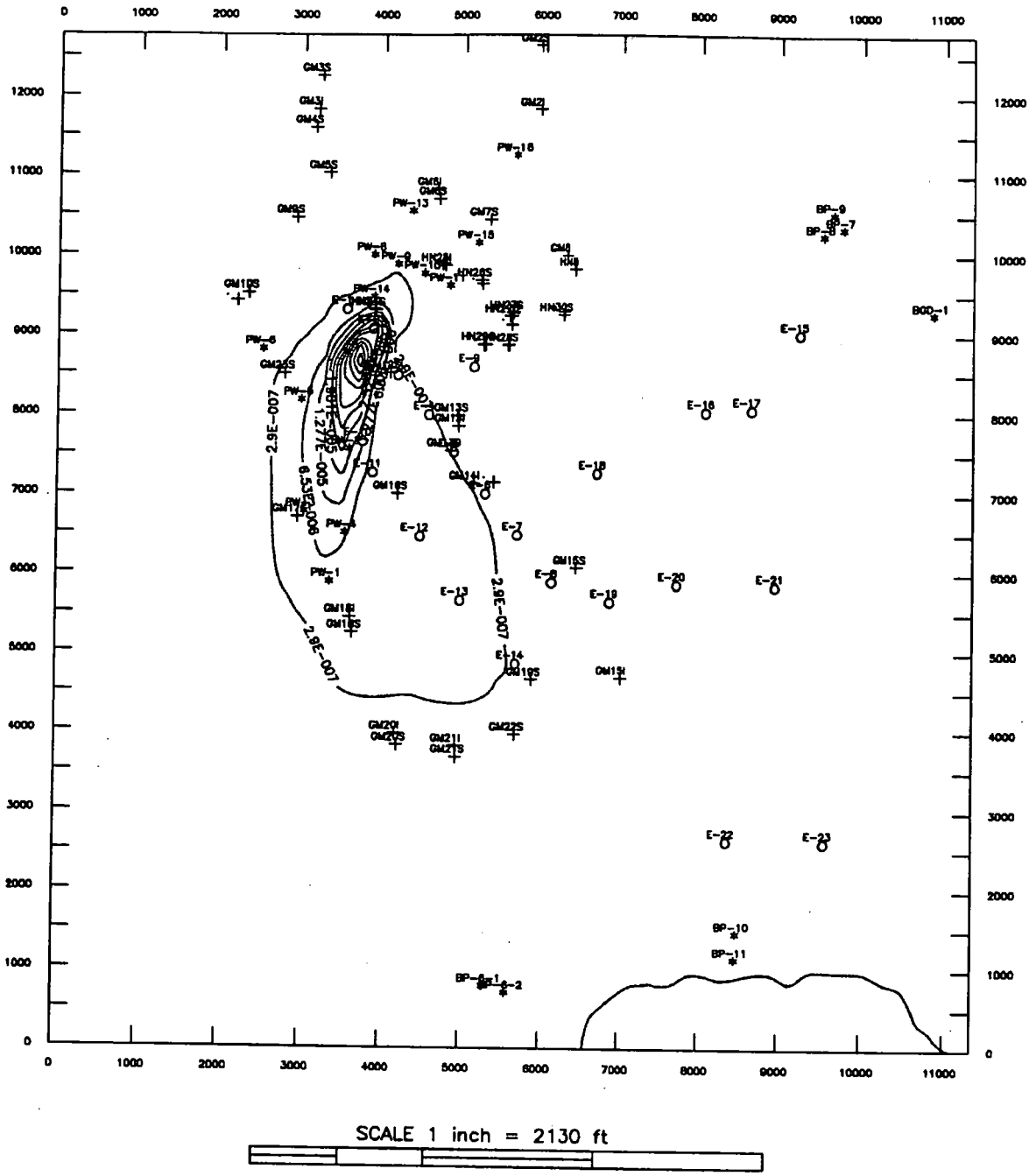
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-19 Layer 4, Average Pumping Conditions (No Action), TCE after 30 years, Contour Interval = 100 ppb.



* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-20 Layer 5, Average Pumping Conditions (No Action), TCE after 30 years, Contour Interval = 100 ppb.



* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

conditions. Figures 4-21 through 4-25 show TCA concentrations after 30 years, and Figures 4-26 to 4-30 show PCE concentrations after 30 years.

4.2.3 On-Site / Near-Site Remediation System

Initial Transport Simulation

The initial on-site/near-site remediation system was focused on areas where groundwater shows the highest level of contamination. Specifically, wells were located to remediate the 'hot-spot' of contamination present in layer 1 in the vicinity of Site 1, and the northwest-southeast trending plume present in layer 2 (see Figures 4-1 to 4-15). Initial concentrations of contaminants in model layers 3, 4 and 5 show substantially lower levels of TCE, TCA and PCE compared to the concentrations found in layer 1 and layer 2. Well were located in layer 3 to remediate groundwater contamination which may exist currently, or which may enter layer 3 from layer 2 due to the downward flow gradient. Existing Grumman production wells were used as extraction wells for contamination in layer 4 and layer 5. For the initial transport simulation the on-site/near-site extraction wells were placed within the long axis of the contamination plume, as close to Navy property as possible. The initial remediation system consisted of PW-08, PW-09, PW-10, PW-14, and wells E-1 through E-9. Production wells had pumping rates of 900 gpm, extraction wells had pumping rates of 100 gpm. Pumping rates and well locations for the on-site / near-site extraction system are listed on Table 3-1. All water pumped from the extraction wells was returned to the NWIRP recharge basins. Southern Grumman production wells and BWD wells were pumping at 1991/1992 average rates. The acceptable clean-up goal, using this remediation system was chosen to be approximately 30 years.

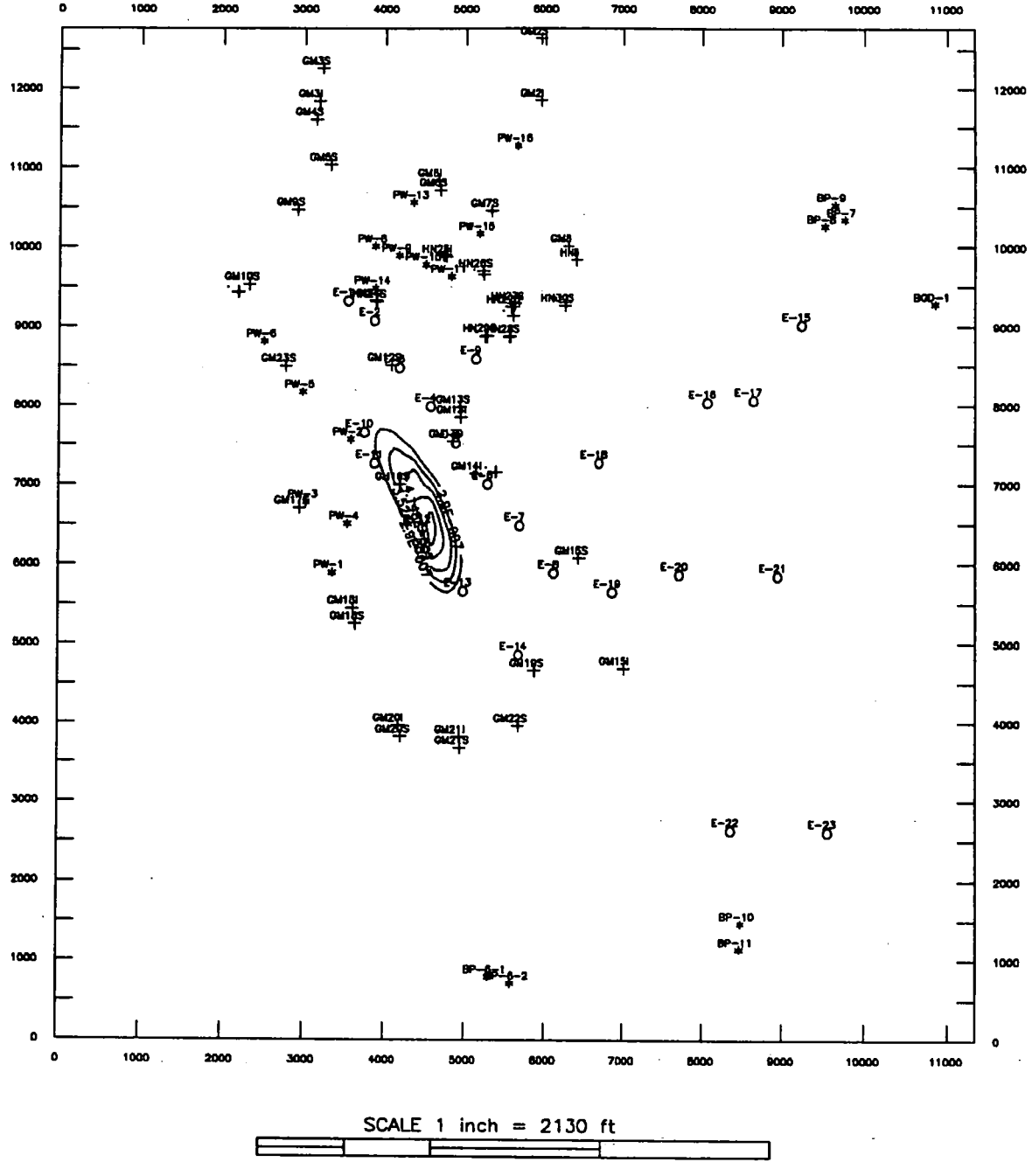
Figures 4-31 to 4-35 illustrate TCE concentrations in each model layer after 30 years of pumping the remediation system. Figures 4-36 through 4-40 show TCA concentrations after 30 years, and Figures 4-41 to 4-45 show PCE concentrations after 30 years.

As shown in Figures 4-36 to 4-40, after the 30 year remediation simulation, TCA concentrations are reduced significantly, to less than 35 ppb. However, significant TCE contamination was present in layer 3, to the west of well E-5. In addition, significant PCE contamination was present in layer 2 west of well E-8. Additional extraction wells were added in the second transport simulation to address these areas of contamination which persisted after 30 years.

Second Transport Simulation

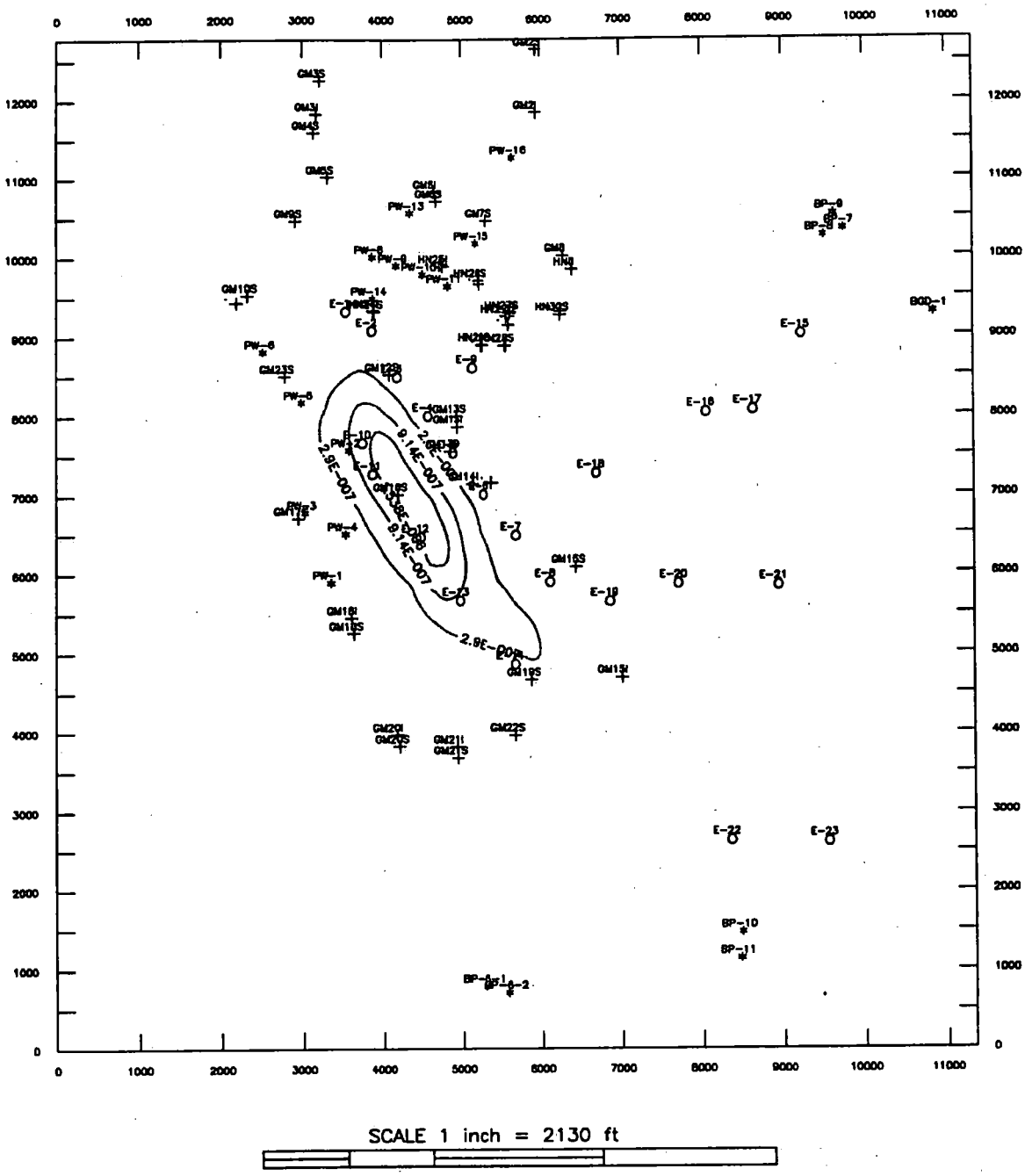
For the second transport simulation five extraction wells were added to the on-site/near-site remediation system to address the regions of contamination remaining after 30 years, as noted above. Extraction

Figure 4-21 Layer 1, Average Pumping Conditions (No Action), TCA after 30 years, Contour Interval = 1 ppb.



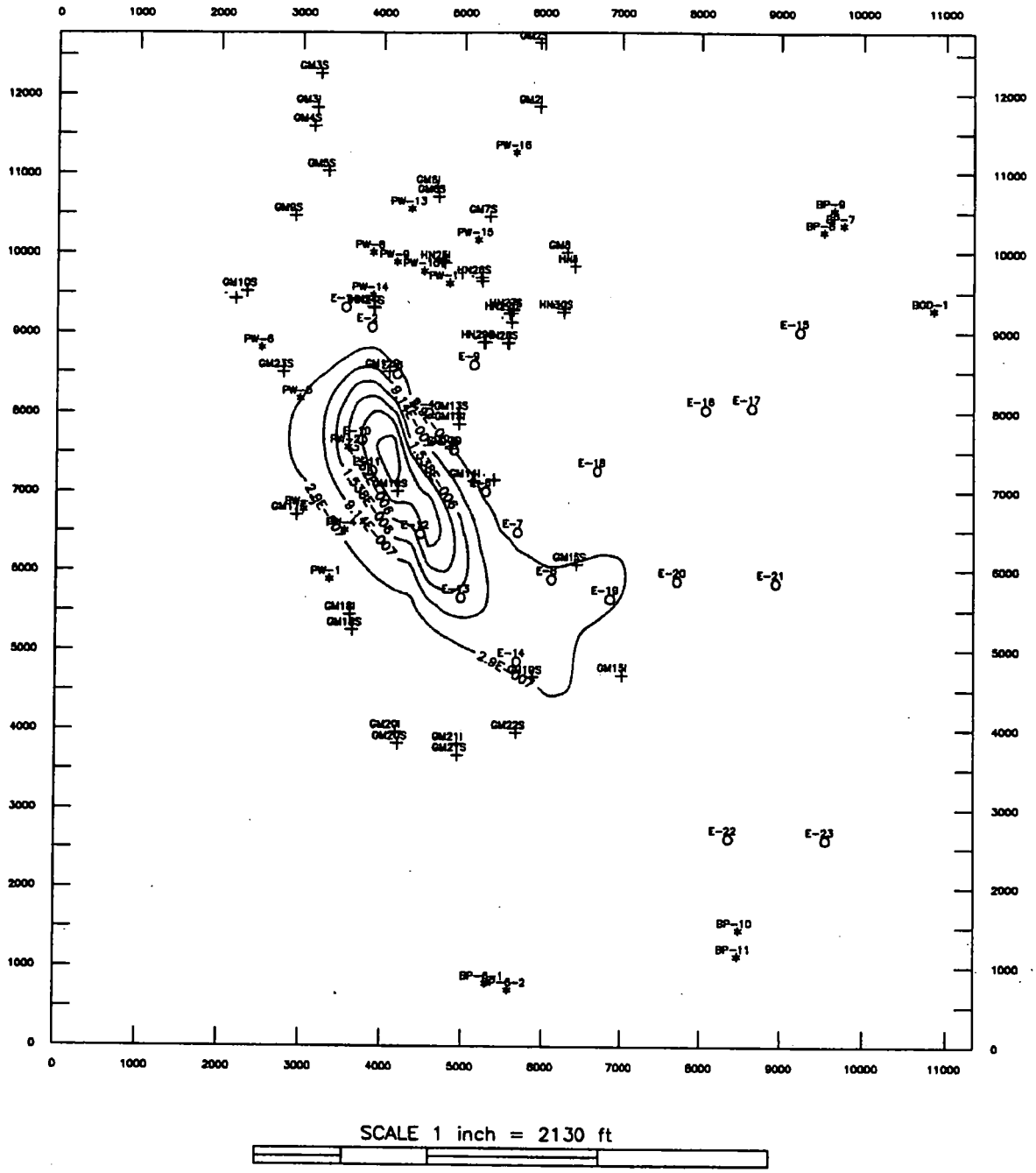
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-22 Layer 2, Average Pumping Conditions (No Action), TCA after 30 years, Contour Interval = 10 ppb.



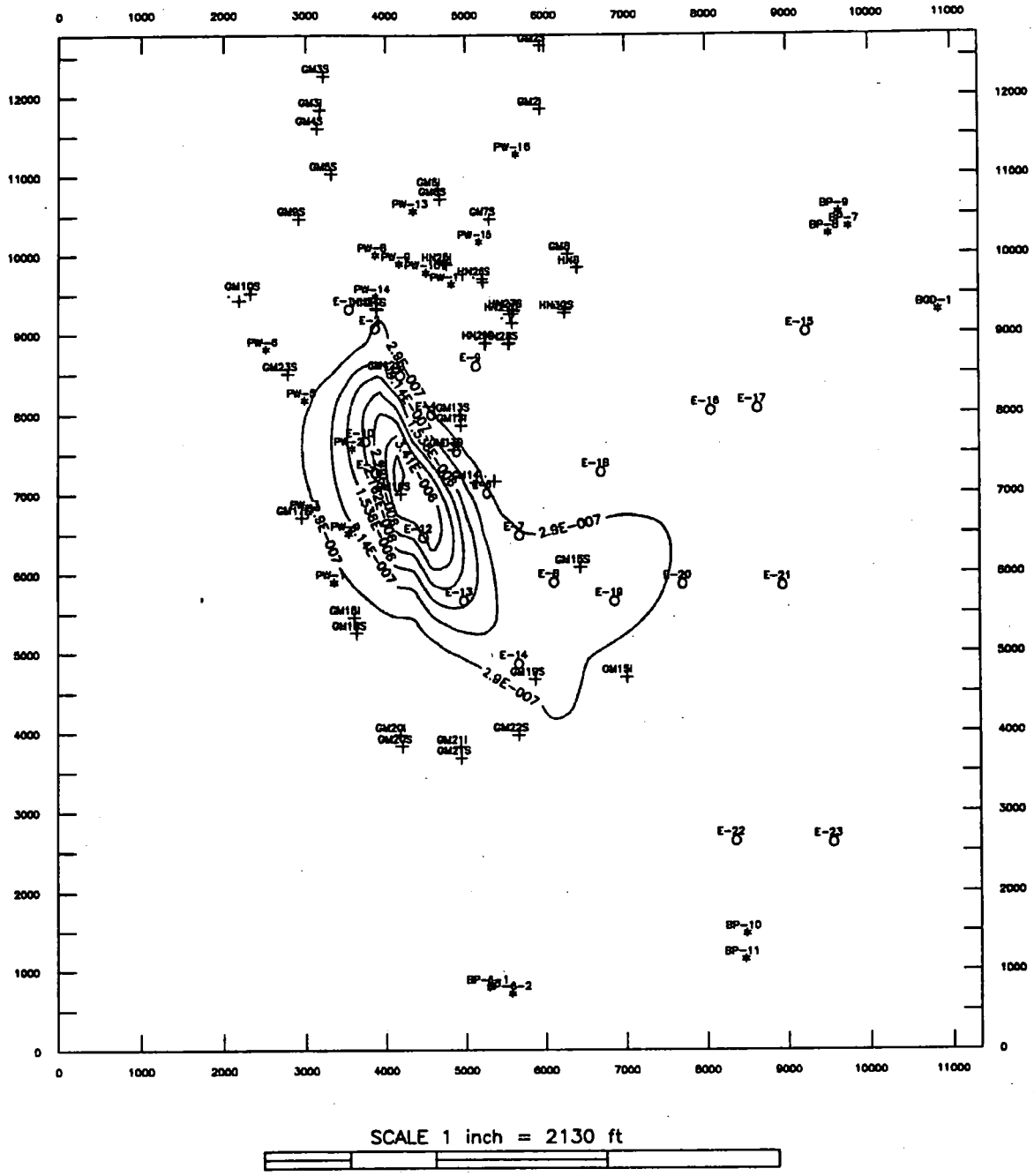
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-23 Layer 3, Average Pumping Conditions (No Action), TCA after 30 years, Contour Interval = 10 ppb.



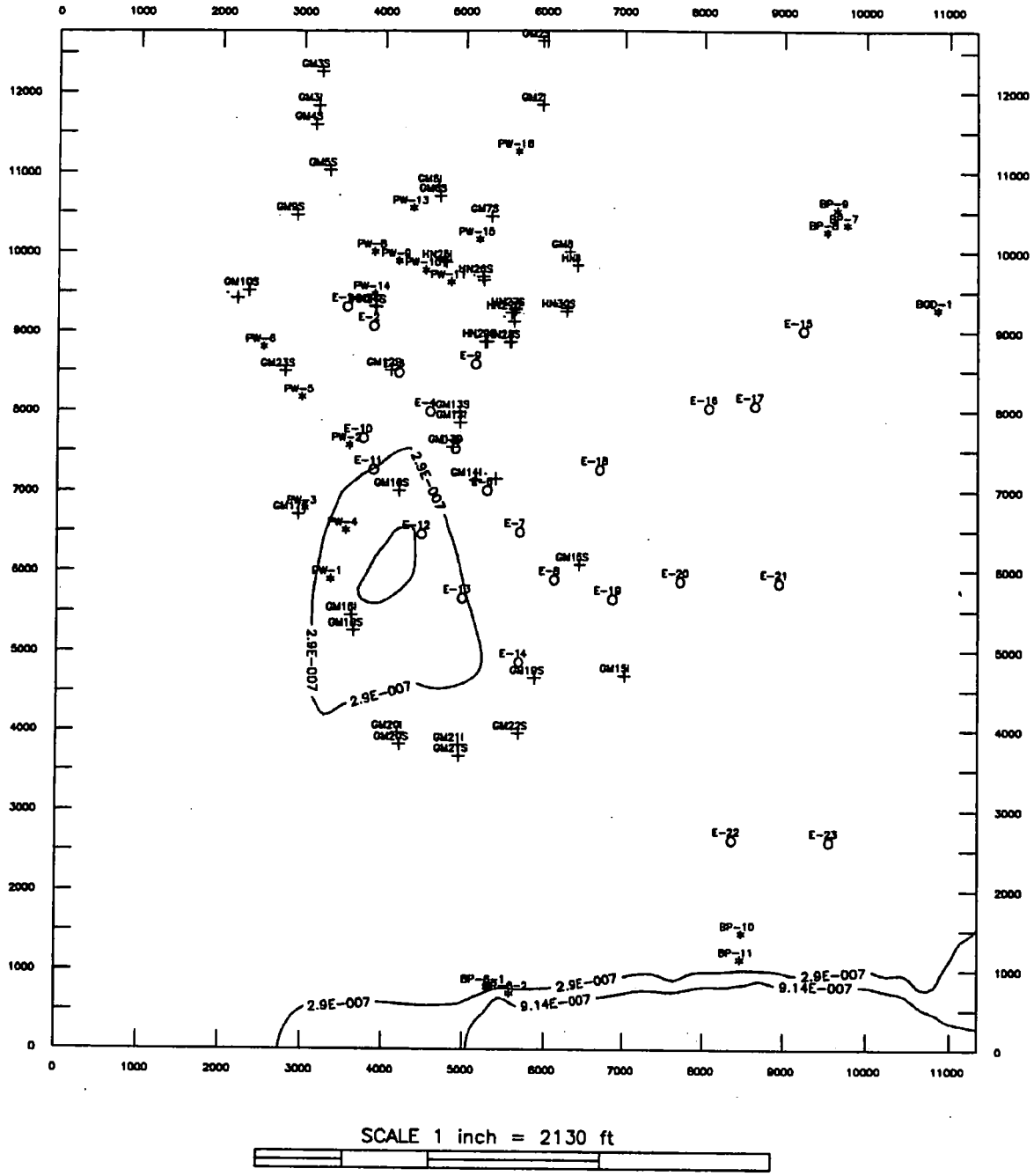
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-24 Layer 4, Average Pumping Conditions (No Action), TCA after 30 years, Contour Interval = 10 ppb.



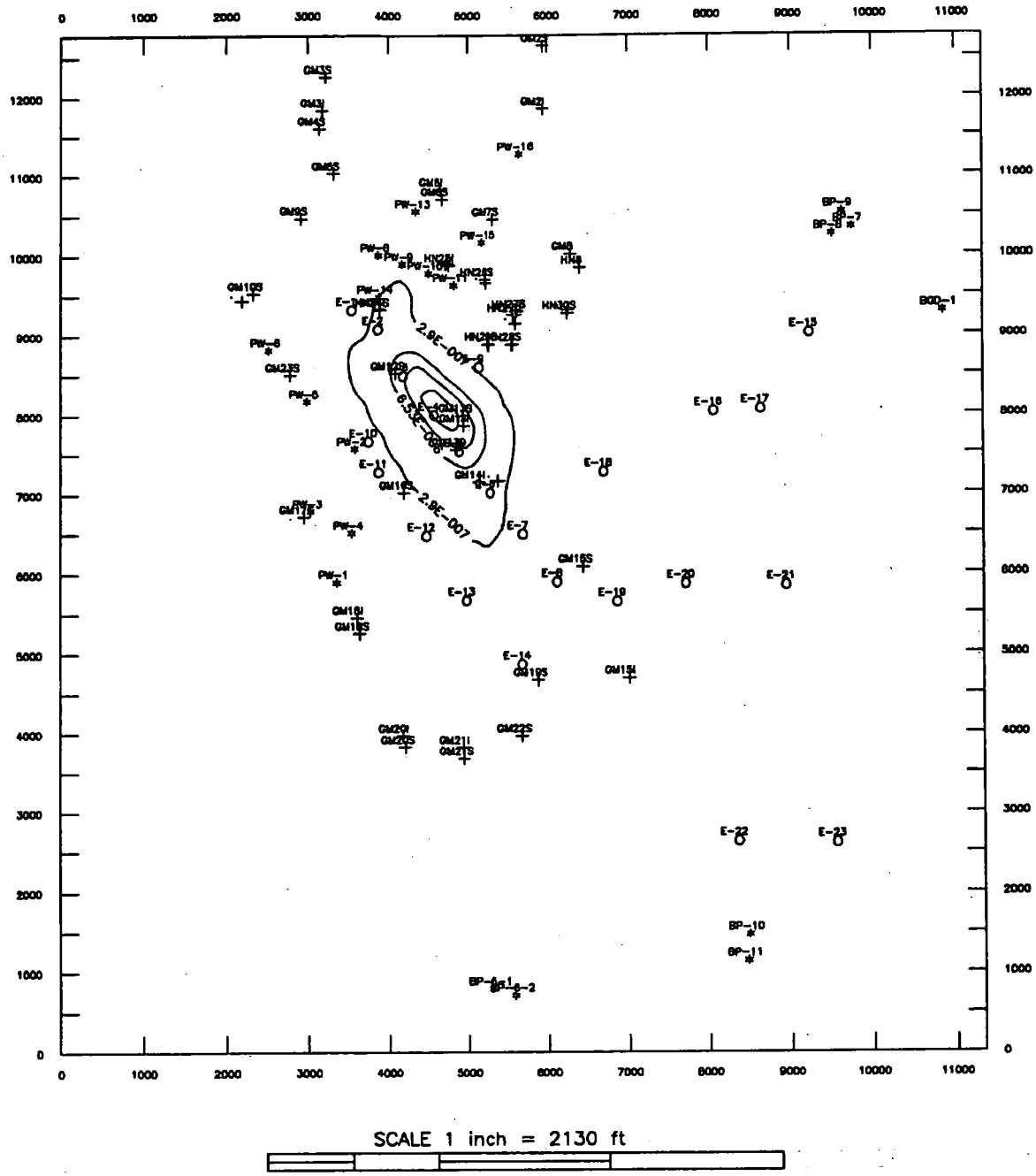
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-25 Layer 5, Average Pumping Conditions (No Action), TCA after 30 years, Contour Interval = 10 ppb.



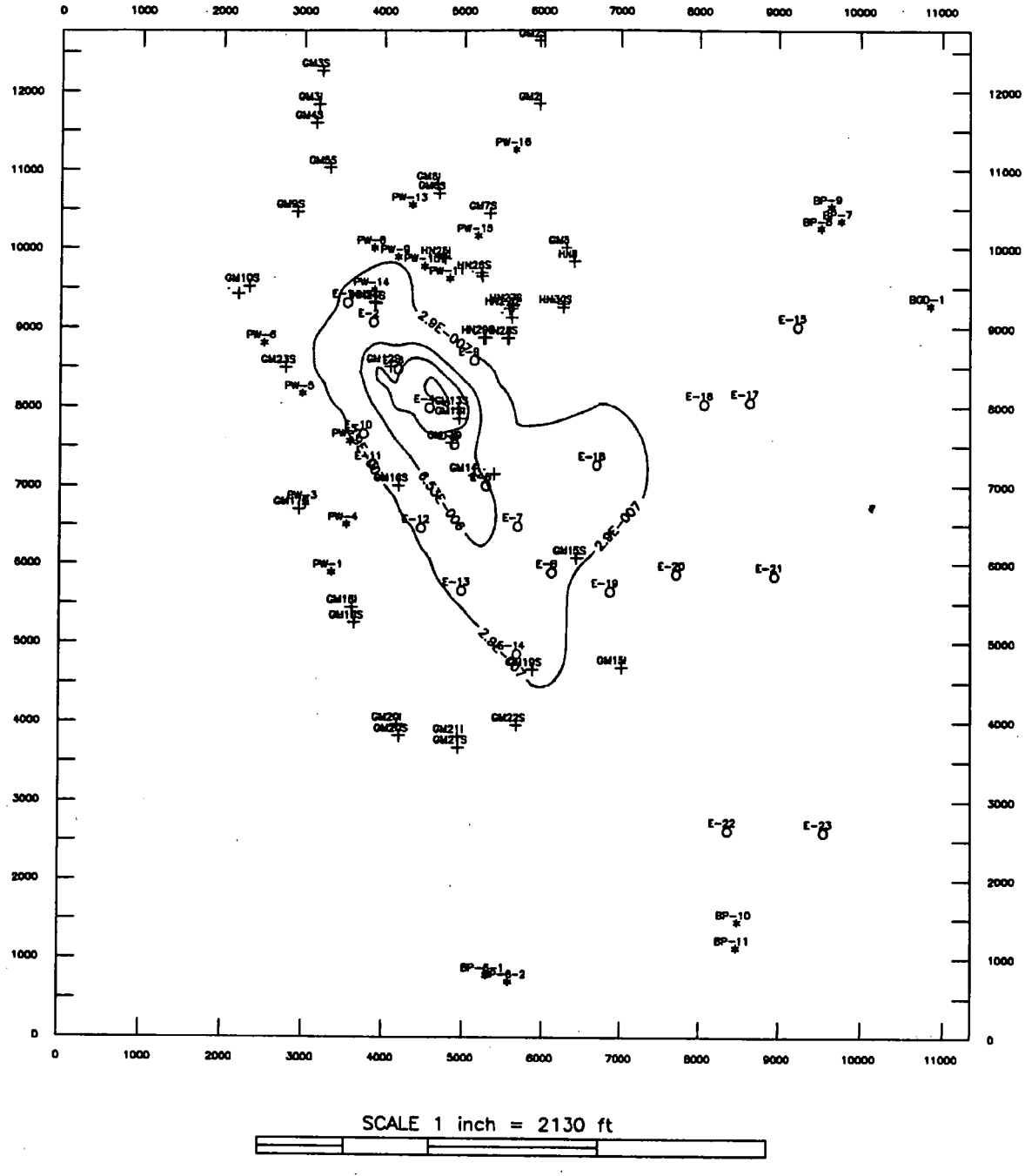
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-26 Layer 1, Average Pumping Conditions (No Action), PCE after 30 years, Contour Interval = 100 ppb.



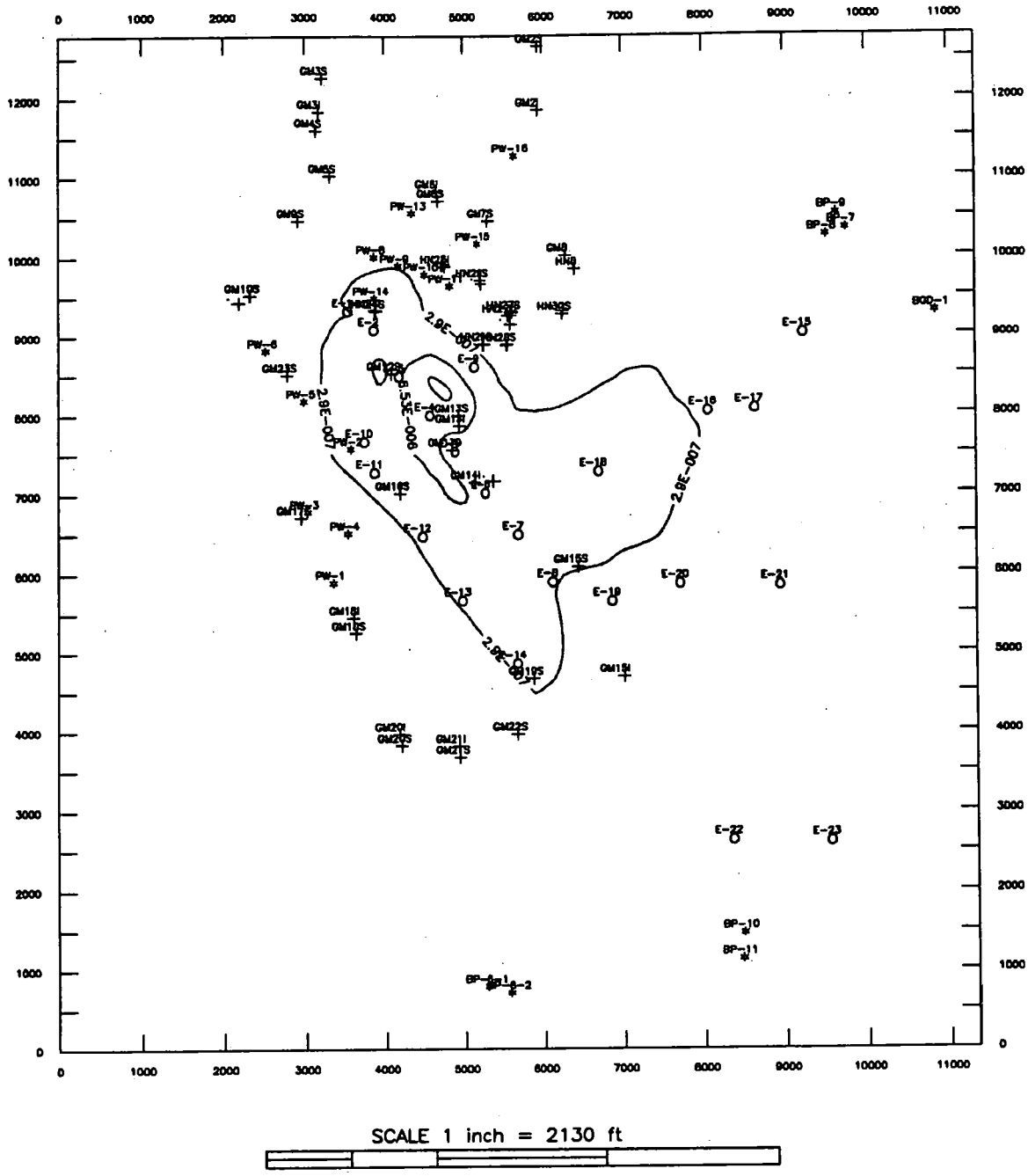
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-27 Layer 2, Average Pumping Conditions (No Action), PCE after 30 years, Contour Interval = 100 ppb.



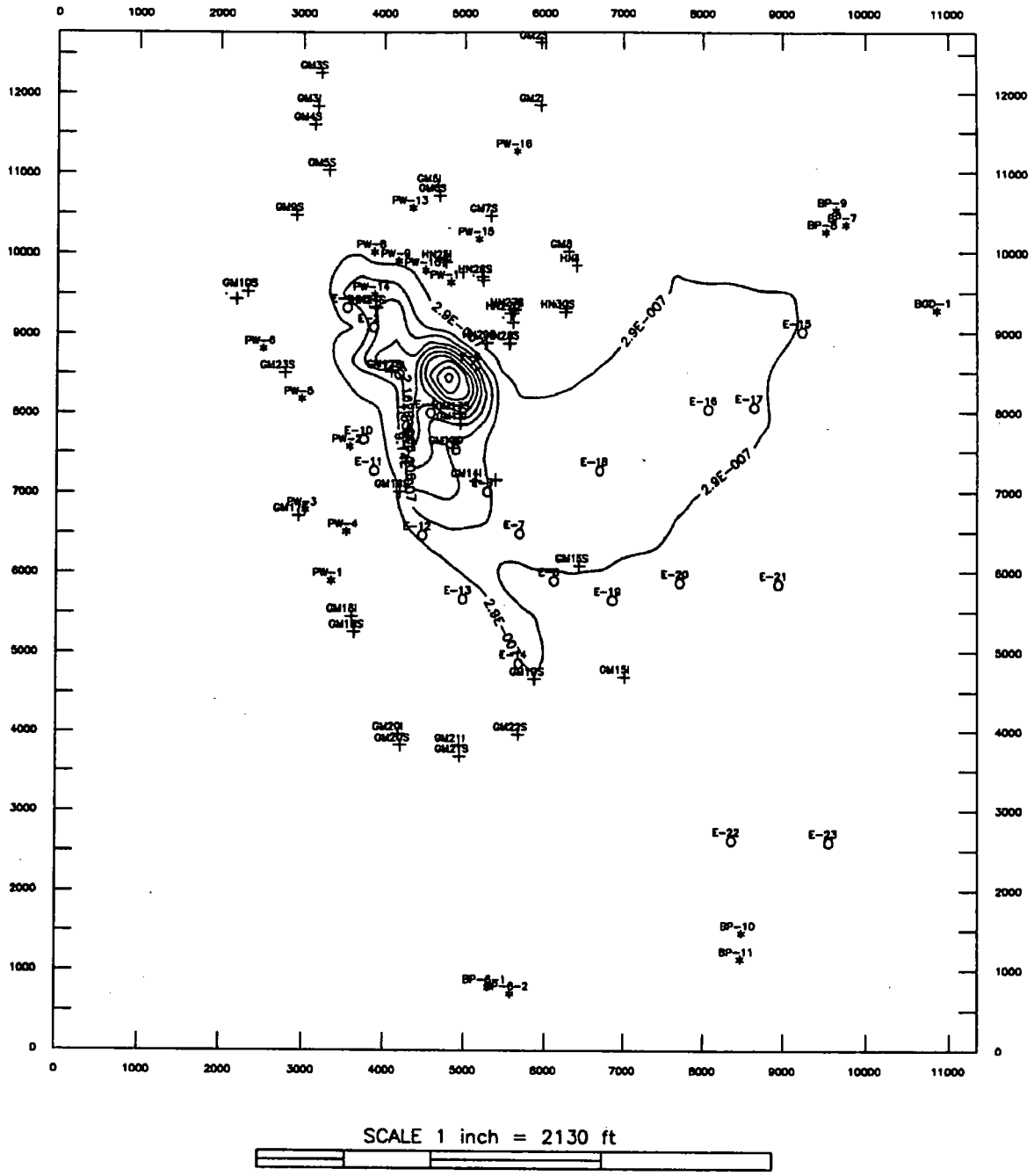
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-28 Layer 3, Average Pumping Conditions (No Action), PCE after 30 years, Contour Interval = 100 ppb.



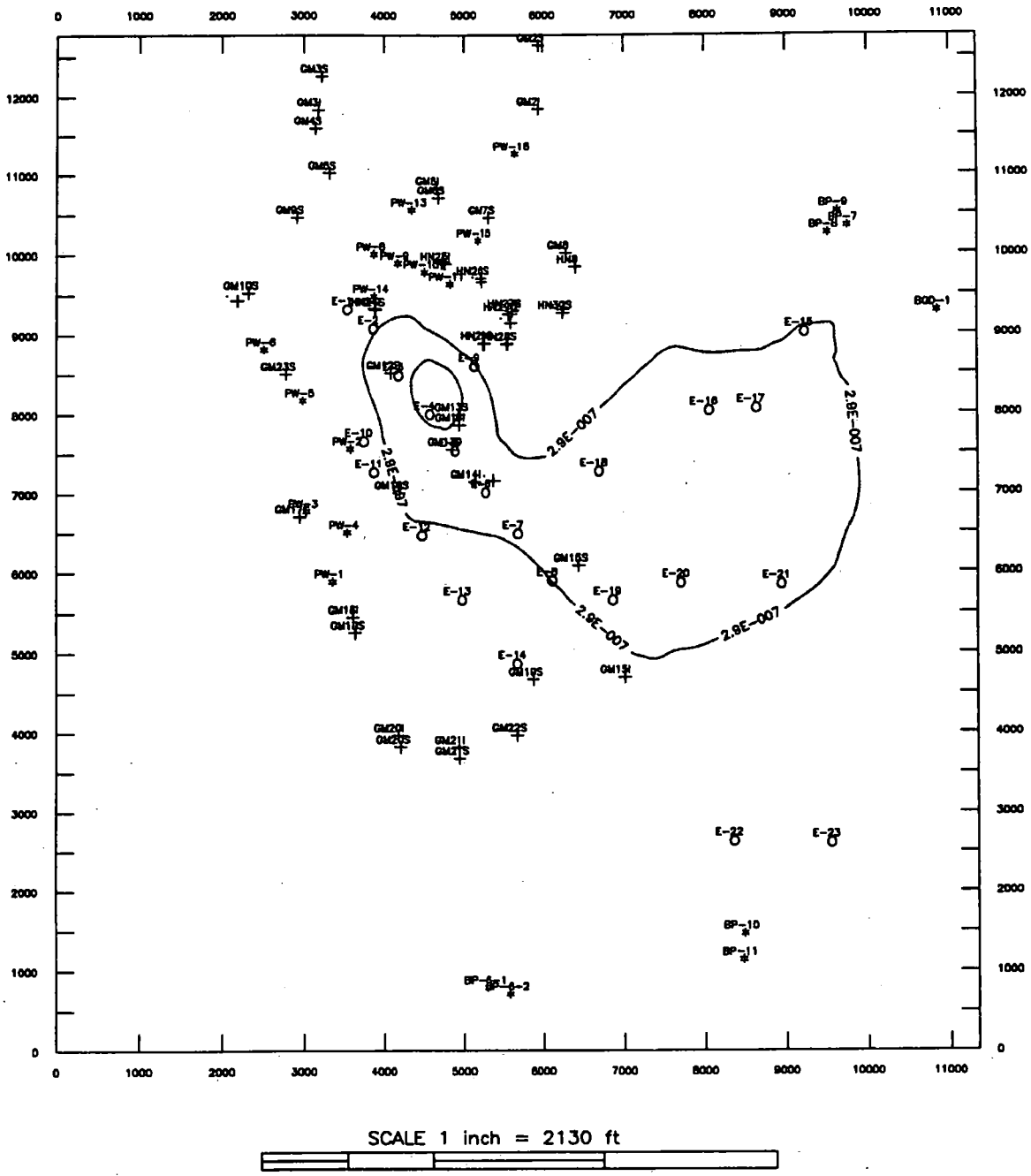
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-29 Layer 4, Average Pumping Conditions (No Action), PCE after 30 years, Contour Interval = 10 ppb.



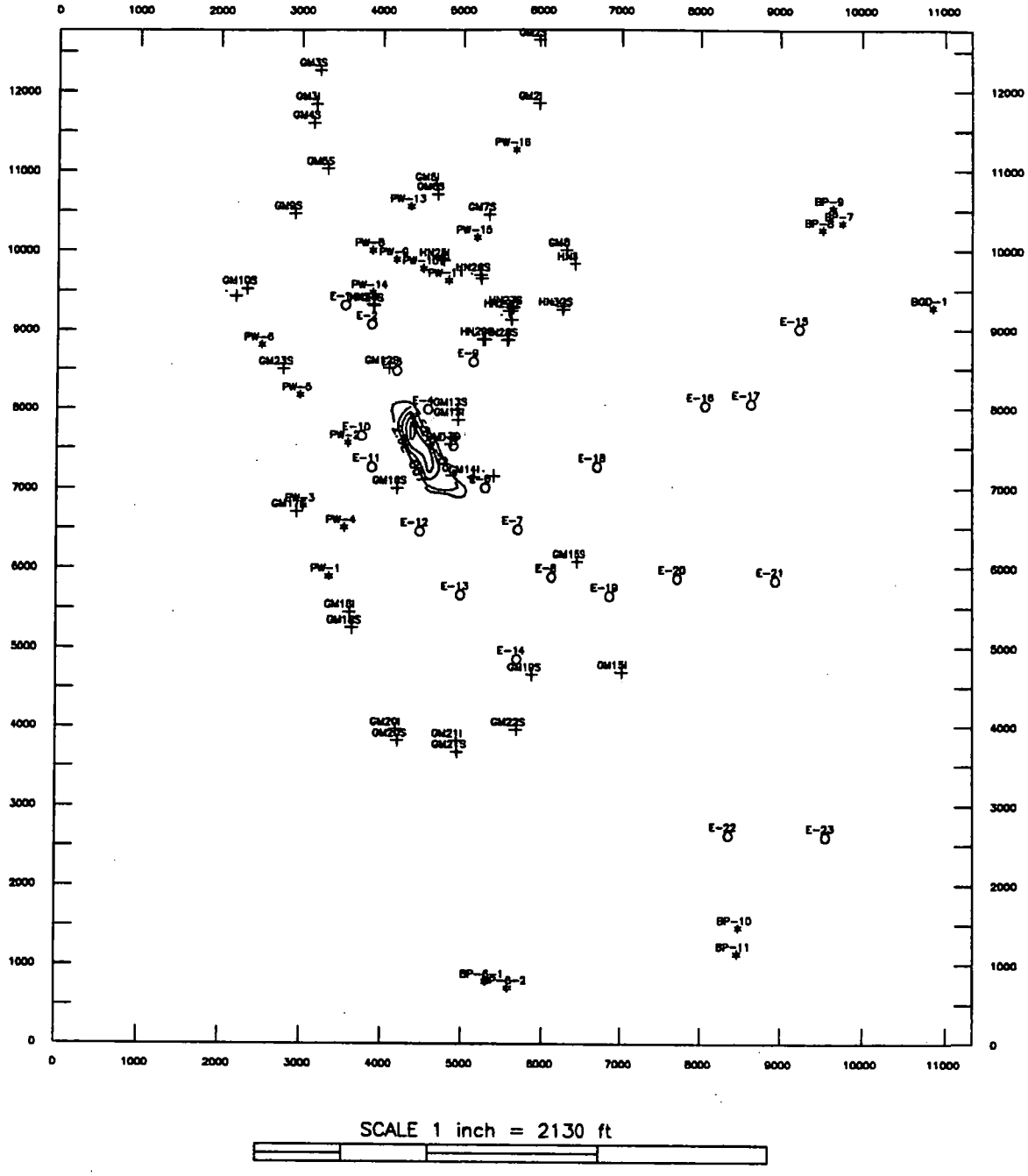
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-30 Layer 5, Average Pumping Conditions (No Action), PCE after 30 years, Contour Interval = 10 ppb.



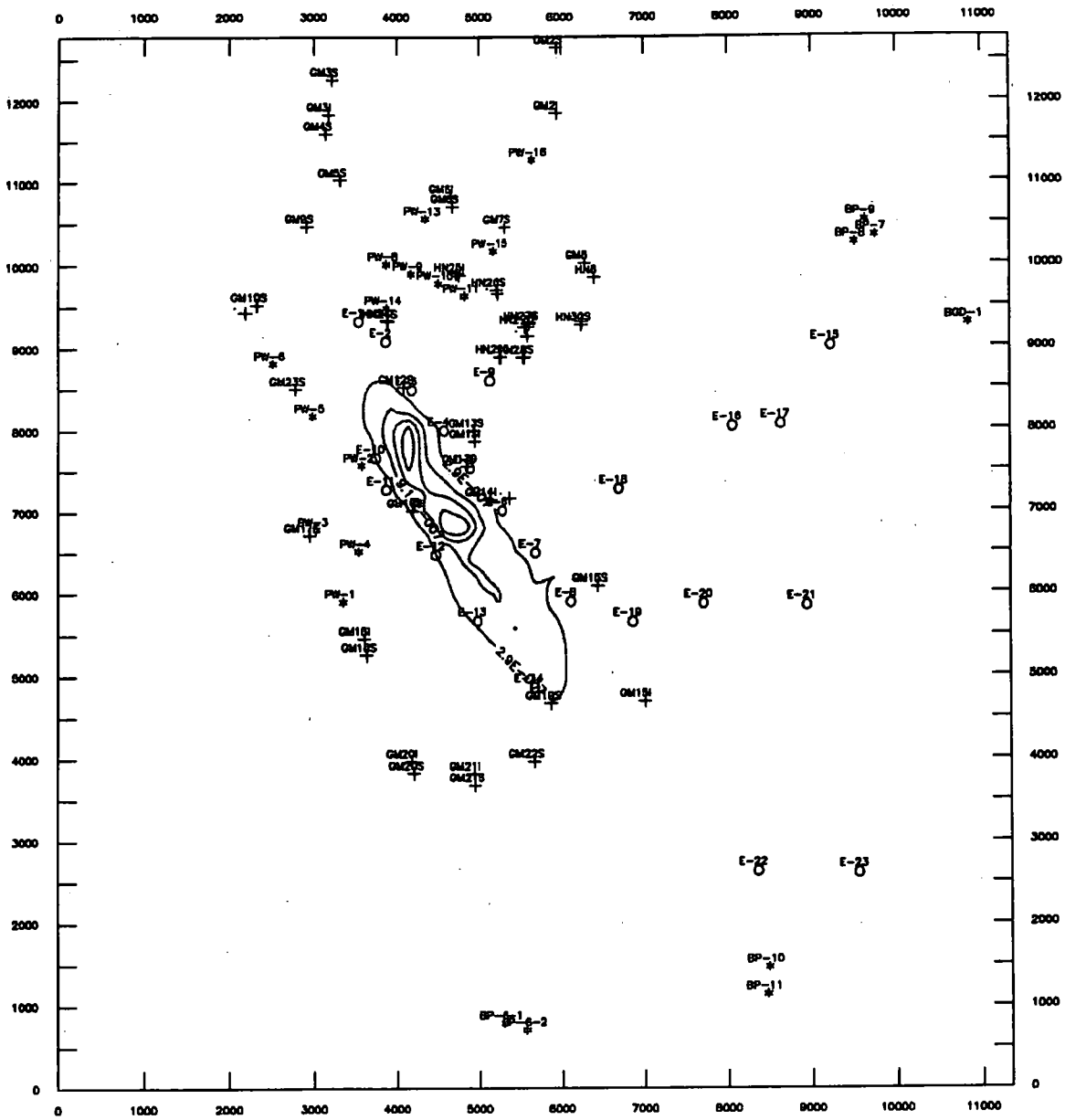
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-31 Layer 1, On-Site System, Initial Run, TCE after 30 years, Contour Interval = 1 ppb.



* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

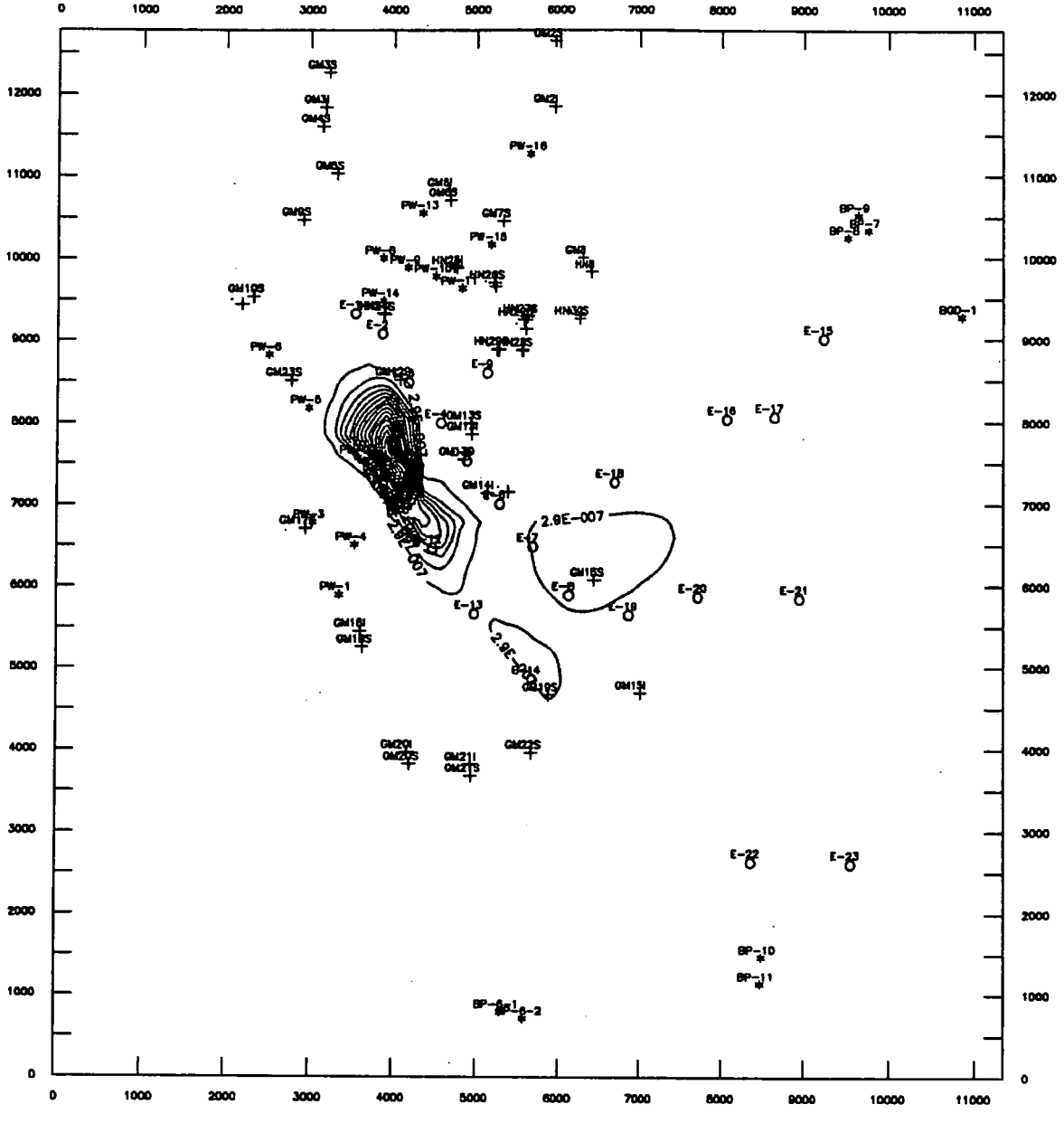
Figure 4-32 Layer 2, On-Site System, Initial Run, TCE after 30 years, Contour Interval = 10 ppb.



SCALE 1 inch = 2130 ft

* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

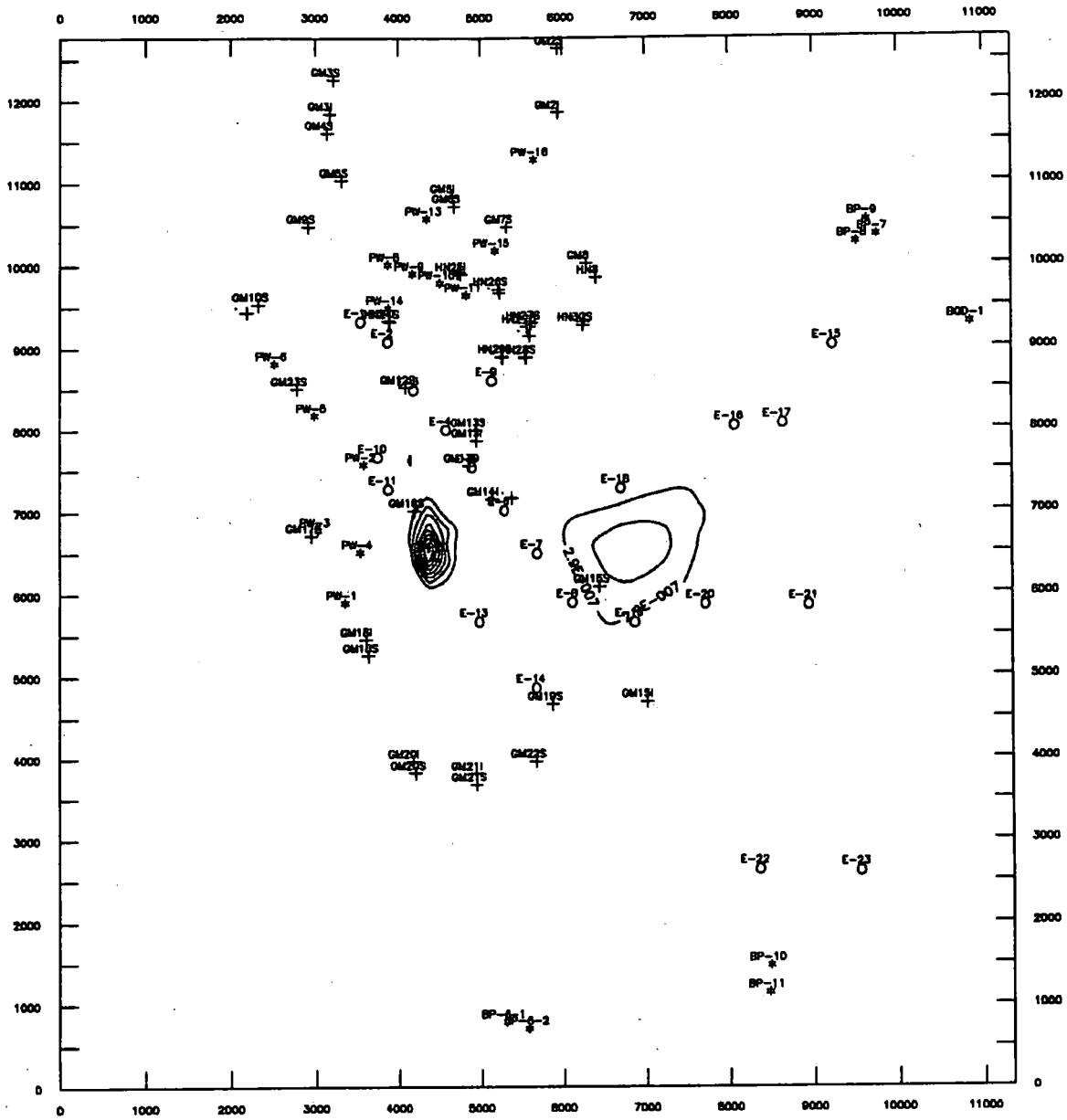
Figure 4-33 Layer 3, On-Site System, Initial Run, TCE after 30 years, Contour Interval = 10 ppb.



SCALE 1 inch = 2130 ft

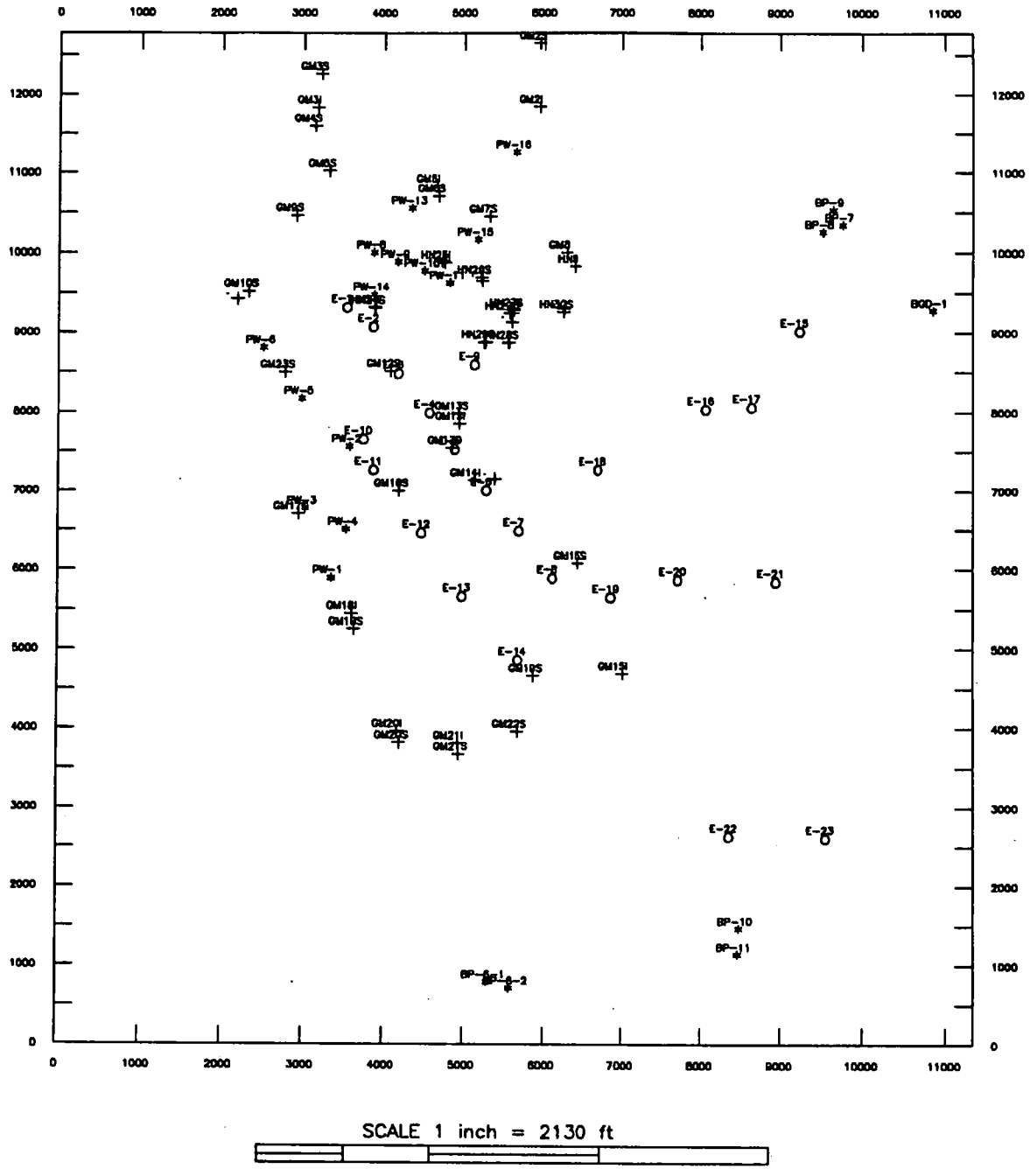
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-34 Layer 4, On-Site System, Initial Run, TCE after 30 years, Contour Interval = 1 ppb.



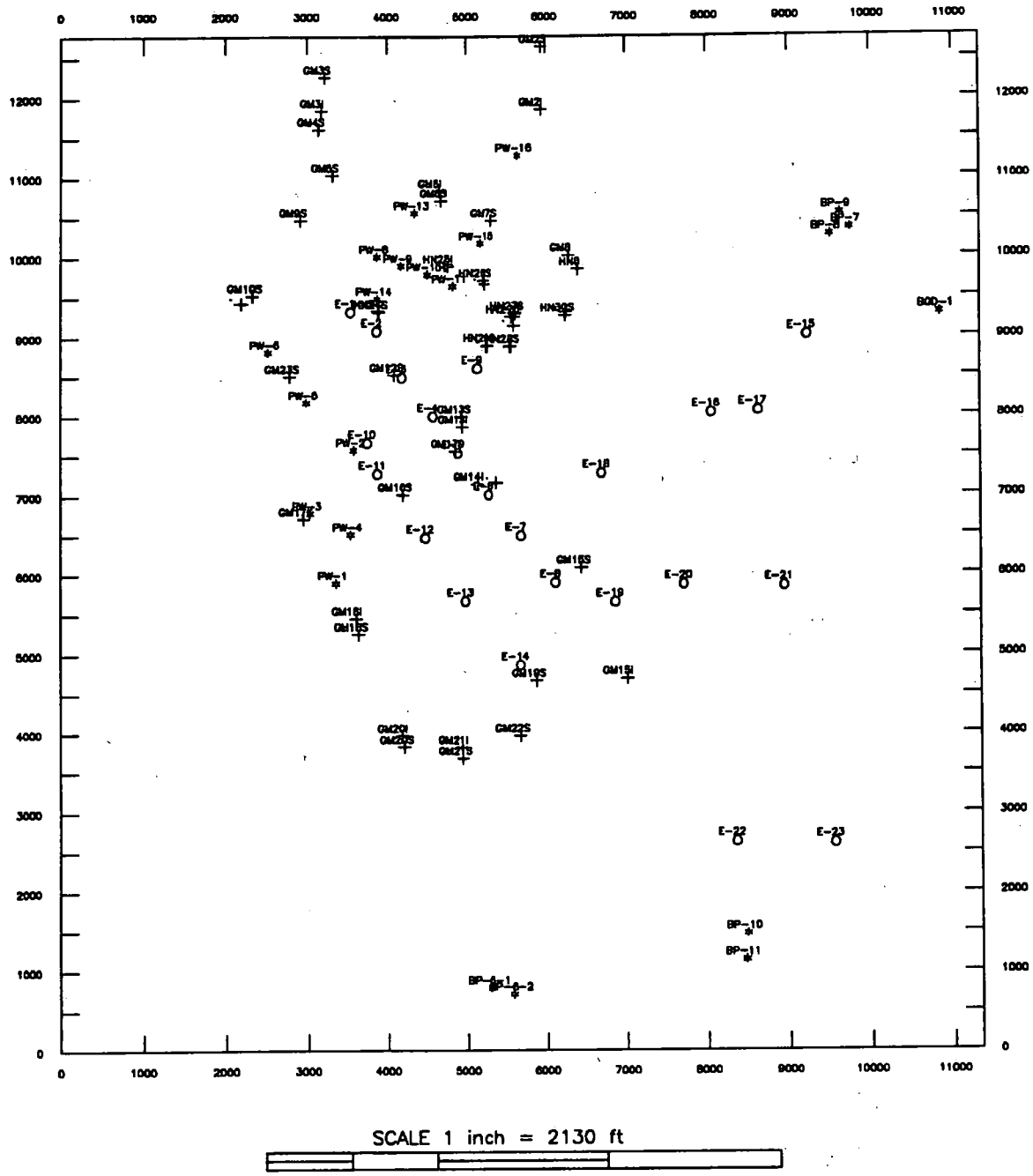
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-35 Layer 5, On-Site System, Initial Run, TCE after 30 years, Contour Interval = 1 ppb.



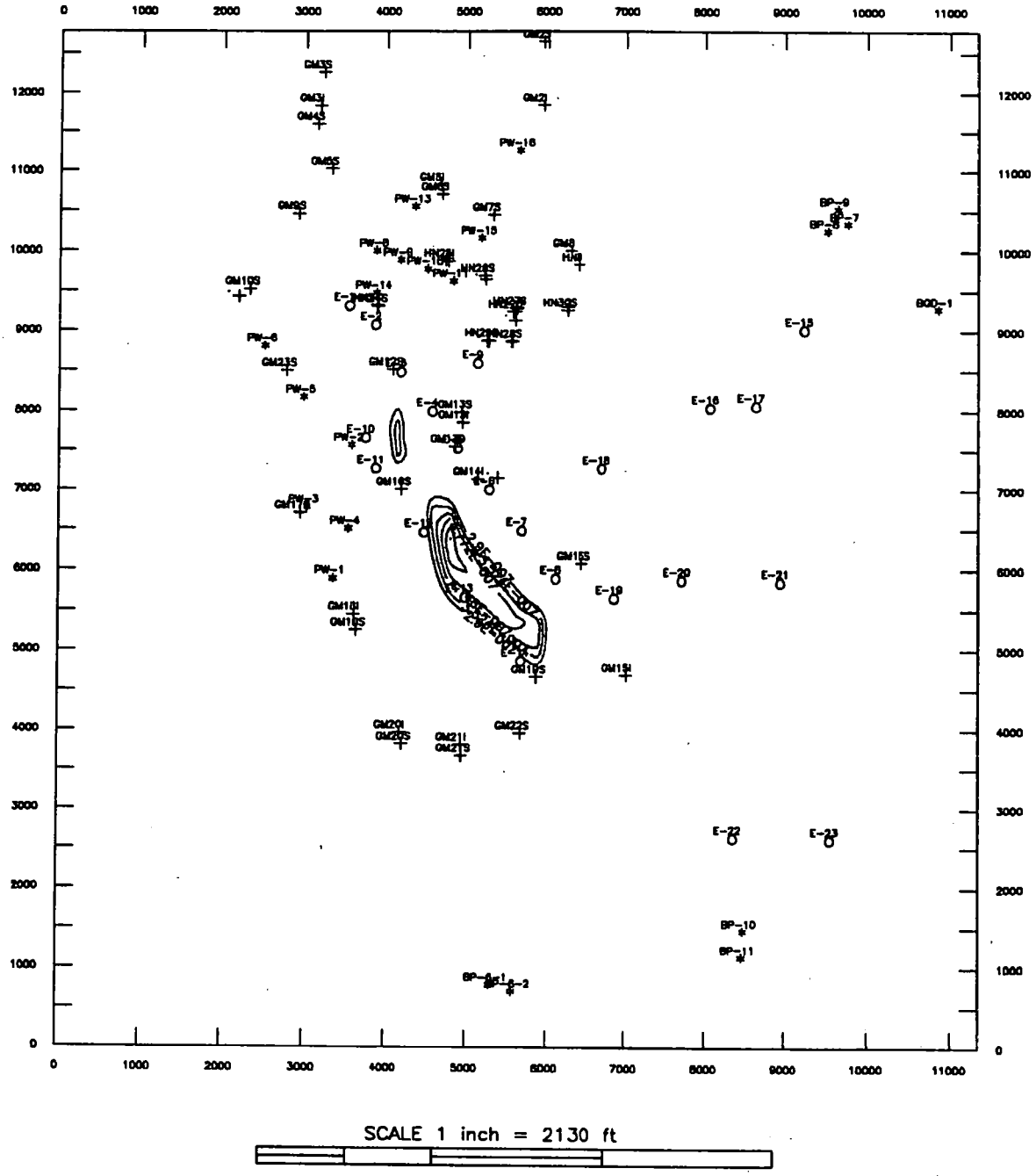
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-36 Layer 1, On-Site System, Initial Run, TCA after 30 years, Contour Interval = 1 ppb.



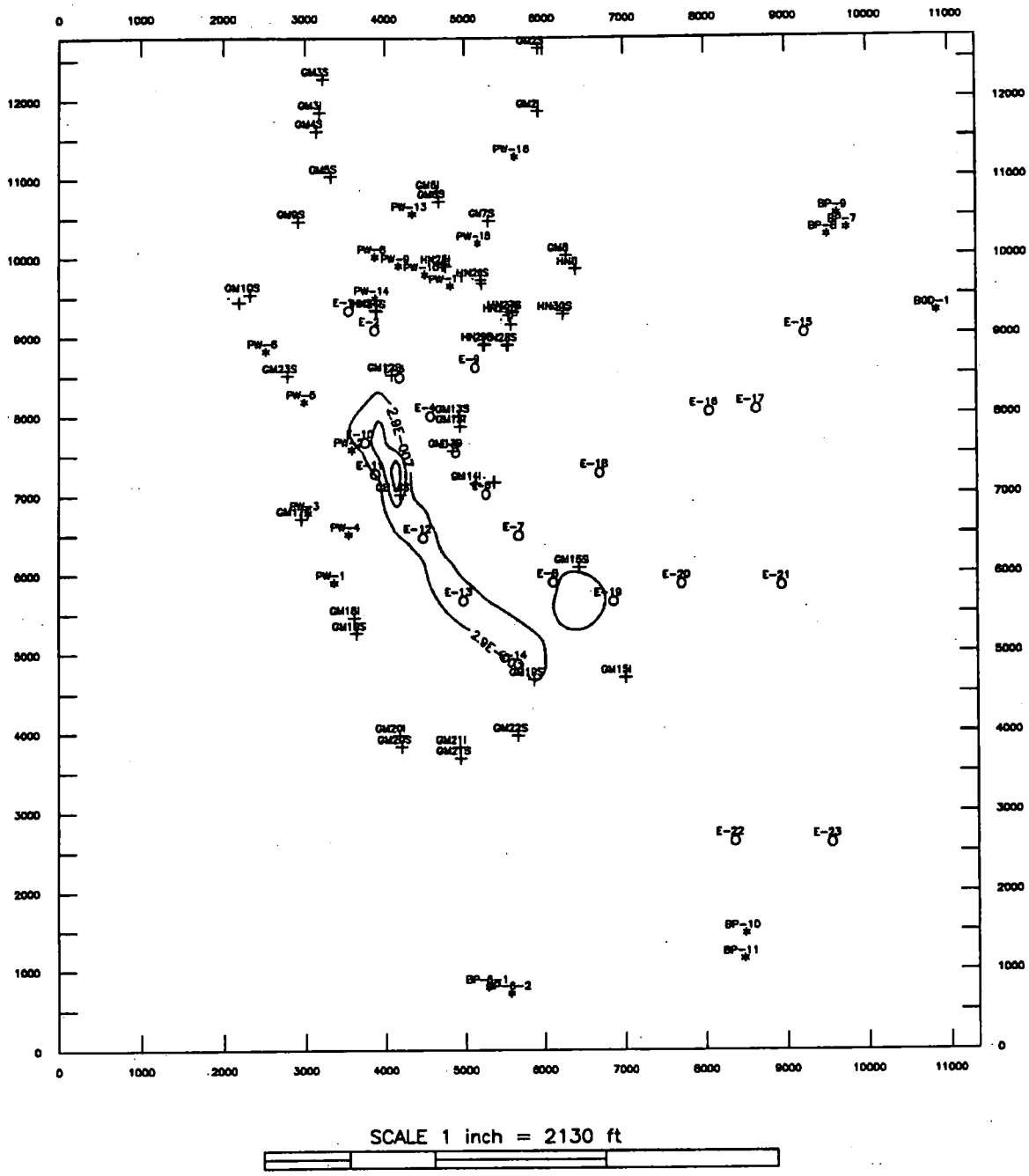
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-37 Layer 2, On-Site System, Initial Run, TCA after 30 years, Contour Interval = 1 ppb.



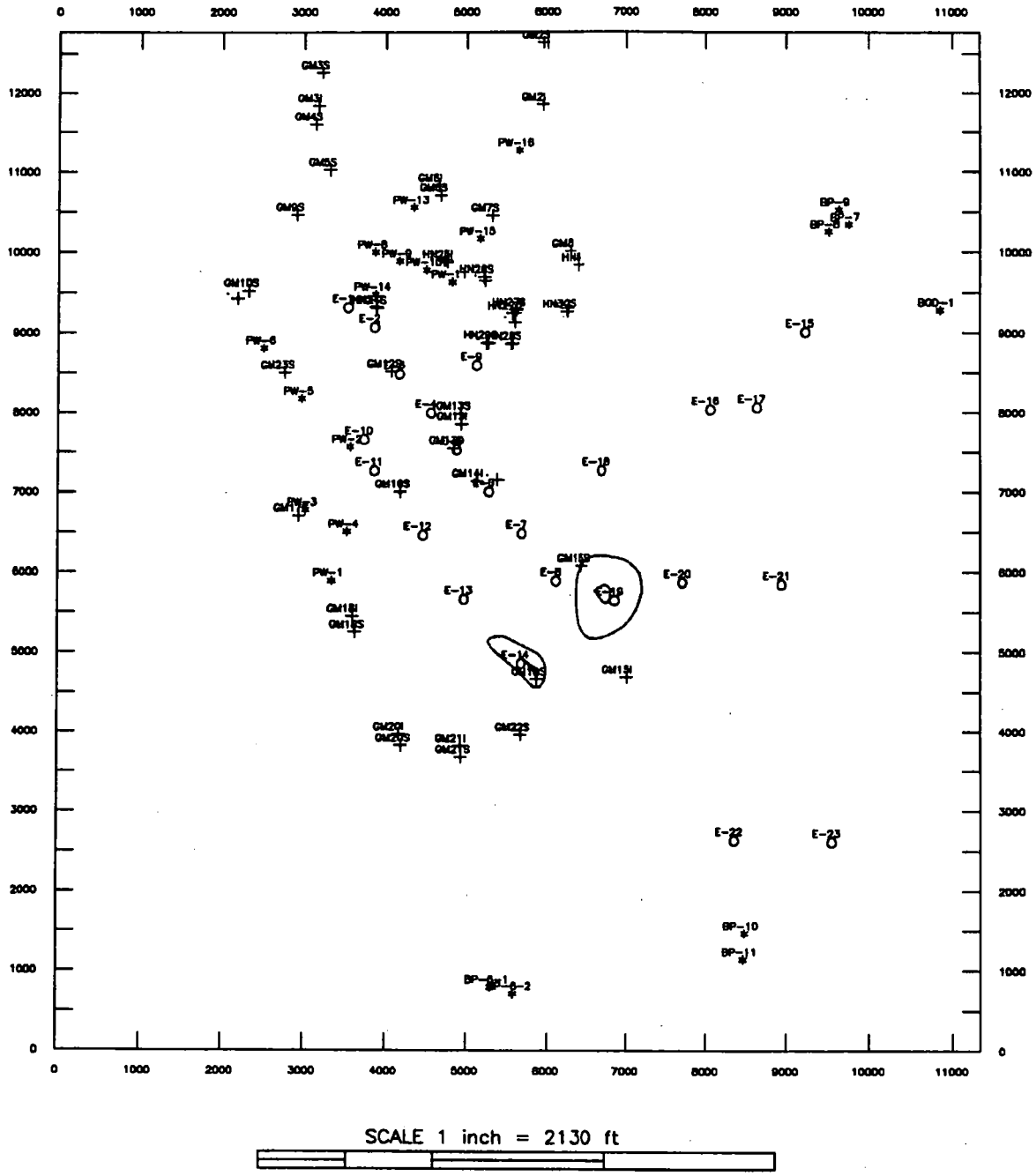
• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-38 Layer 3, On-Site System, Initial Run, TCA after 30 years, Contour Interval = 10 ppb.



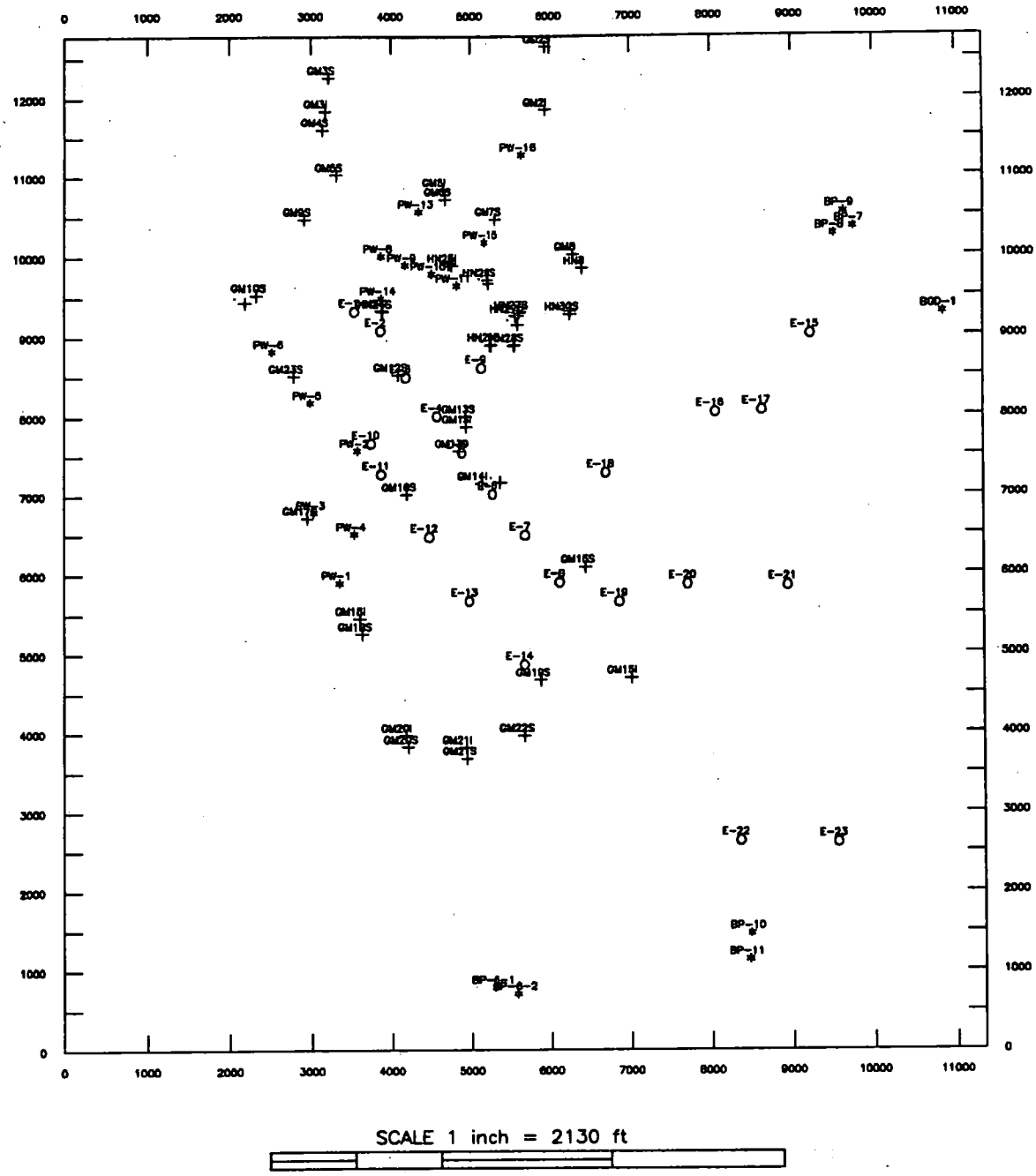
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-39 Layer 4, On-Site System, Initial Run, TCA after 30 years, Contour Interval = 1 ppb.



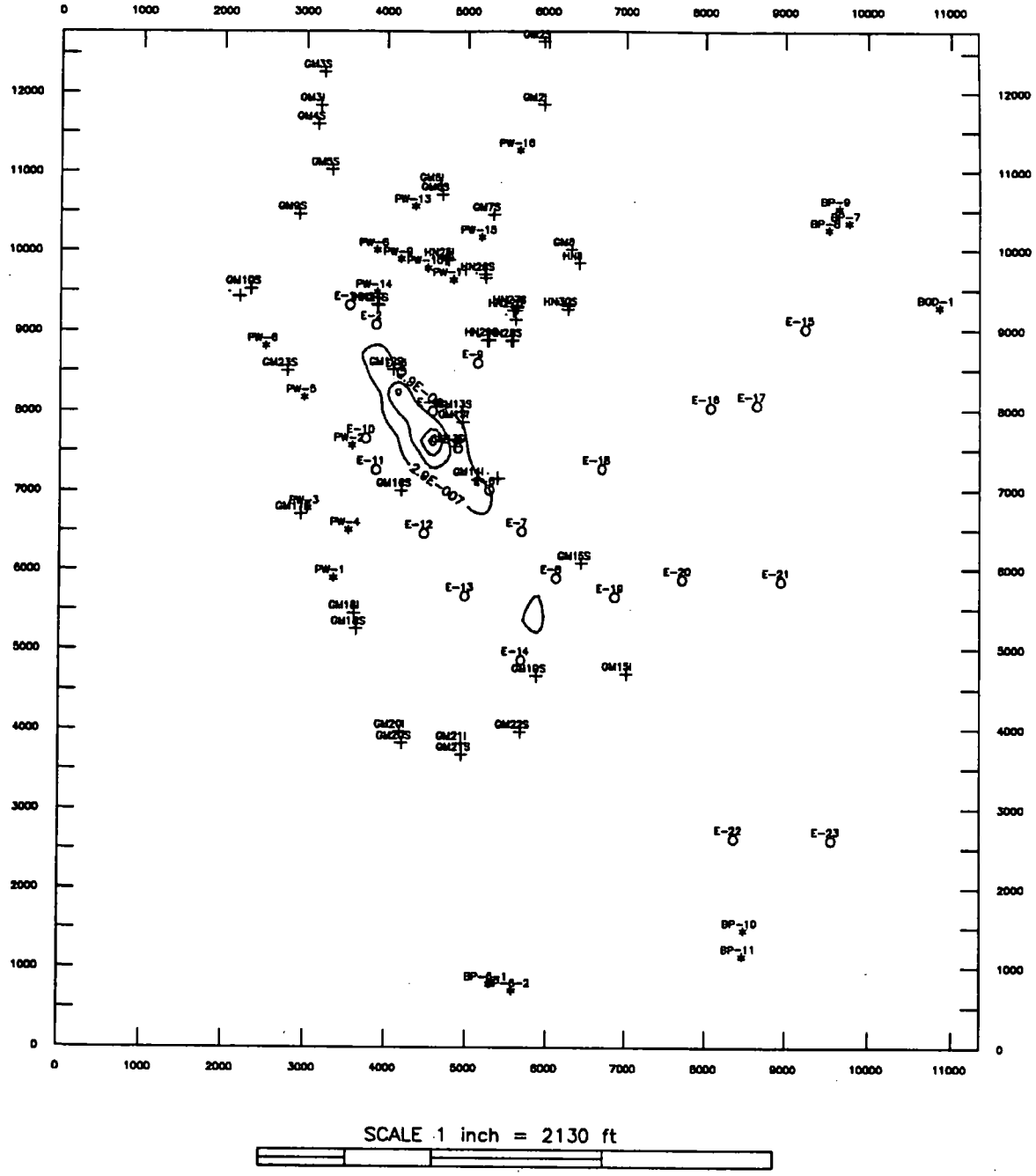
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-40 Layer 5, On-Site System, Initial Run, TCA after 30 years, Contour Interval = 1 ppb.



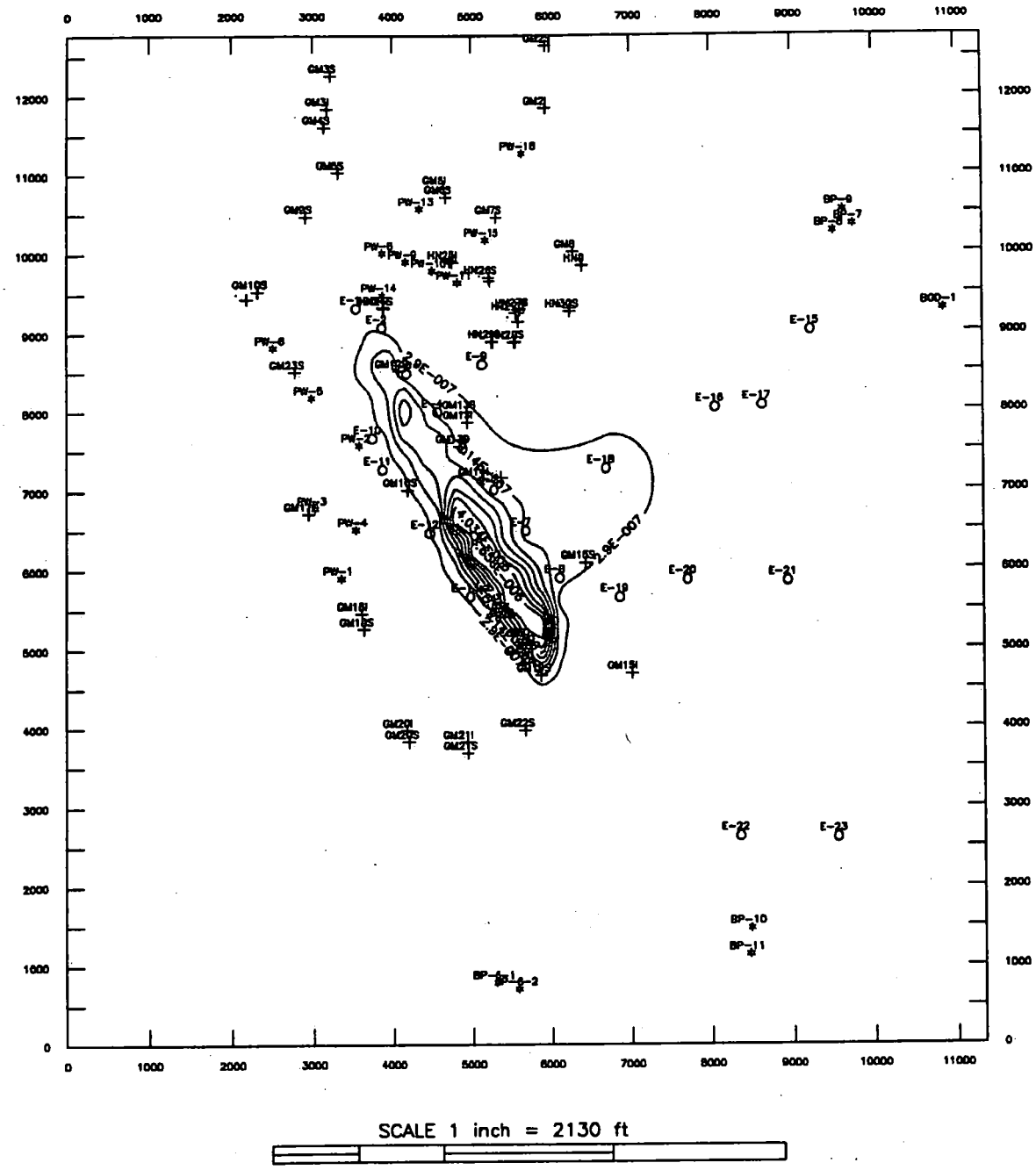
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-41 Layer 1, On-Site System, Initial Run, PCE after 30 years, Contour Interval = 10 ppb.



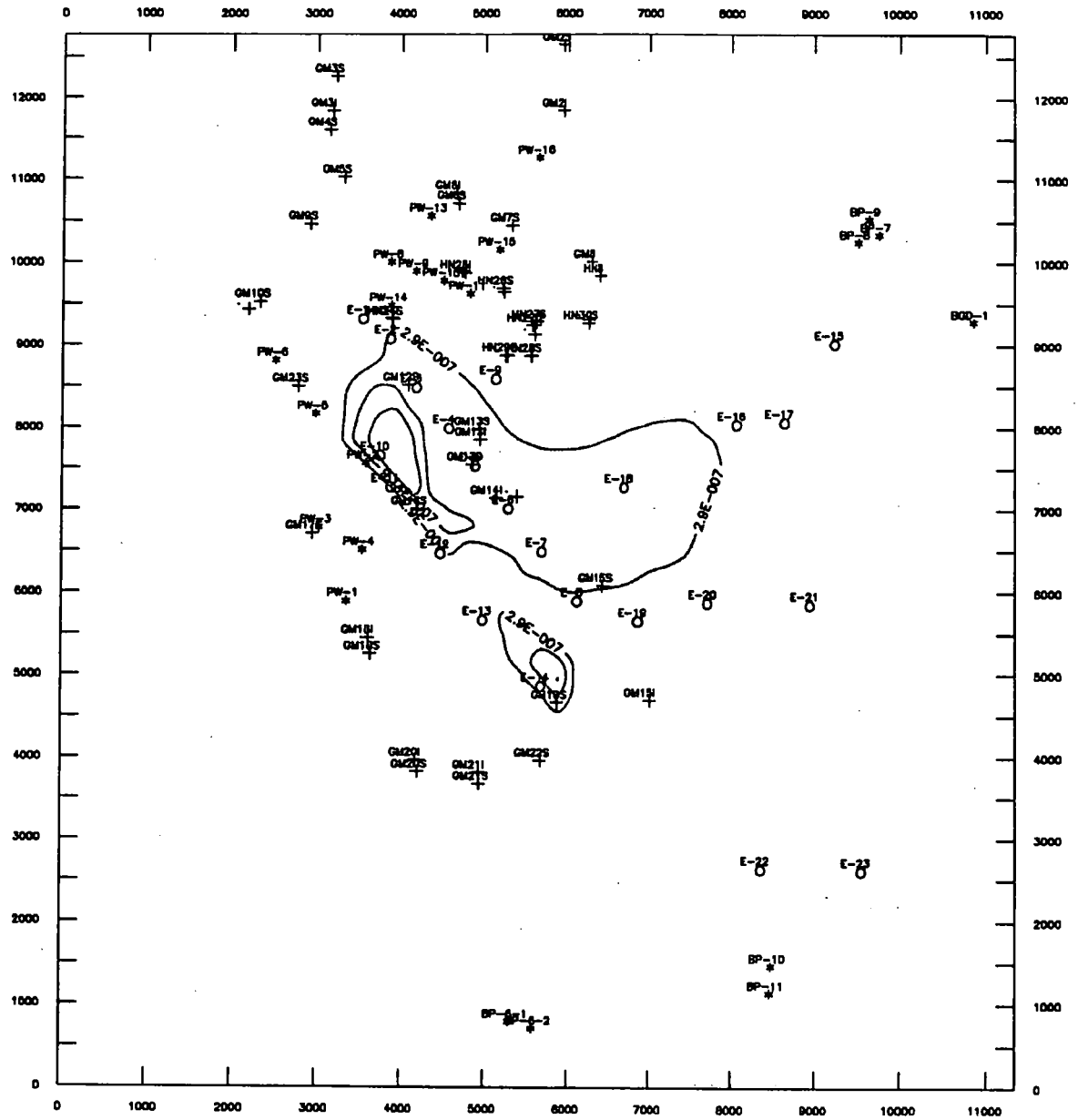
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-42 Layer 2, On-Site System, Initial Run, PCE after 30 years, Contour Interval = 10 ppb.



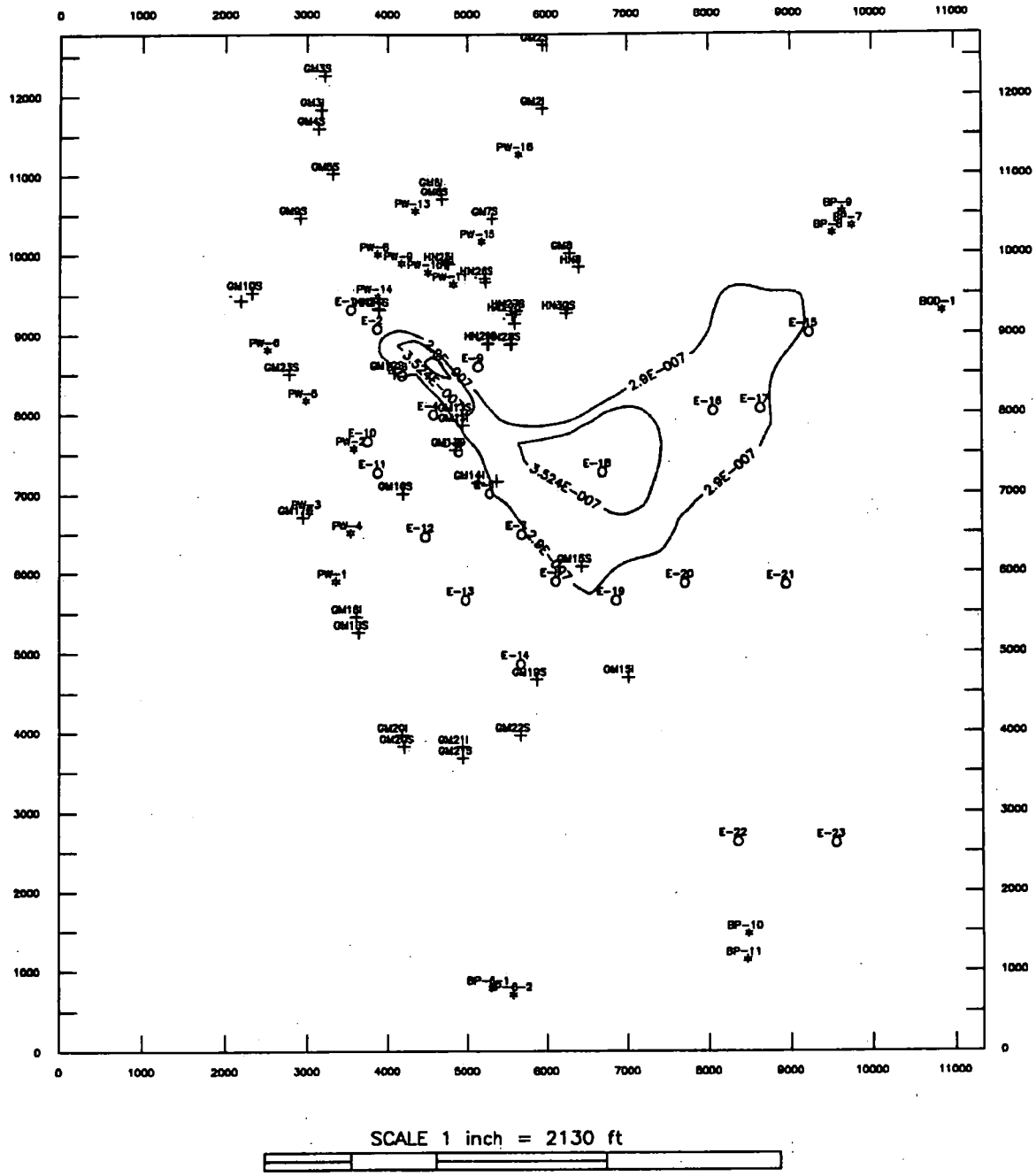
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-43 Layer 3, On-Site System, Initial Run, PCE after 30 years, Contour Interval = 10 ppb.



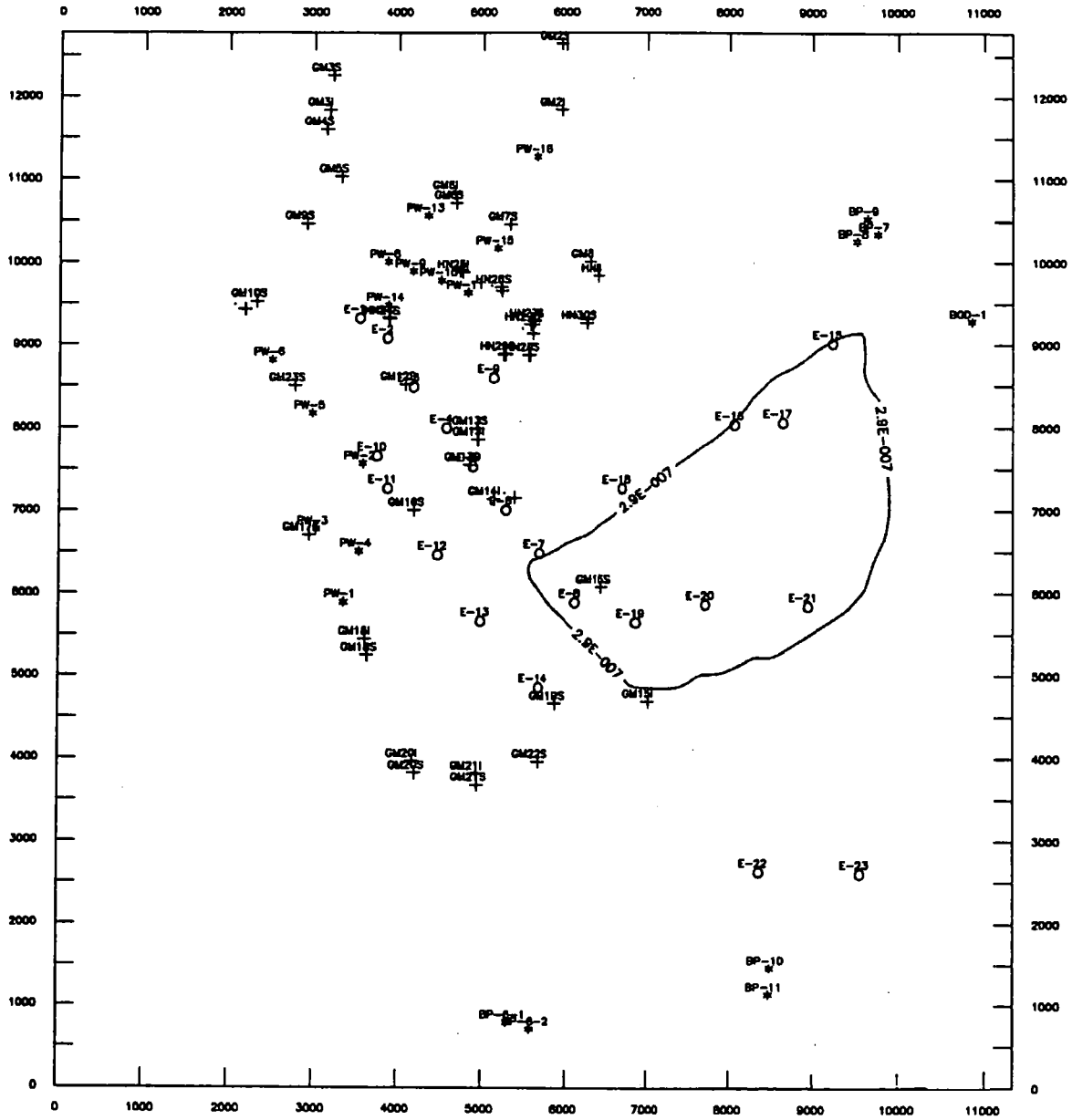
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-44 Layer 4, On-Site System; Initial Run, PCE after 30 years, Contour Interval = 1 ppb.



* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-45 Layer 5, On-Site System, Initial Run, PCE after 30 years, Contour Interval = 1 ppb.



SCALE 1 inch = 2130 ft

* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

wells E-10 through E-14 are located in model layers 2 and 3. These wells were pumping at rates of 100 gpm from layer 2 and/or layer 3 only. Transport simulations were run for TCE and PCE which showed the highest levels of contamination after the initial run. Due to the significantly lower levels of TCA contamination after 30 years, transport of this chemical was not simulated for the second transport run. Figures 4-46 to 4-50 illustrate TCE concentrations in each model layer after 30 years of pumping the remediation system. Figures 4-51 through 4-55 show PCE concentrations after 30 years.

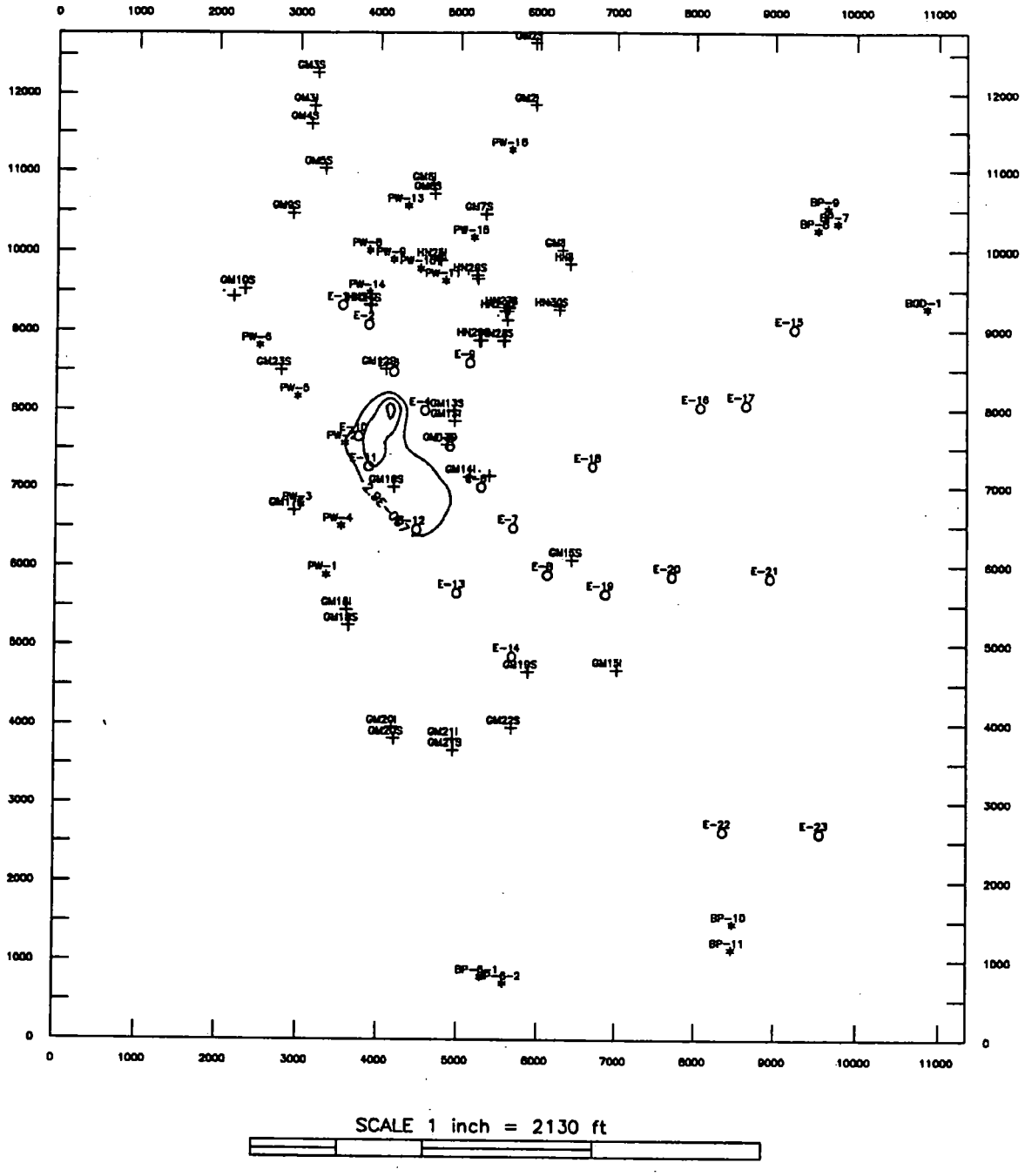
As seen in these figures, TCE concentrations layer 3, to the west of well E-5 are significantly lower than in the initial transport simulation. PCE concentrations in layer 2 west of well E-8 also show improvement compared to the initial transport simulation. It is likely that improvements in groundwater contaminant concentrations could be achieved with additional adjustments (optimization) of well pumping rates and well locations in concert with subsequent transport model simulations.

4.2.4 Off-Site Remediation System

The off-site remediation system was directed at all groundwater with concentrations of greater than 5 ppb for any of the three chemicals of concern. In addition to the plume of contamination in the immediate vicinity of the NWIRP, low levels of contaminants may be present to the east of the facility in layers 2 and 3, and to the south and east in layers 4 and 5. To prevent further migration of these contaminants, and to remediate this groundwater, extraction wells were located to capture the northern and southern portion on the >5 ppb plume. The off-site system consists of Grumman production wells PW-08, PW-09, PW-10 and PW-14 in layers 4 and 5, on-site extraction wells E-1 to E-9 which are screened in layers 1 through layer 4, and off-site extraction wells E-15 to E-23, screened in layers 2 through 5. Table 3-2 lists pumping rates and depths of each well in the off-site remediation system. Water pumped from the Grumman production wells and extraction wells E-1 through E-9 was assumed to be returned to the NWIRP recharge basins. Water from E-15 through E-21 was assumed to be pumped to the east (municipal) recharge basin, while water from E-22 and E-23 was returned to the south Grumman recharge basins.

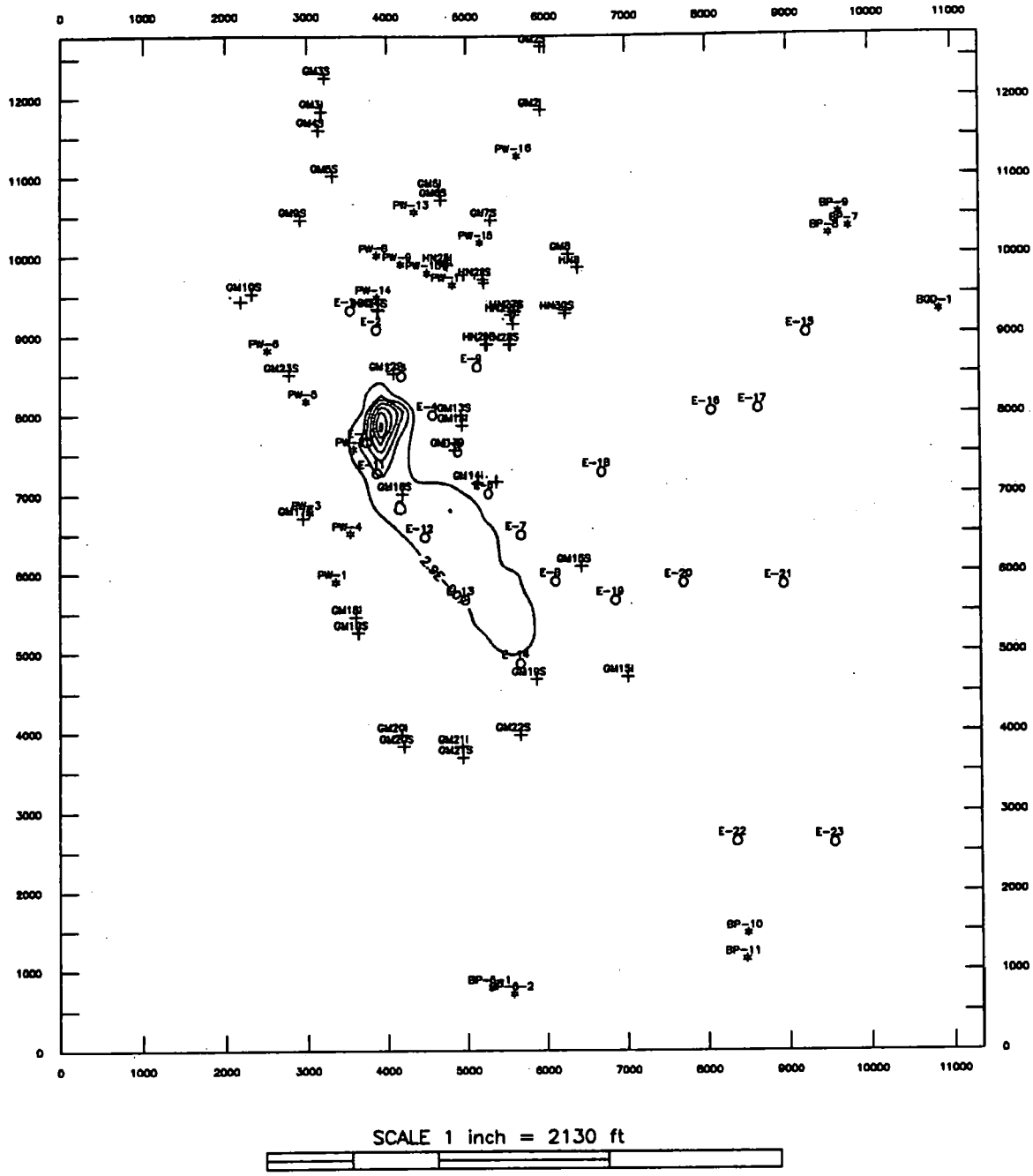
Figures 4-56 to 4-60 illustrate TCE concentrations in each model layer after 30 years of pumping the off-site remediation system. Figures 4-61 through 4-65 show TCA concentrations after 30 years, and Figures 4-66 to 4-70 show PCE concentrations after 30 years. Results of the contaminant transport modeling for TCE, TCA and PCE show significantly reduced levels of contamination at both on- and off-site locations compared to the initial chemical concentrations.

Figure 4-46 Layer 1, On-Site System, Second Run, TCA after 30 years, Contour Interval = 10 ppb.



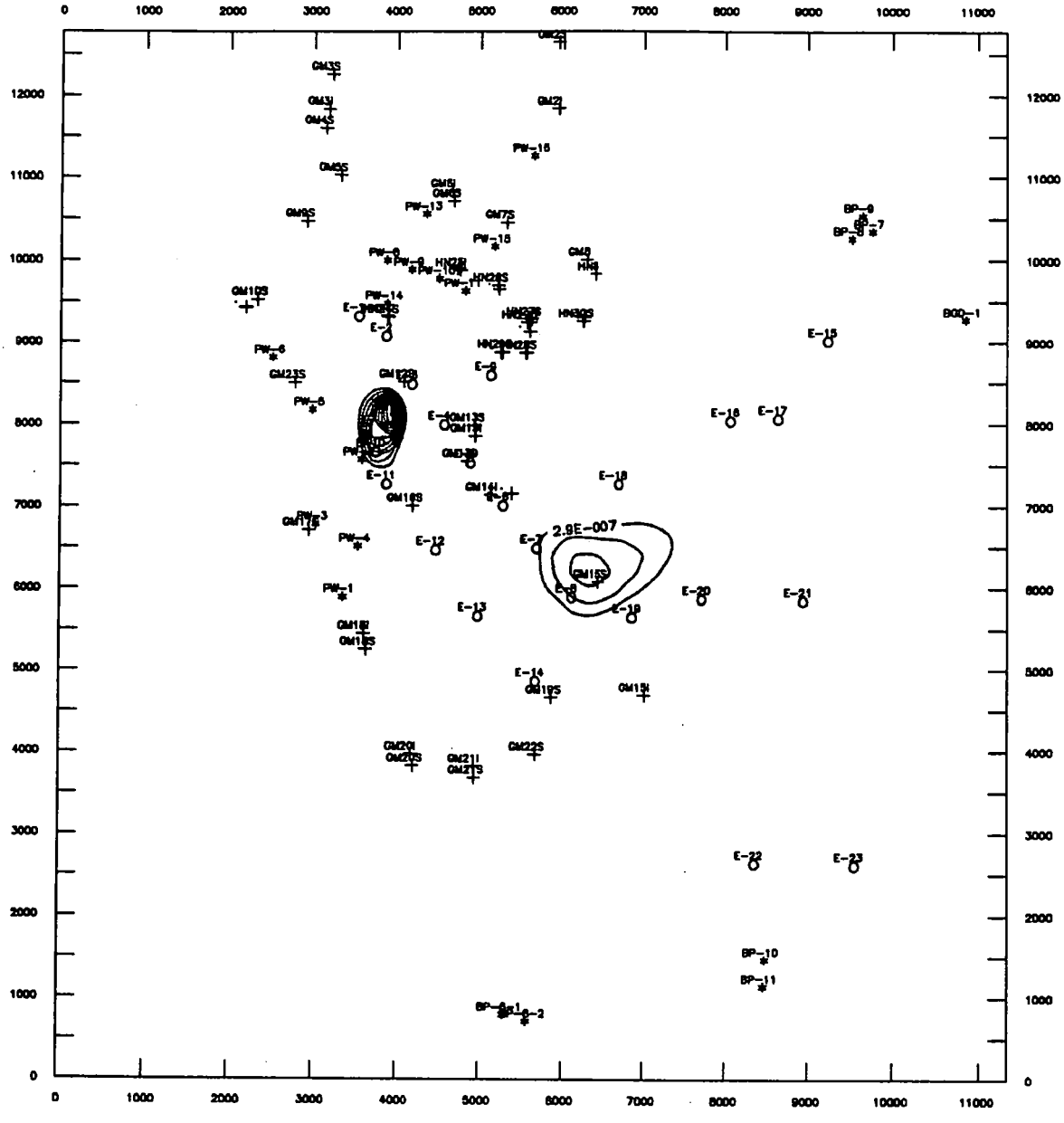
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-47 Layer 2, On-Site System, Second Run, TCA after 30 years, Contour Interval = 10 ppb.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

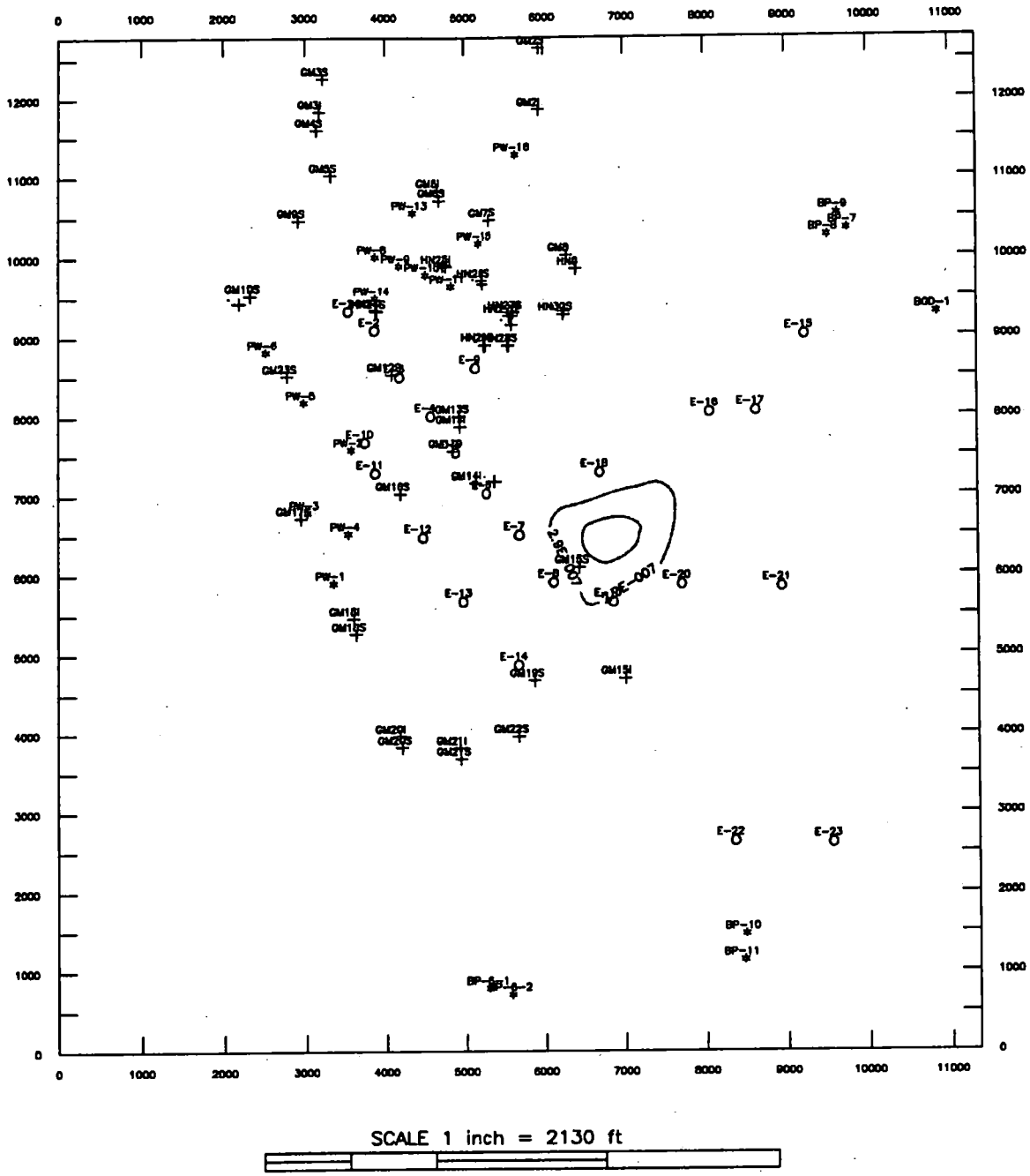
Figure 4-48 Layer 3, On-Site System, Second Run, TCA after 30 years, Contour Interval = 1 ppb.



SCALE 1 inch = 2130 ft

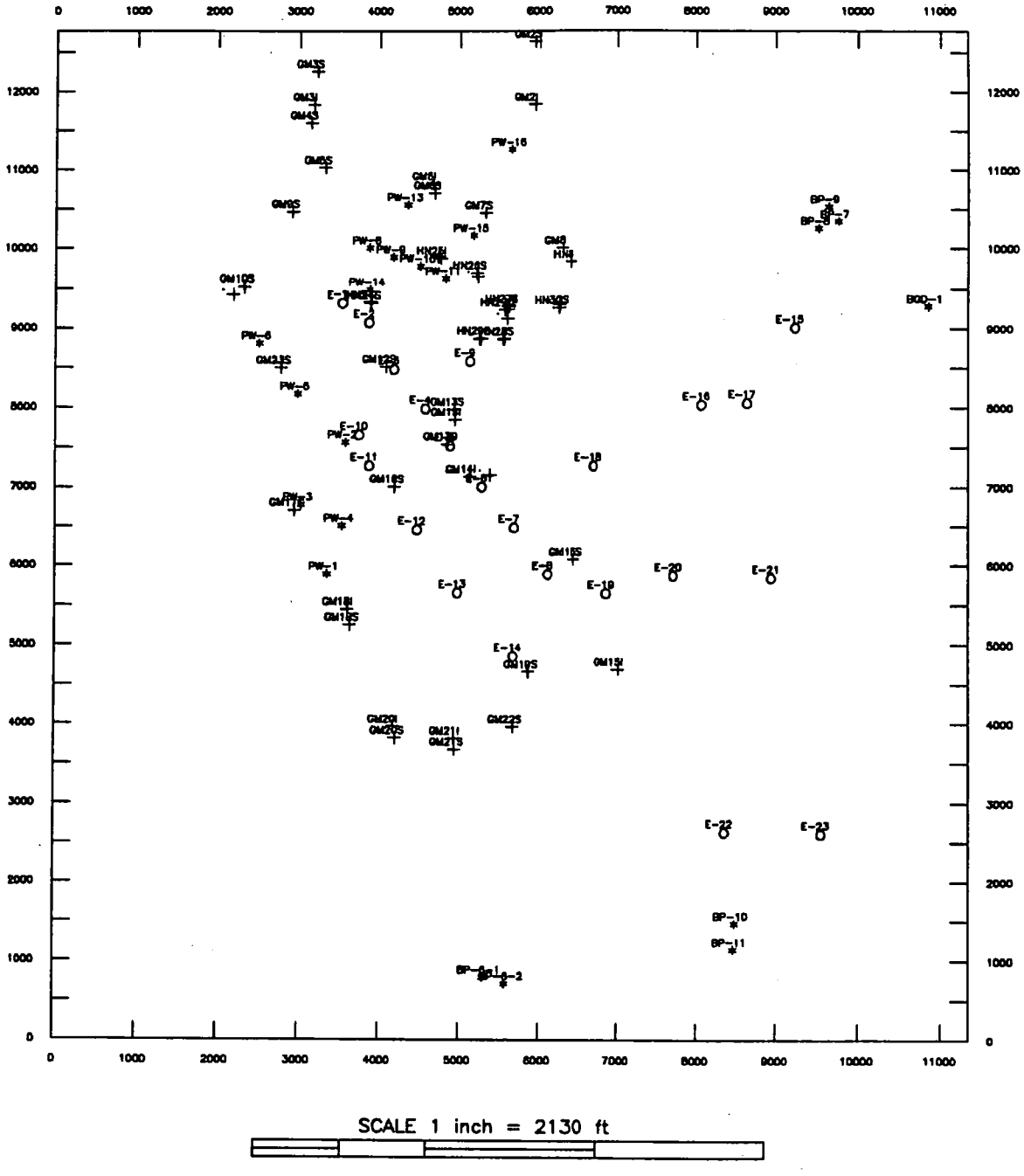
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-49 Layer 4, On-Site System, Second Run, TCA after 30 years, Contour Interval = 1 ppb.



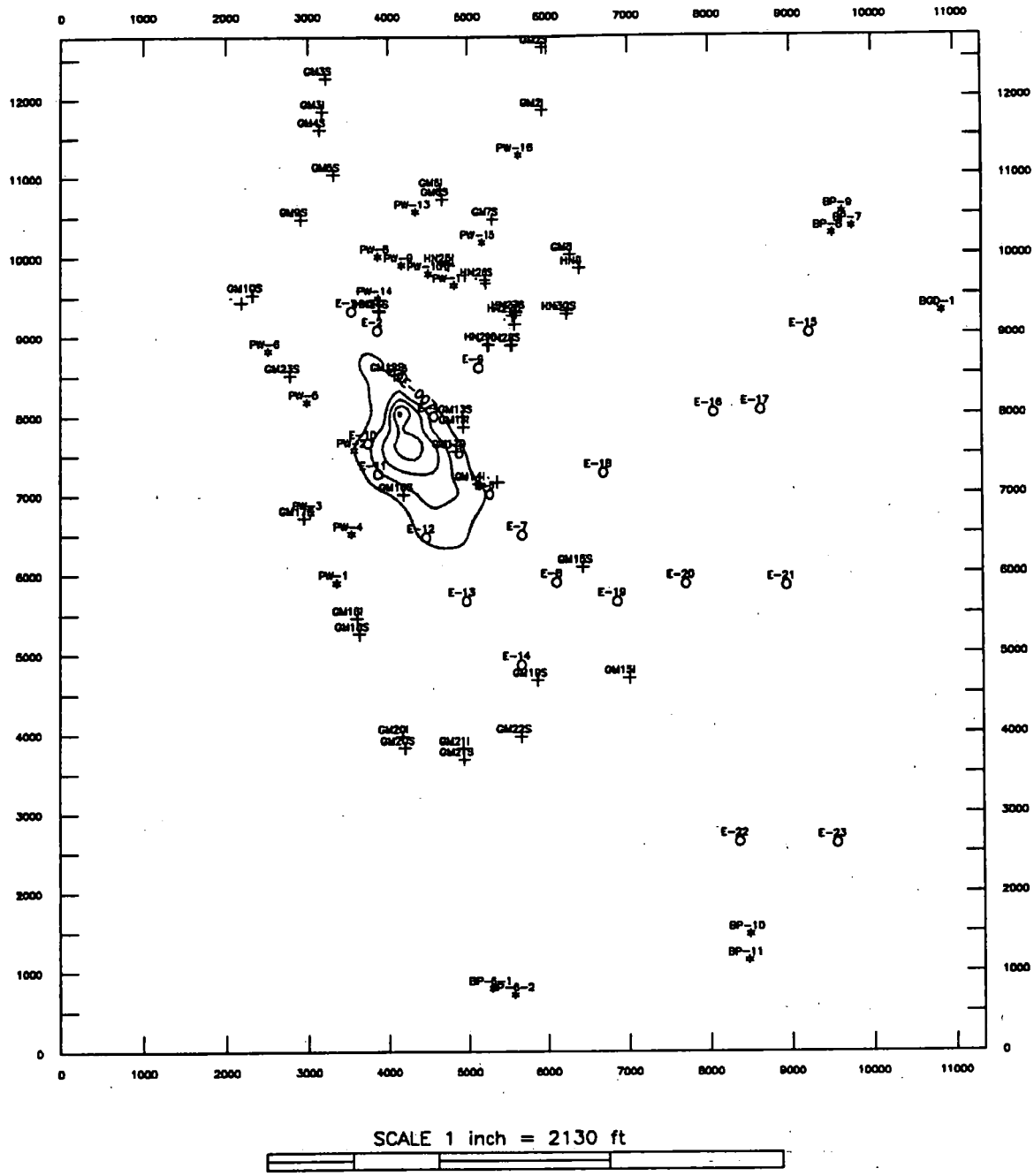
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-50 Layer 5, On-Site System, Second Run, TCA after 30 years, Contour Interval = 1 ppb.



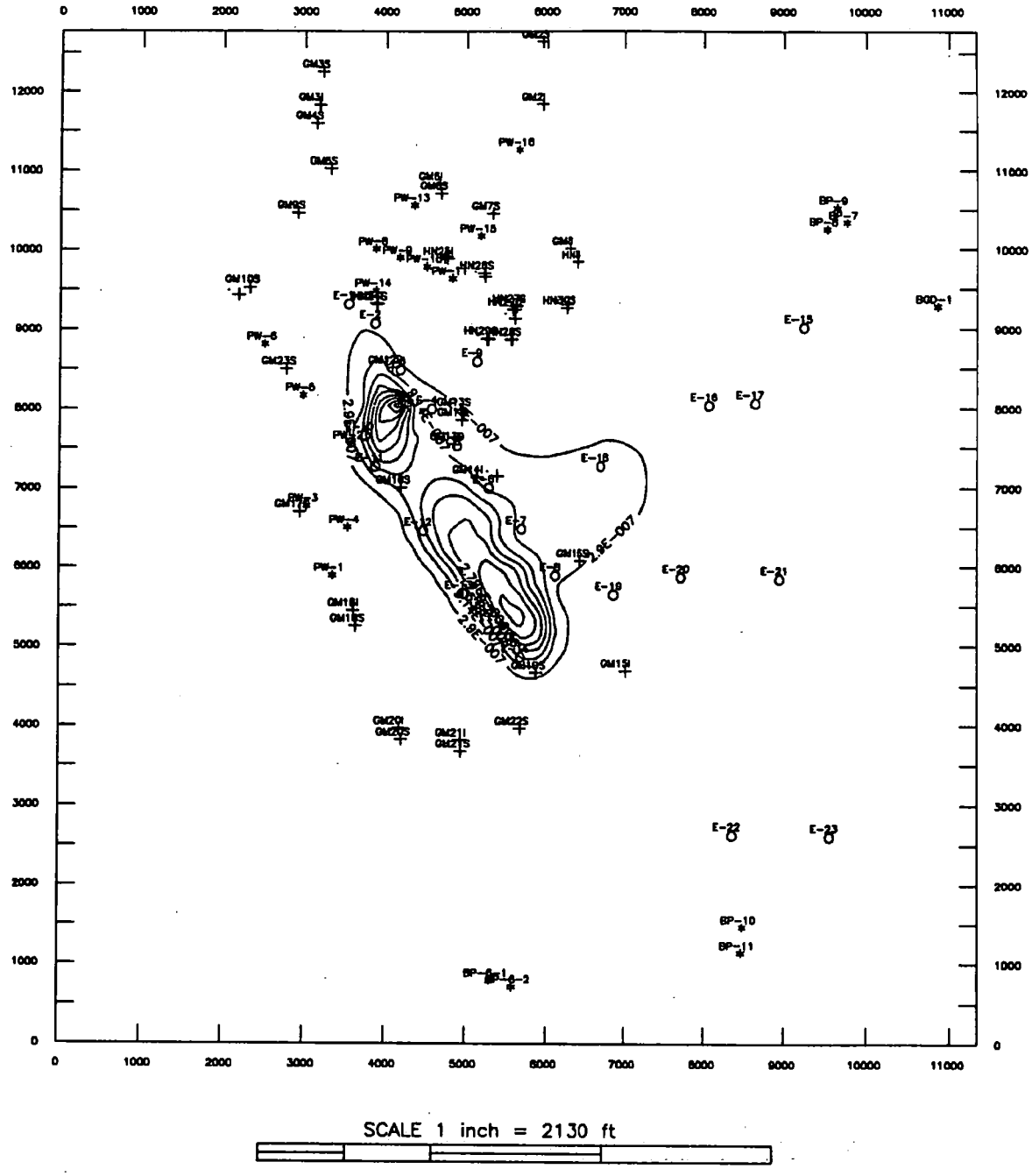
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-51 Layer 1, On-Site System, Second Run, PCE after 30 years, Contour Interval = 10 ppb.



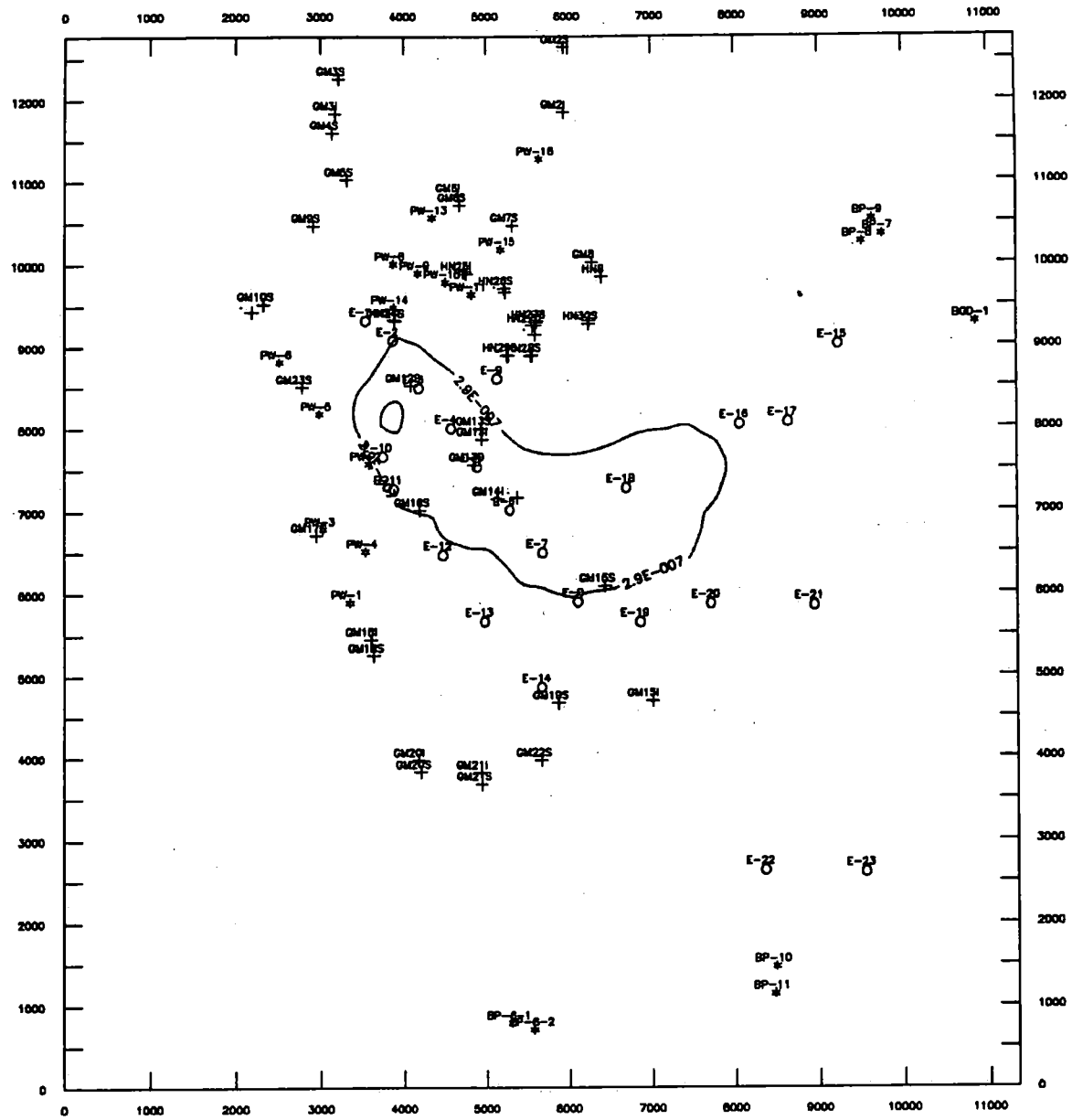
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-52 Layer 2, On-Site System, Second Run, PCE after 30 years, Contour Interval = 10 ppb.



* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

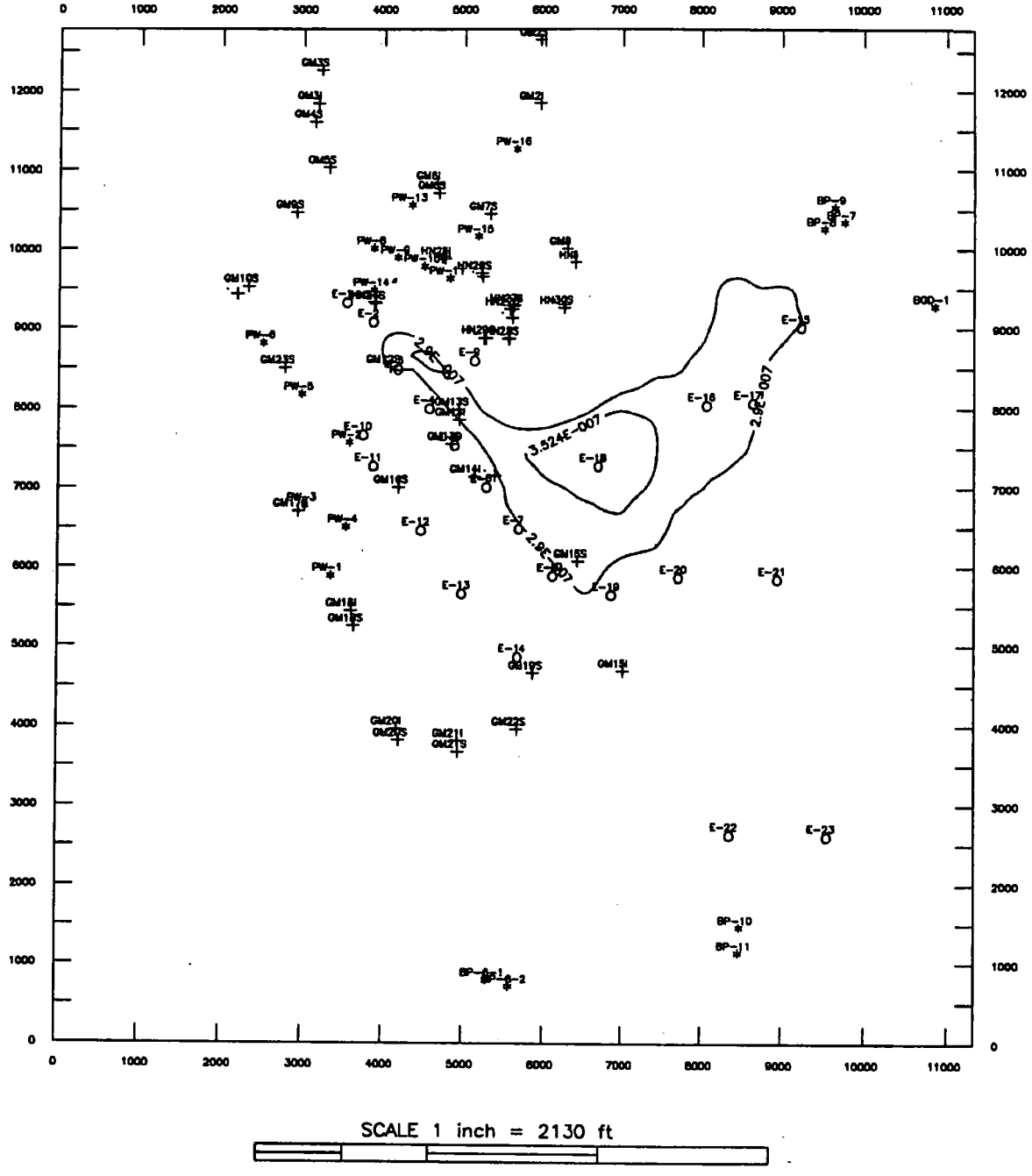
Figure 4-53 Layer 3, On-Site System, Second Run, PCE after 30 years, Contour Interval = 10 ppb.



SCALE 1 inch = 2130 ft

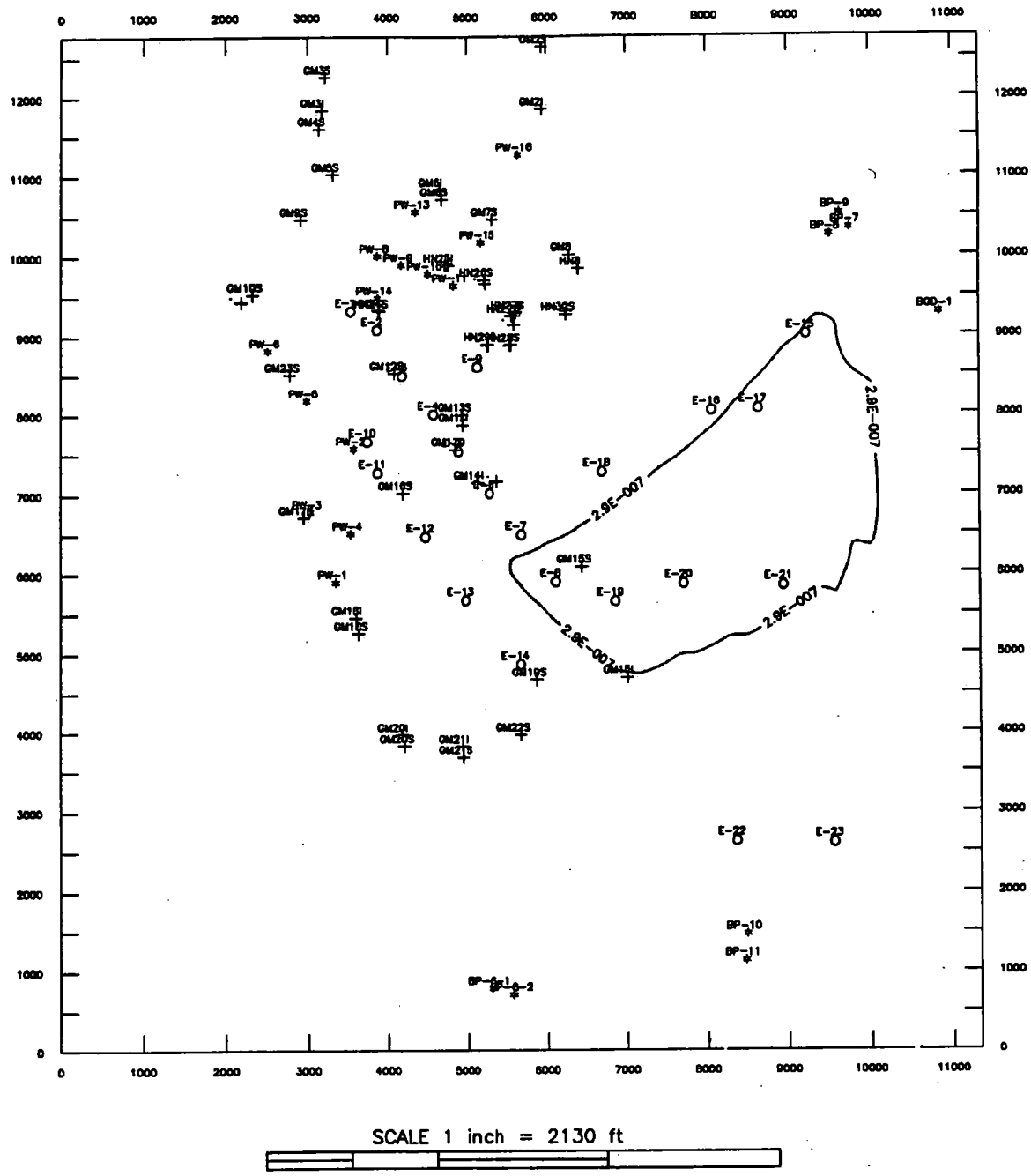
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-54 Layer 4, On-Site System, Second Run, PCE after 30 years, Contour Interval = 1 ppb.



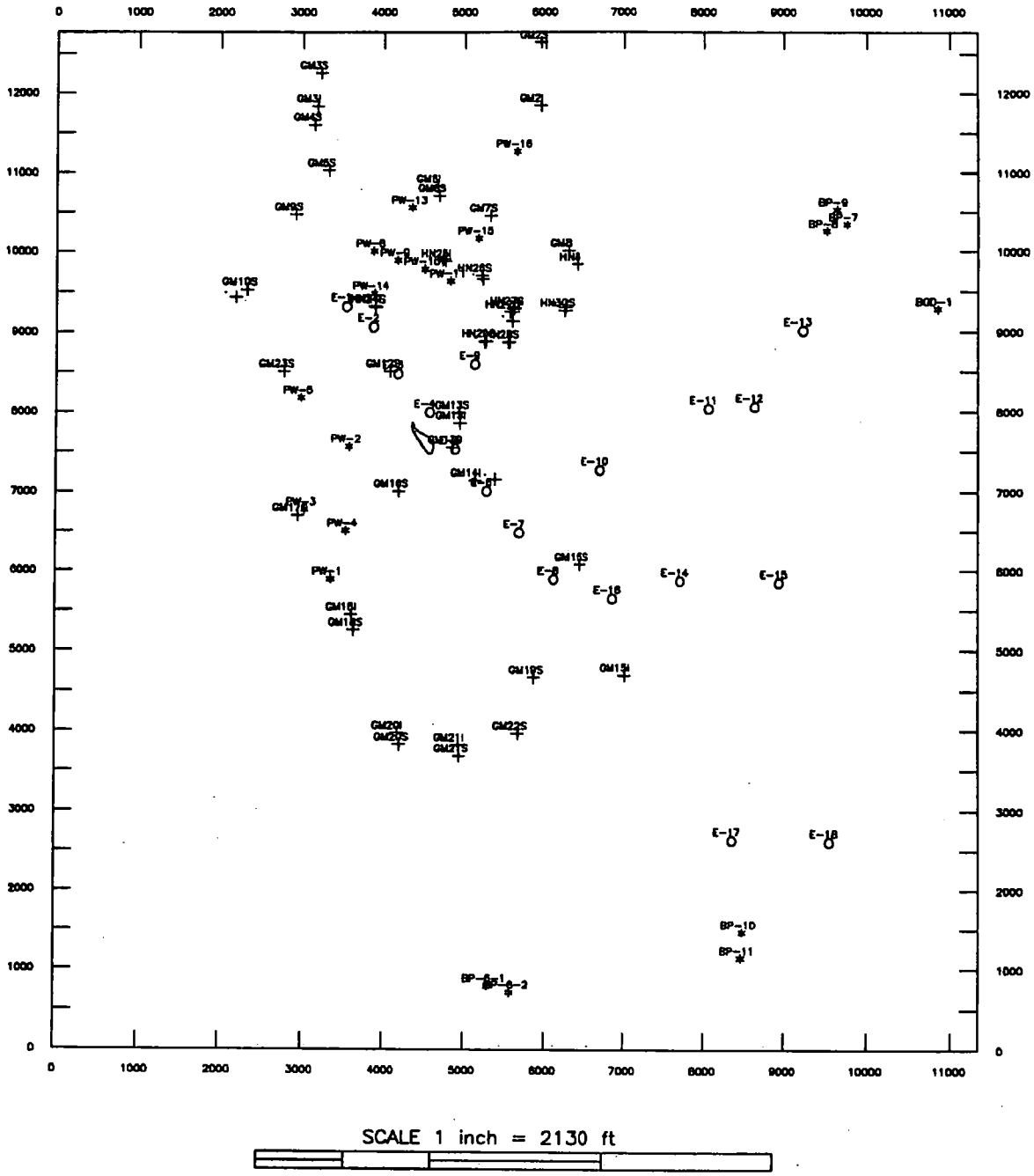
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-55 Layer 5, On-Site System, Second Run, PCE after 30 years, Contour Interval = 1 ppb.



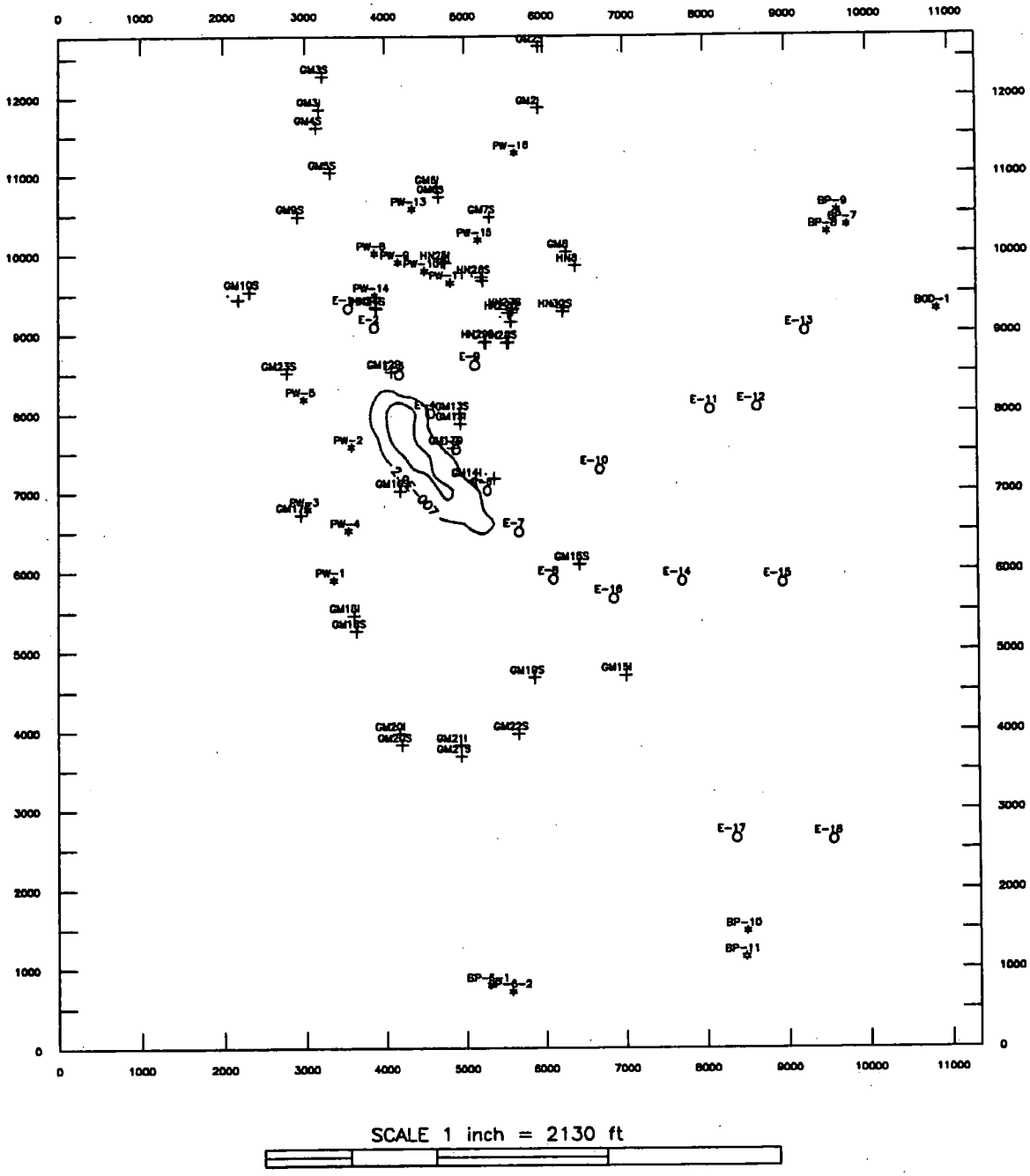
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-56 Layer 1, Off-Site System, TCE after 30 years, Contour Interval = 10 ppb.



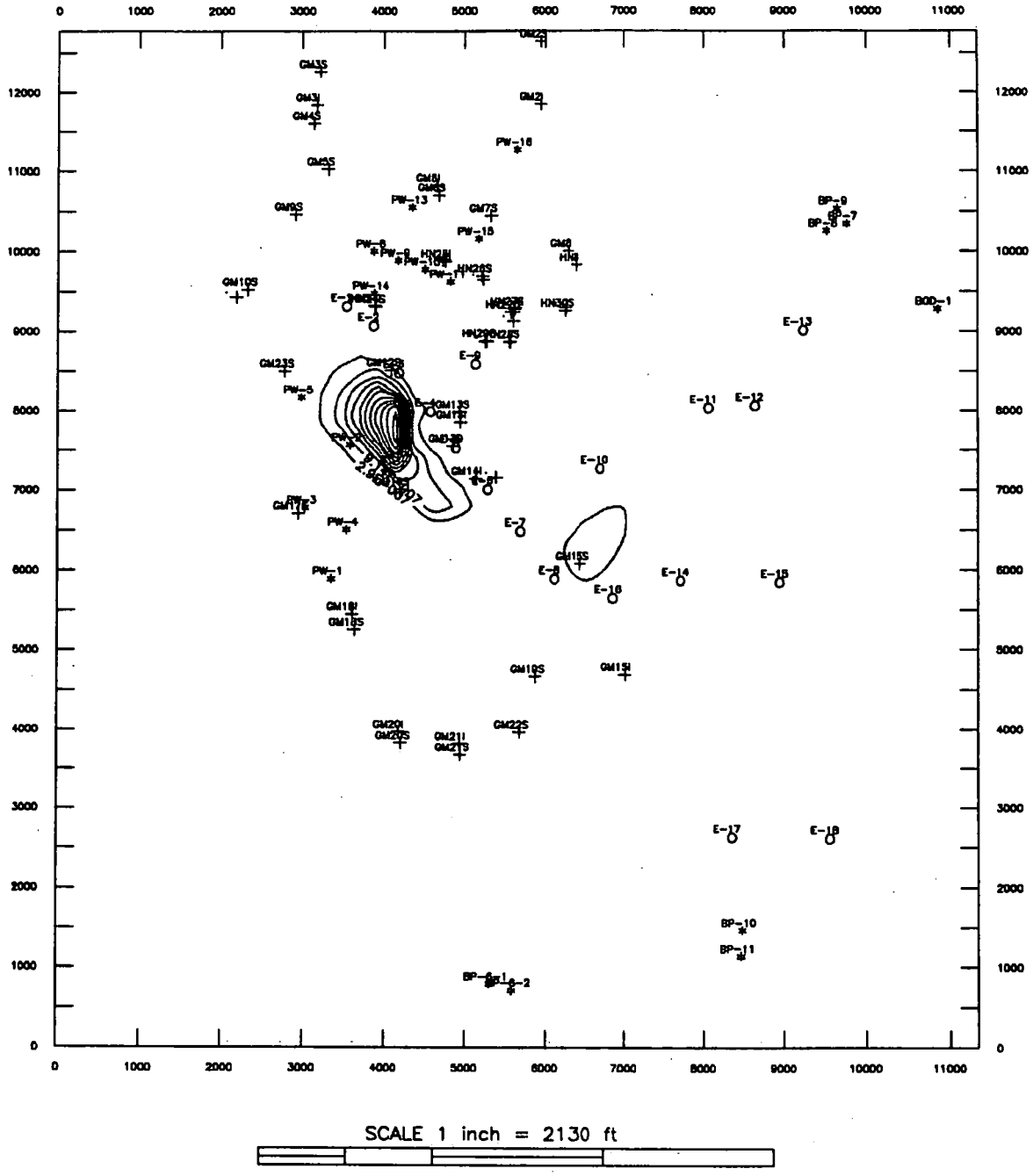
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-57 Layer 2, Off-Site System, TCE after 30 years, Contour Interval = 10 ppb.



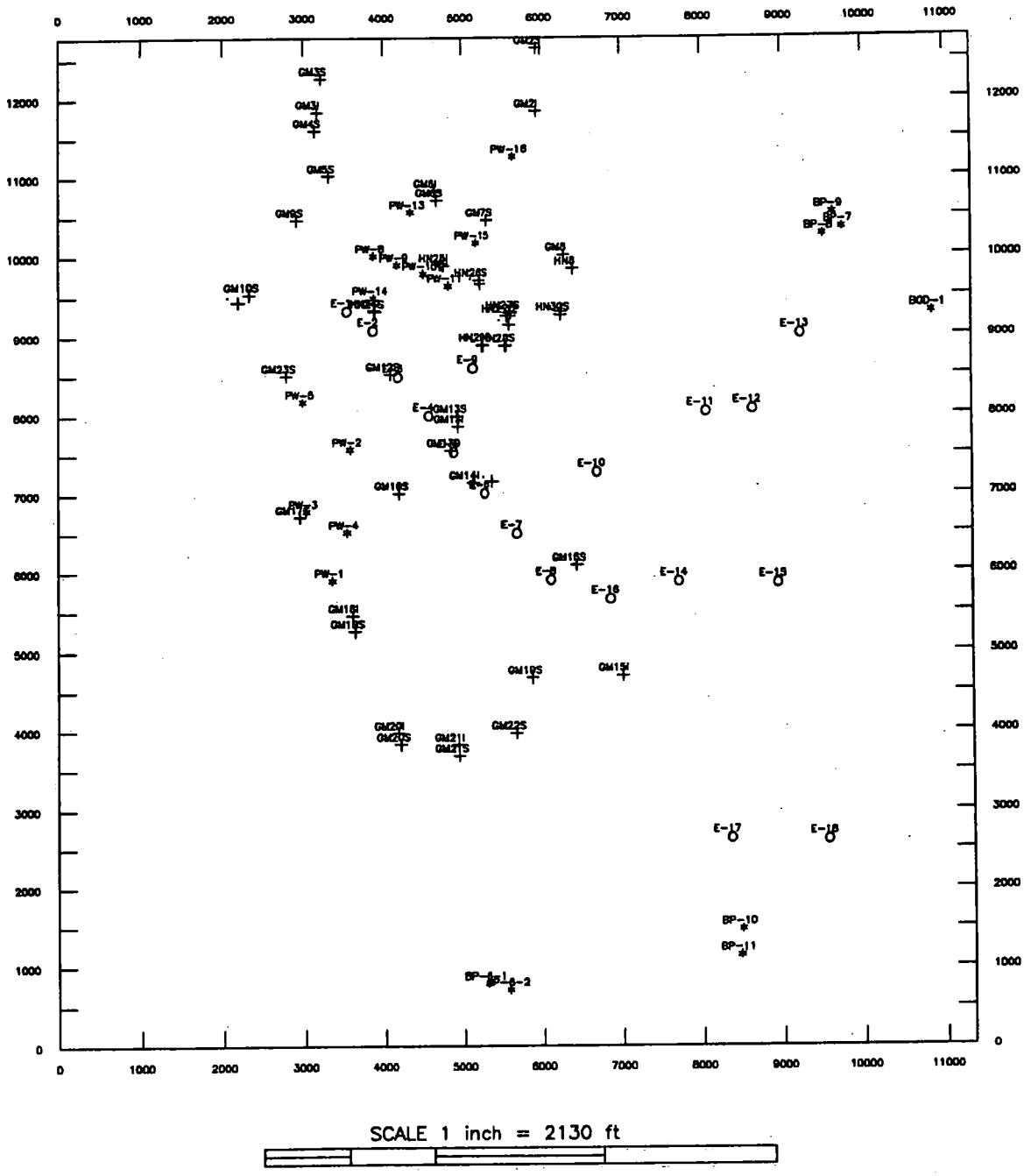
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-58 Layer 3, Off-Site System, TCE after 30 years, Contour Interval = 10 ppb.



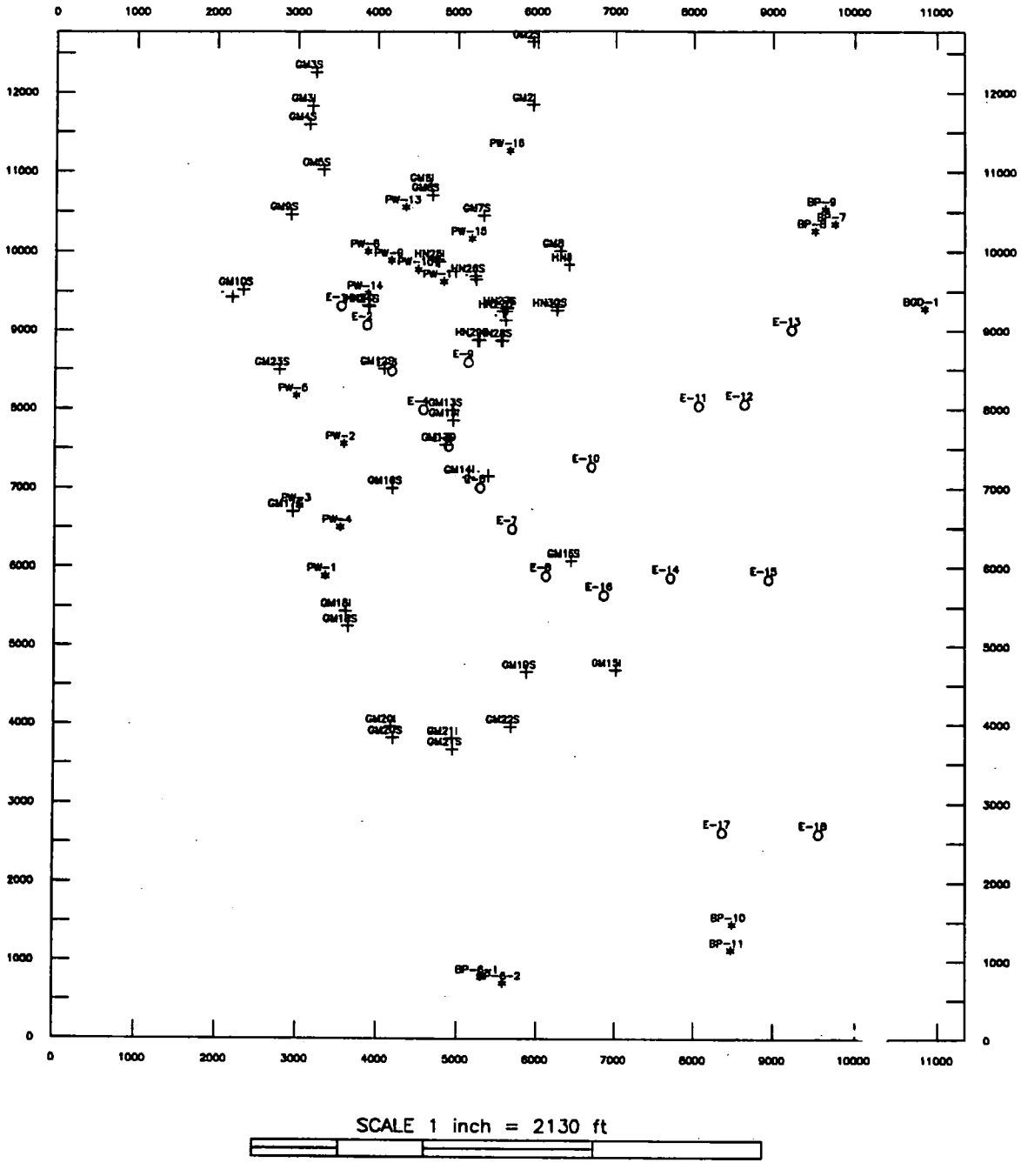
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-59 Layer 4, Off-Site System, TCE after 30 years, Contour Interval = 1 ppb.



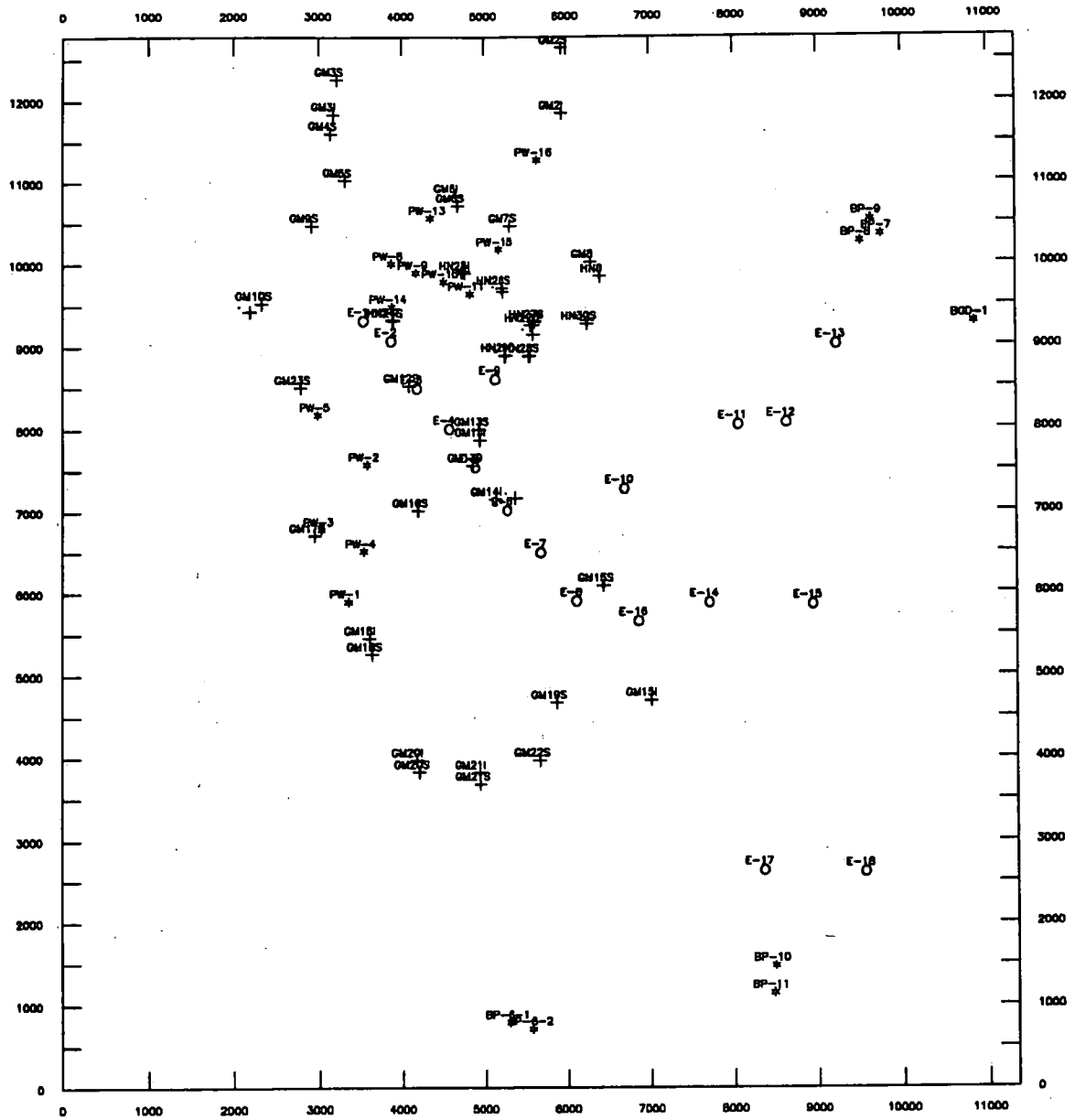
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-60 Layer 5, Off-Site System, TCE after 30 years, Contour Interval = 1 ppb.



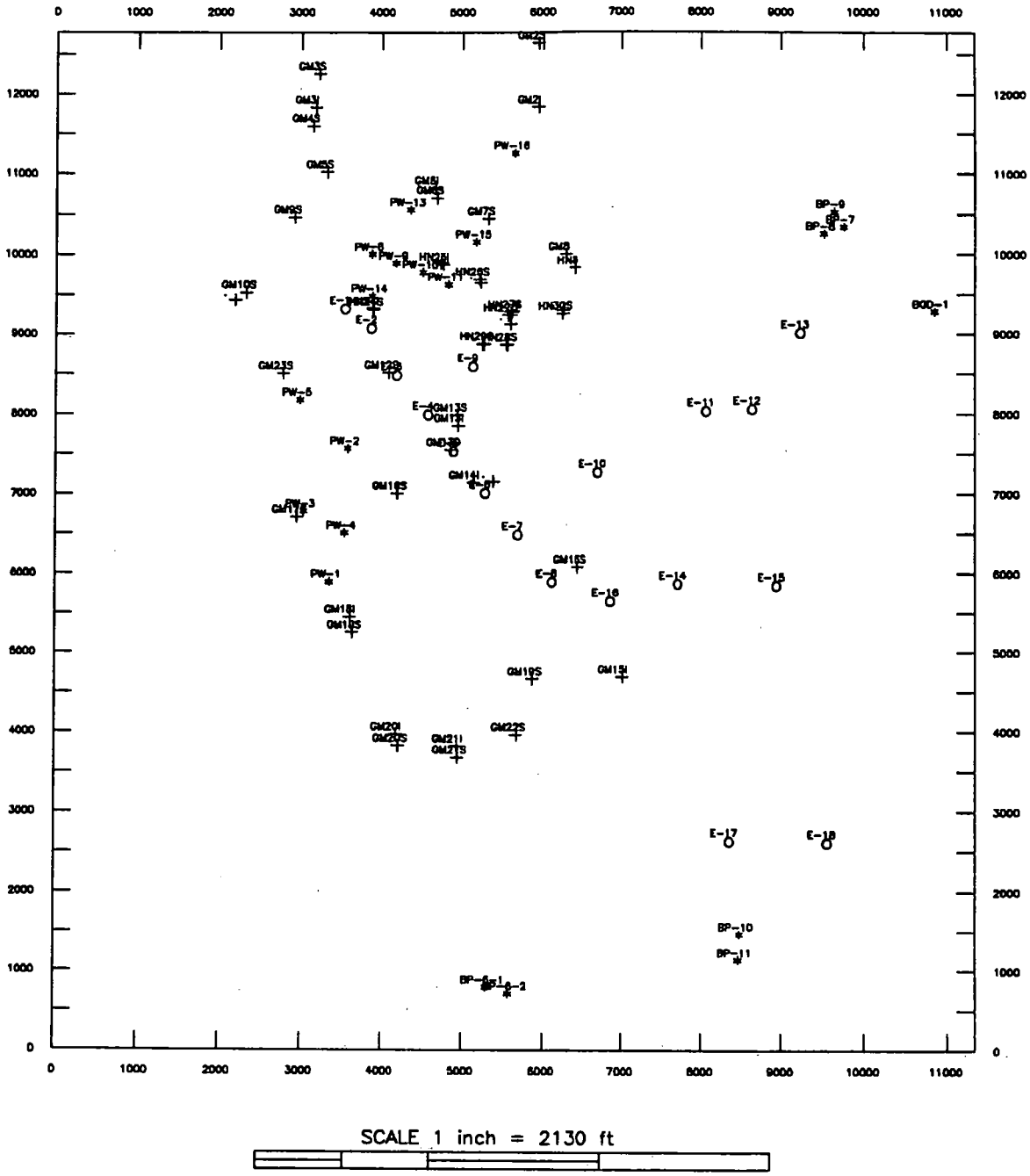
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-61 Layer 1, Off-Site System, TCA after 30 years, Contour Interval = 1 ppb.



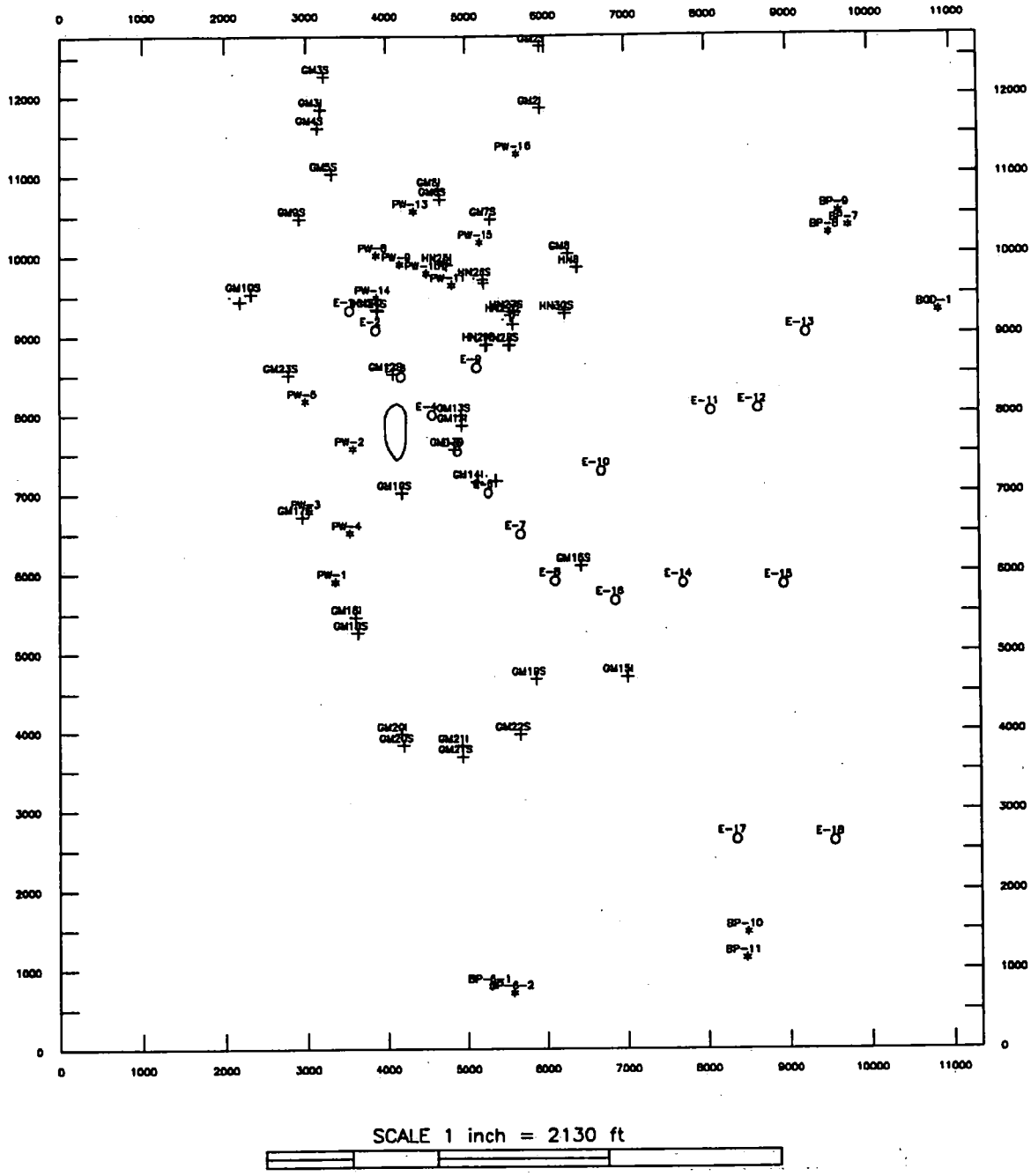
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-62 Layer 2, Off-Site System, TCA after 30 years, Contour Interval = 1 ppb.



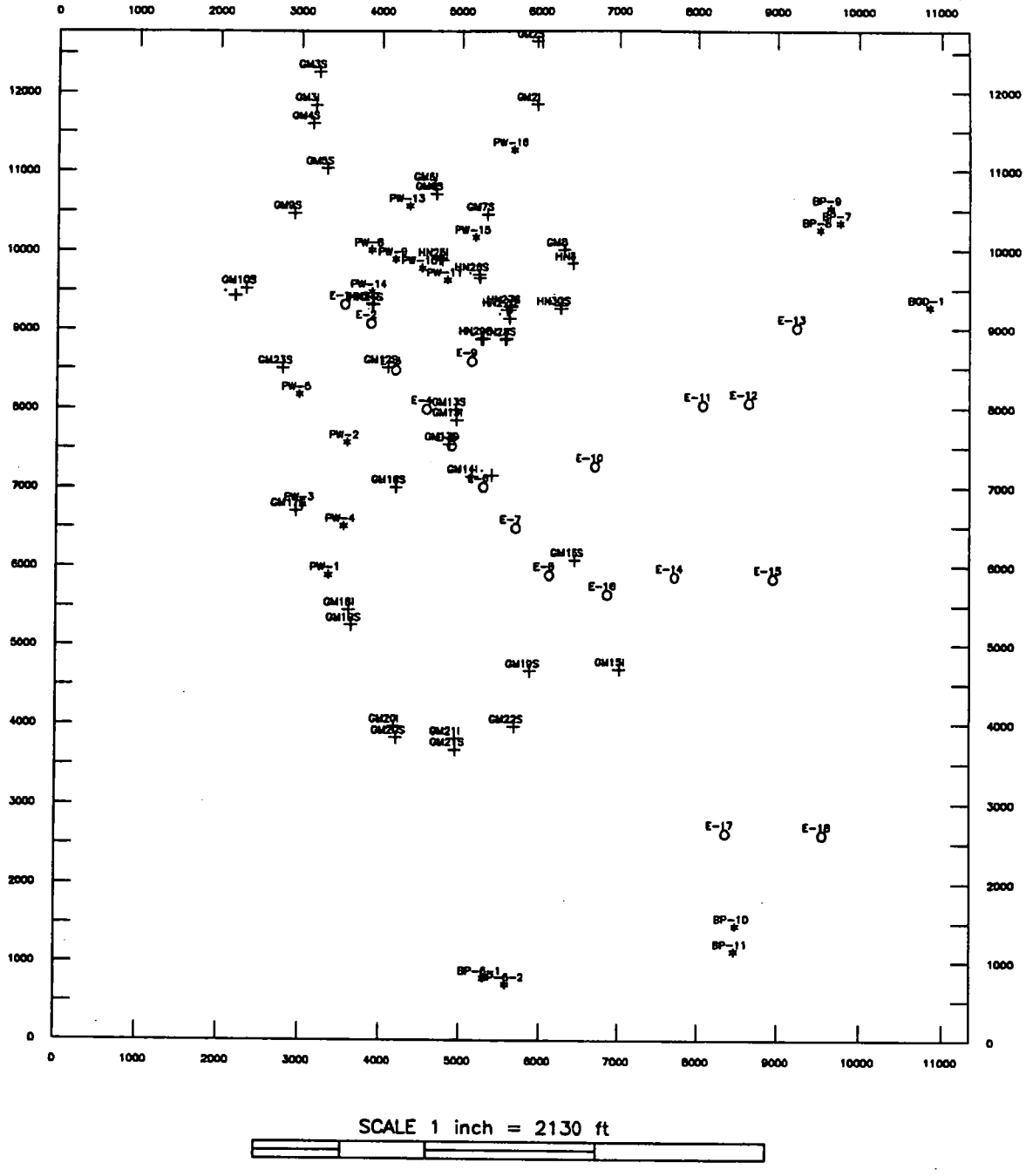
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-63 Layer 3, Off-Site System, TCA after 30 years, Contour Interval = 1 ppb.



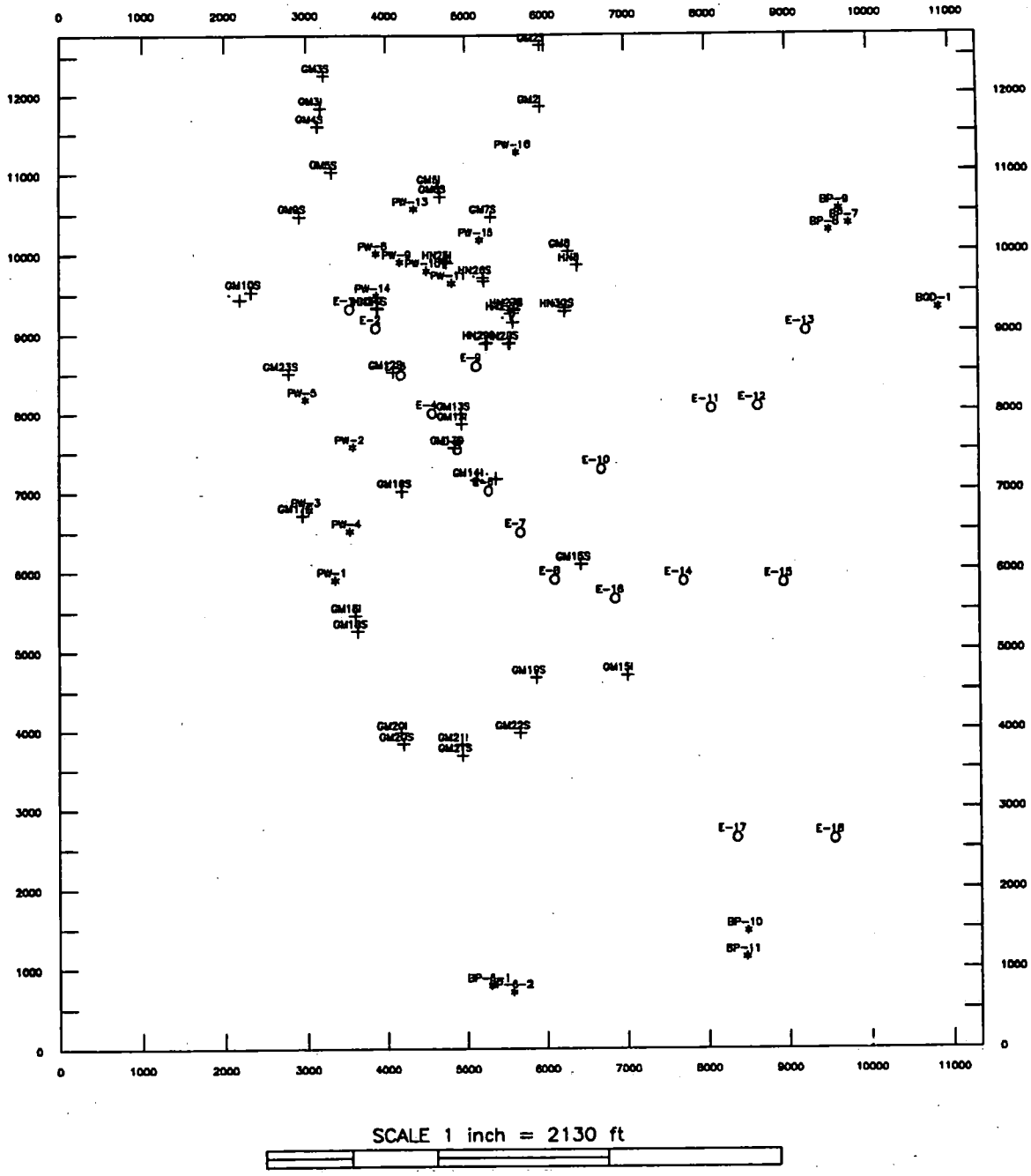
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-64 Layer 4, Off-Site System, TCA after 30 years, Contour Interval = 1 ppb.



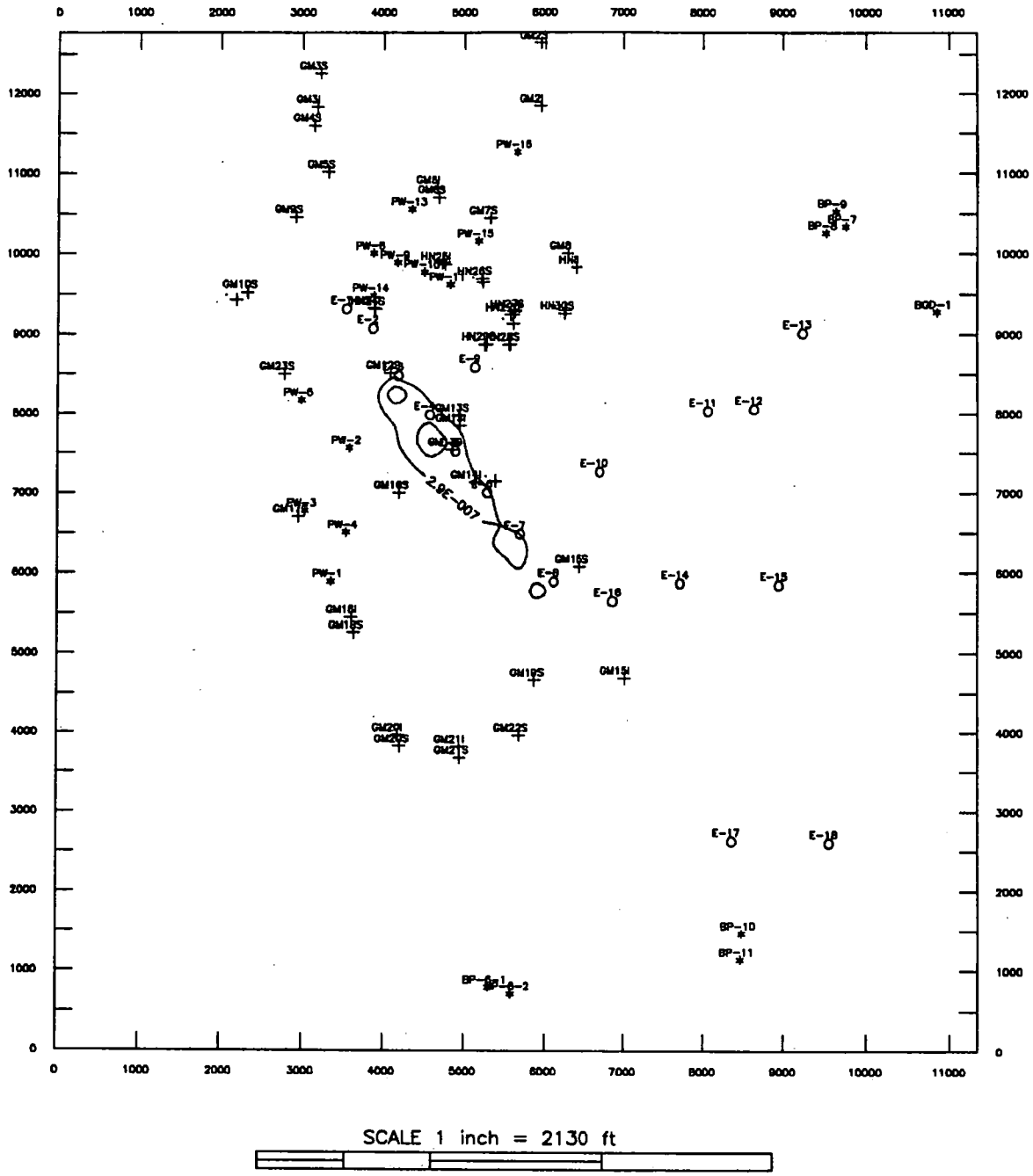
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-65 Layer 5, Off-Site System, TCA after 30 years, Contour Interval = 1 ppb.



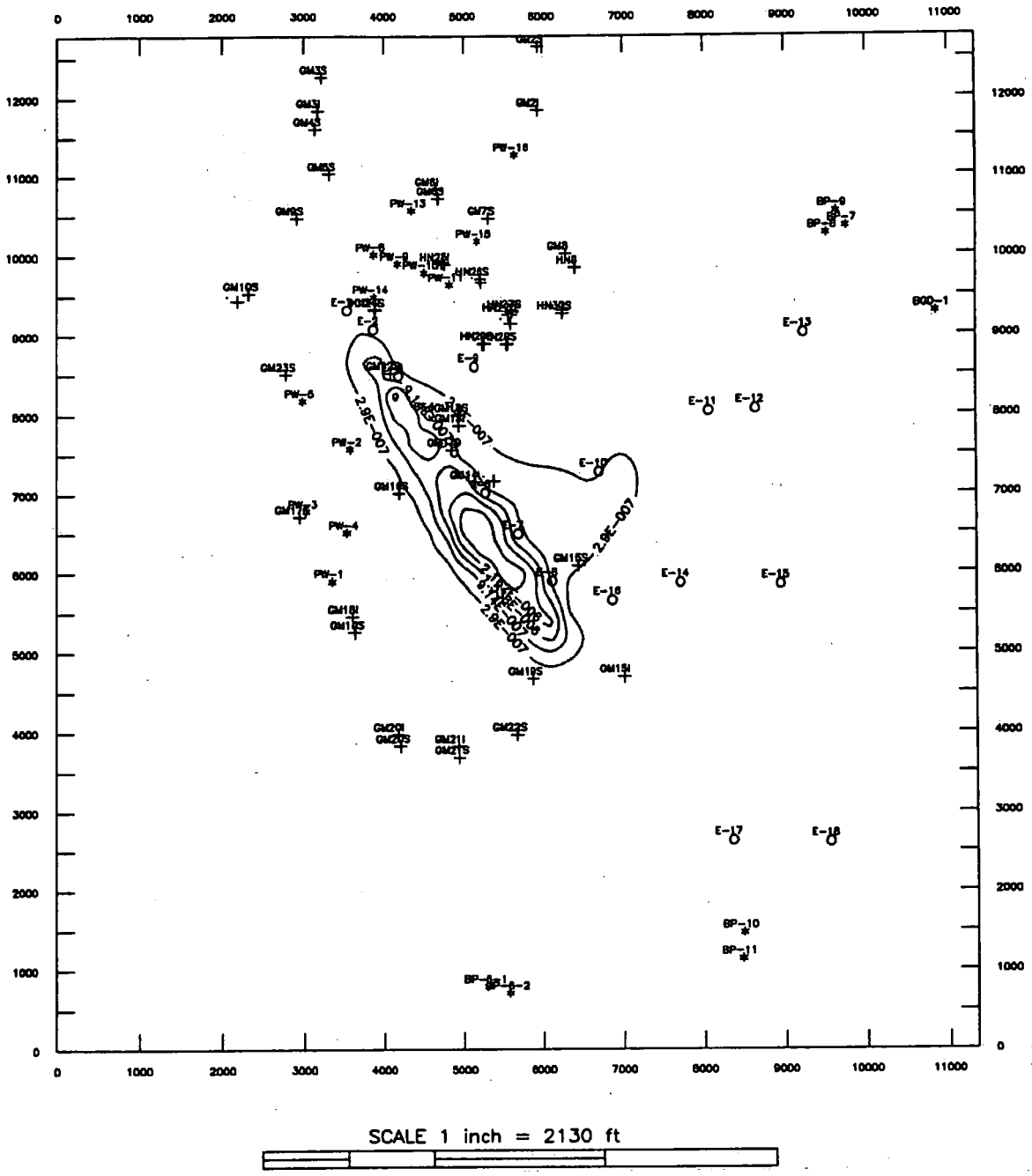
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-66 Layer 1, Off-Site System, PCE after 30 years, Contour Interval = 10 ppb.



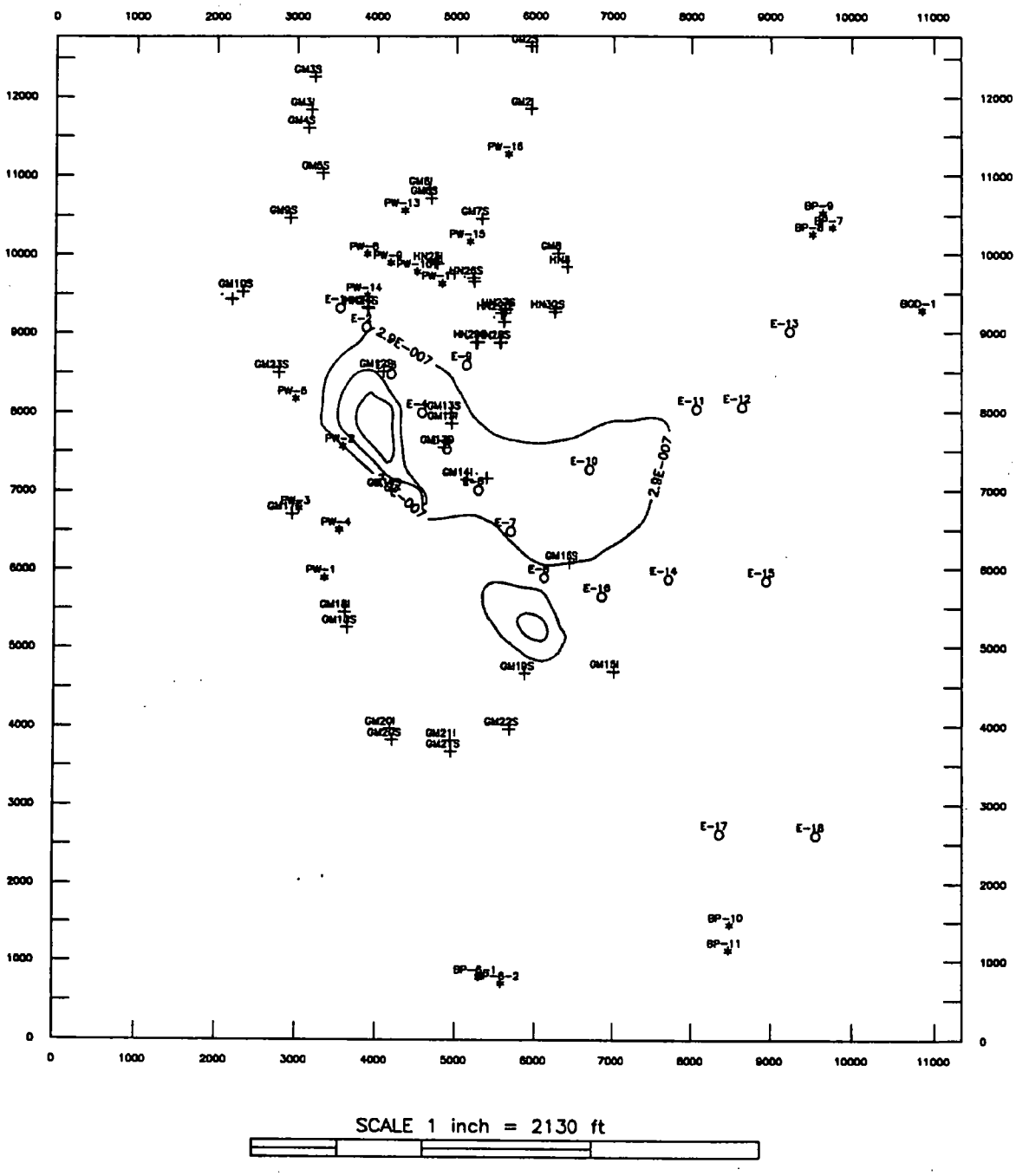
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-67 Layer 2, Off-Site System, PCE after 30 years, Contour Interval = 10 ppb.



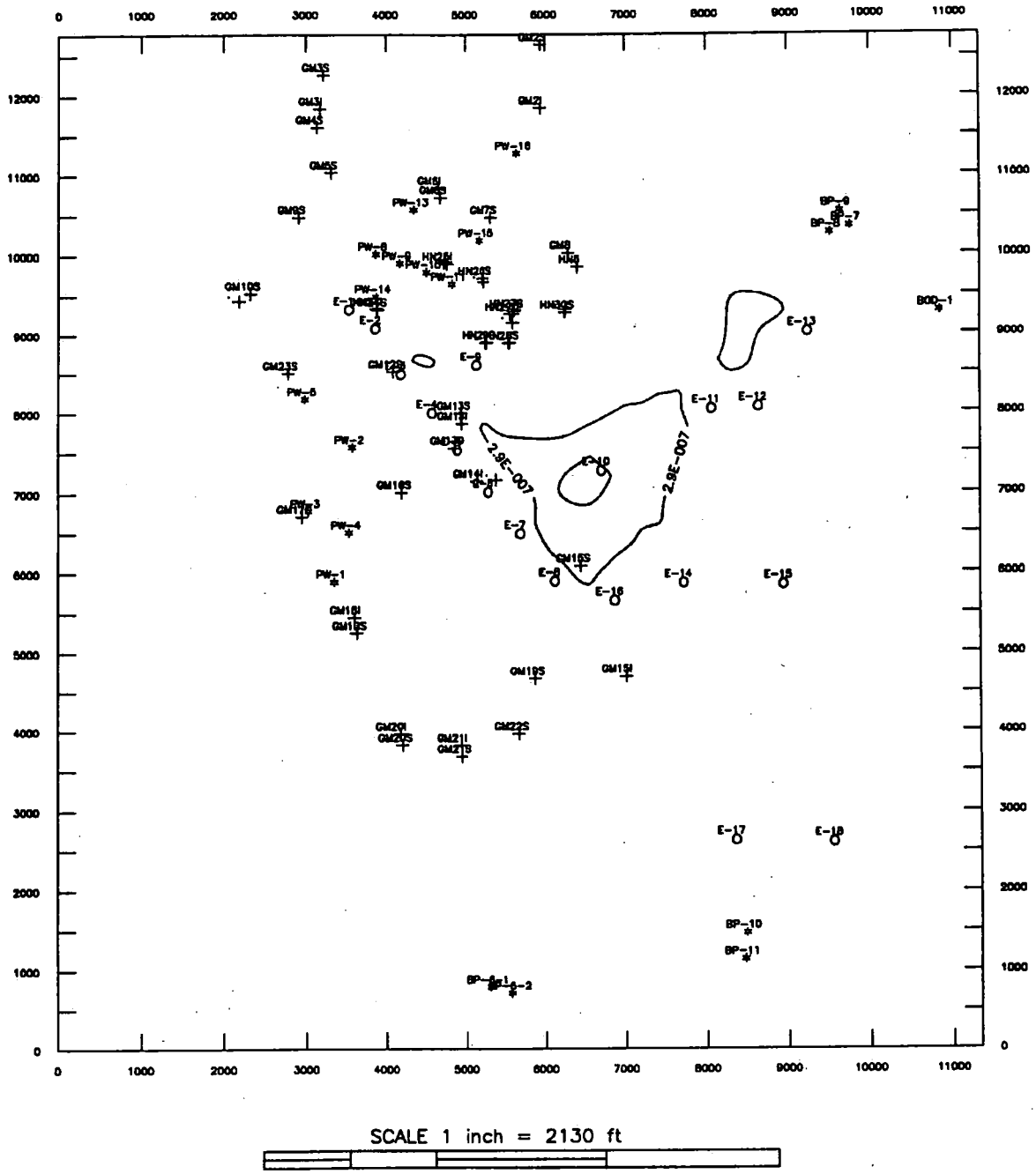
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-68 Layer 3, Off-Site System, PCE after 30 years, Contour Interval = 10 ppb.



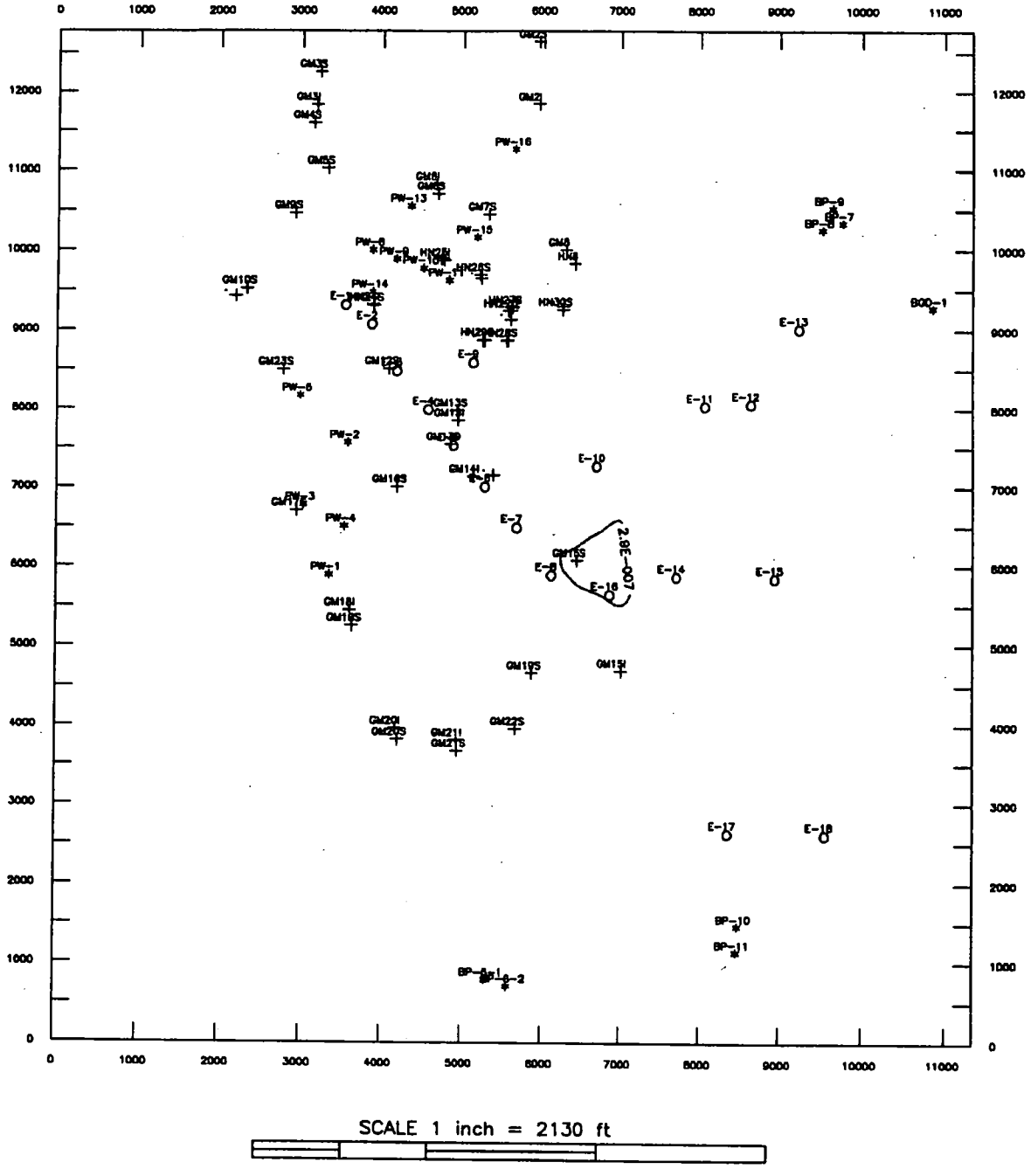
* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-69 Layer 4, Off-Site System, PCE after 30 years, Contour Interval = 10 ppb.



* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
0 = Extraction Well Location
Note: Starting concentration contour = 5 ppb

Figure 4-70 Layer 5, Off-Site System, PCE after 30 years, Contour Interval = 1 ppb.



* = Production Well Location
\+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location
Note: Starting concentration contour = 5 ppb

APPENDIX E

COST ESTIMATES

SOILS COST ESTIMATES

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
No Action
Alternative S1
(OMNWNA1) 2/11/94

Annual Costs

ITEM	ITEM $ COST PER 5 YEARS	NOTES
1. Site Review	20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	20000.00	Post Remedial monitoring will be performed for years 5,10,15,20,25,30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
No Action
Alternative S1
(PWANAS1) 2/11/94
56

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	0											
2. O & M COSTS		0										
3. ANNUAL COSTS	0	0	0	0	0	20	0	0	0	0	20	0
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	0	0	0	0	0	16	0	0	0	0	12	0

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	0	0	0	20	0	0	0	0	20	0	0	0
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	0	0	0	10	0	0	0	0	8	0	0	0

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	0	20	0	0	0	0	20	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	0	6	0	0	0	0	5	56

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Capping
Current Industrial Use
Alternative S2A
Sheet 1 of 2
(NWBS2A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	6	MO	1000.00				6000				6000	
2) Storage Trailer (1)	6	MO	500.00				3000				3000	
3) Construction Survey		LS	10000.00				10000				10000	
4) Portable Communication Equipment	4	SETS	1500.00				6000				6000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	6	MO	4000.00				24000				24000	
7) Security	6	MO	10000.00				60000				60000	
8) Decontamination Trailer	6	MO	1500.00				9000				9000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	24	WKS	250.00				6000				6000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	6	MO	1200.00				7200				7200	
4) Decon Water	79200	GAL	.20				15840				15840	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	18	CY		70.00	125.00	5.00		1260	2250	90	3600	
b) Gravel Base - 4"	18	CY		7.50	3.33	8.00		135	60	144	339	
c) Curb	360	LF		3.07	1.99	.05		1105	716	18	1840	
6) Clean Water Storage Tank	3			3000.00	300.00			9000	900		9900	3000 Gallon
7) Spent Water Storage Tank	3			5000.00	400.00			15000	1200		16200	5000 Gallon
CAPPING												
1) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
2) Clay Layer - 12"	21067	CY		8.00	2.70	7.43		168536	56881	156528	381945	
a) Place, Spread & Compact	21067	CY			.84	2.67			17696	56249	73945	
3) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
4) Filter Fabric - 2 Layers	126400	SY	1.70				214880				214880	
5) Soil - 24"	42133	CY		4.50	2.70	7.43			113759	313048	426807	
a) Place & Spread	42133	CY			.63	.57			26544	24016	50560	
6) Revegetation	569	MSF		24.60	8.40	6.68		13997	4780	3801	22578	
							386920	370490	339192	770656	1867258	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Capping
Current Industrial Use
Alternative S2A
Sheet 2 of 2
(NWBS2A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							386920	370490	339192	770656	1867258	
Burden @ 30% of Labor Cost									101758		101758	
Labor @ 10% of Labor Cost									33919		33919	
Material @ 10% of Material Cost								37049			37049	
SubContract @ 10% of Sub. Cost							38692				38692	
Total Direct Cost							425612	407539	474869	770656	2078676	
Indirects @ 75% of Total Direct Labor Cost									356151		356151	
Profit @ 10% of Total Direct Cost											207868	
											2642695	
Health & Safety Monitoring @ 10%											264269	
Total Field Cost											2906964	
Contingency @ 20% of Total Field Cost											581393	
Engineering @ 10% of Total Field Cost											290696	
TOTAL COST THIS PAGE											3779054	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Cap
Current Industrial Use
Alternative S2A
(OMNWC2A) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Cap Maintenance	15000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	15000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Cap
Current Industrial Use
Alternative S2A
(PWANAS2A) 2/12/94
4065

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	3779.1											
2. O & M COSTS		15										
3. ANNUAL COSTS	3779.1	15	15	15	15	35	15	15	15	15	35	15
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	3779	14	14	13	12	27	11	11	10	10	21	9

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	15	15	15	35	15	15	15	15	35	15	15	15
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	8	8	8	17	7	7	6	6	13	5	5	5

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	15	35	15	15	15	15	35	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	5	10	4	4	4	4	8	4065

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Capping
Future Residential Use
Alternative S2B
Sheet 1 of 2
(NWBS2B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	6	MO	1000.00				6000				6000	
2) Storage Trailer (1)	6	MO	500.00				3000				3000	
3) Construction Survey		LS	10000.00				10000				10000	
4) Portable Communication Equipment	4	SETS	1500.00				6000				6000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	6	MO	4000.00				24000				24000	
7) Security	6	MO	10000.00				60000				60000	
8) Decontamination Trailer	6	MO	1500.00				9000				9000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	24	WKS	250.00				6000				6000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	6	MO	1200.00				7200				7200	
4) Decon Water	79200	GAL	.20				15840				15840	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	18	CY		70.00	125.00	5.00		1260	2250	90	3600	
b) Gravel Base - 4"	18	CY		7.50	3.33	8.00		135	60	144	339	
c) Curb	360	LF		3.07	1.99	.05		1105	716	18	1840	
6) Clean Water Storage Tank	3			3000.00	300.00			9000	900		9900	3000 Gallon
7) Spent Water Storage Tank	3			5000.00	400.00			15000	1200		16200	5000 Gallon
CAPPING												
1) Gravel Layer - 6"	9767	CY		6.00	2.70	7.43		58602	26371	72569	157542	
a) Place, Spread & Compact	9767	CY			.84	2.67			8204	26078	34282	
2) Clay Layer - 12"	19533	CY		8.00	2.70	7.43		156264	52739	145130	354133	
a) Place, Spread & Compact	19533	CY			.84	2.67			16408	52153	68561	
3) Gravel Layer - 6"	9767	CY		6.00	2.70	7.43		58602	26371	72569	157542	
a) Place, Spread & Compact	9767	CY			.84	2.67			8204	26078	34282	
4) Filter Fabric - 2 Layers	117200	SY	1.70				199240				199240	
5) Soil - 24"	39067	CY		4.50	2.70	7.43			105481	290268	395749	
a) Place & Spread	39067	CY			.63	.57			24612	22268	46880	
6) Revegetation	527	MSF		24.60	8.40	6.68		12964	4427	3520	20911	
							371280	347993	317776	714881	1751929	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Capping
Future Residential Use
Alternative S2B
Sheet 2 of 2
(NWBS2B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							371280	347993	317776	714881	1751929	
Burden @ 30% of Labor Cost									95333		95333	
Labor @ 10% of Labor Cost									31778		31778	
Material @ 10% of Material Cost								34799			34799	
SubContract @ 10% of Sub. Cost							37128				37128	
Total Direct Cost							408408	382792	444886	714881	1950967	
Indirects @ 75% of Total Direct Labor Cost									333664		333664	
Profit @ 10% of Total Direct Cost											195097	
											2479728	
Health & Safety Monitoring @ 10%											247973	
Total Field Cost											2727701	
Contingency @ 20% of Total Field Cost											545540	
Engineering @ 10% of Total Field Cost											272770	
TOTAL COST THIS PAGE											3546011	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Cap
Future Residential Use
Alternative S2B
(OMNWC2B) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Cap Maintenance	14000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	14000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Impermeable Cap
Future Residential Use
Alternative S2B
(PWANAS2B) 2/11/94
3817

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	3546											
2. O & M COSTS		14										
3. ANNUAL COSTS	3546	14	14	14	14	34	14	14	14	14	34	14
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	3546	13	13	12	12	27	10	10	9	9	21	8

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	14	14	14	34	14	14	14	14	34	14	14	14
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	8	7	7	16	6	6	6	6	13	5	5	5

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	14	34	14	14	14	14	34	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	4	10	4	4	4	3	8	3817

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Alternative S3
Sheet 1 of 2
(NWBS3)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	18	MO	1000.00				18000				18000	
2) Storage Trailer (1)	18	MO	500.00				9000				9000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00				9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	18	MO	4000.00				72000				72000	
7) Security	18	MO	10000.00				180000				180000	
8) Decontamination Trailer	18	MO	1500.00				27000				27000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	72	WKS	250.00				18000				18000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	18	MO	1200.00				21600				21600	
4) Decon Water	237600	GAL	.20				47520				47520	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	239900	CY	35.00				8396500				8396500	
2) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
RESTORATION												
1) Backfill	900	CY		4.00	2.70	7.43		3600	2430	6687	12717	
a) Place, Spread & Compact	900	CY			.84	2.67			756	2403	3159	
2) Revegetation	90	MSF		24.60	8.40	6.68		2214	756	601	3571	
							9797455	157073	91845	121475	10167847	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Alternative S3
Sheet 2 of 2
(NWBS3)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							9797455	157073	91845	121475	10167847	
Burden @ 30% of Labor Cost									27553		27553	
Labor @ 10% of Labor Cost									9184		9184	
Material @ 10% of Material Cost								15707			15707	
SubContract @ 10% of Sub. Cost							979746				979746	
Total Direct Cost							10777201	172780	128583	121475	11200038	
Indirects @ 75% of Total Direct Labor Cost									96437		96437	
Profit @ 10% of Total Direct Cost											1120004	
											12416478	
Health & Safety Monitoring @ 6%											744989	
Total Field Cost											13161467	
Contingency @ 20% of Total Field Cost											2632293	
Engineering @ 8% of Total Field Cost											1052917	
TOTAL COST THIS PAGE											16846678	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Alternative S3
(OMNWIV3) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Gravel Maintenance	10000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	10000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Alternative S3
(PWANAS3) 2/11/94
17056

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	16847											
2. O & M COSTS		10										
3. ANNUAL COSTS	16847	10	10	10	10	30	10	10	10	10	30	10
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	16847	10	9	9	8	24	7	7	7	6	18	6

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	10	10	10	30	10	10	10	10	30	10	10	10
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	6	5	5	14	5	4	4	4	11	4	3	3

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	10	30	10	10	10	10	30	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	3	9	3	3	3	2	7	17056

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S4
Sheet 1 of 2
(NWBS4A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	18	MO	1000.00				18000				18000	
2) Storage Trailer (1)	18	MO	500.00				9000				9000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00				9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	18	MO	4000.00				72000				72000	
7) Security	18	MO	10000.00				180000				180000	
8) Decontamination Trailer	18	MO	1500.00				27000				27000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	72	WKS	250.00				18000				18000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	18	MO	1200.00				21600				21600	
4) Decon Water	237600	GAL	.20				47520				47520	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	9000	MI	5.00				45000				45000	20 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	445	TON	185.00				82325				82325	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	239900	CY	35.00				8396500				8396500	
2) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
RESTORATION												
1) Backfill	900	CY		4.00	2.70	7.43		3600	2430	6687	12717	
a) Place, Spread & Compact	900	CY			.84	2.67			756	2403	3159	
2) Revegetation	90	MSF		24.60	8.40	6.68		2214	756	601	3571	
							9220780	157073	91845	121475	9591172	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S4
Sheet 2 of 2
(NWBS4A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							9220780	157073	91845	121475	9591172	
Burden @ 30% of Labor Cost									27553		27553	
Labor @ 10% of Labor Cost									9184		9184	
Material @ 10% of Material Cost								15707			15707	
SubContract @ 10% of Sub. Cost							922078				922078	
Total Direct Cost							10142858	172780	128583	121475	10565695	
Indirects @ 75% of Total Direct Labor Cost									96437		96437	
Profit @ 10% of Total Direct Cost											1056570	
											11718702	
Health & Safety Monitoring @ 6%											703122	
Total Field Cost											12421824	
Contingency @ 20% of Total Field Cost											2484365	
Engineering @ 8% of Total Field Cost											993746	
TOTAL COST THIS PAGE											15899934	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S4
(OMNWIV4) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Gravel Maintenance	10000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	10000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excation PCB Soil, Offsite Incineration
Excation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S4
(PWANAS4A) 2/11/94
19651

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	19441.2											
2. O & M COSTS		10										
3. ANNUAL COSTS	19441.2	10	10	10	10	30	10	10	10	10	30	10
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	19441	10	9	9	8	24	7	7	7	6	18	6

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	10	10	10	30	10	10	10	10	30	10	10	10
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	6	5	5	14	5	4	4	4	11	4	3	3

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	10	30	10	10	10	10	30	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	3	9	3	3	3	2	7	19651

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S5
Sheet 1 of 2
(NWBS5)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	18	MO	1000.00				18000				18000	
2) Storage Trailer (1)	18	MO	500.00				9000				9000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00				9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	18	MO	4000.00				72000				72000	
7) Security	18	MO	10000.00				180000				180000	
8) Decontamination Trailer	18	MO	1500.00				27000				27000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	72	WKS	250.00				18000				18000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	18	MO	1200.00				21600				21600	
4) Decon Water	237600	GAL	.20				47520				47520	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	3700	CY			.59	1.00			2183	3700	5883	10-50 ppm
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	111150	MI	5.00				555750				555750	247 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	5495	TON	185.00				1016575				1016575	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	239900	CY	35.00				8396500				8396500	
2) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
RESTORATION												
1) Backfill	900	CY		4.00	2.70	7.43		3600	2430	6687	12717	
a) Place, Spread & Compact	900	CY			.84	2.67			756	2403	3159	
2) Revegetation	90	MSF		24.60	8.40	6.68		2214	756	601	3571	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S5
Sheet 2 of 2
(NWBS5)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							11369780	157073	94028	125175	11746055	
Burden @ 30% of Labor Cost									28208		28208	
Labor @ 10% of Labor Cost									9403		9403	
Material @ 10% of Material Cost								15707			15707	
SubContract @ 10% of Sub. Cost							1136978				1136978	
Total Direct Cost							12506758	172780	131639	125175	12936351	
Indirects @ 75% of Total Direct Labor Cost									98729		98729	
Profit @ 10% of Total Direct Cost											1293635	
											14328716	
Health & Safety Monitoring @ 6%											859723	
Total Field Cost											15188439	
Contingency @ 20% of Total Field Cost											3037688	
Engineering @ 8% of Total Field Cost											1215075	
TOTAL COST THIS PAGE											19441201	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S5
(OMNWIV4A) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Gravel Maintenance	10000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	10000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excation PCB Soil, Offsite Incineration
Excation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (All VOC'S Scenario)
Alternative S5
(PWANAS5) 2/11/94
19651

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	19441.2											
2. O & M COSTS		10										
3. ANNUAL COSTS	19441.2	10	10	10	10	30	10	10	10	10	30	10
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	19441	10	9	9	8	24	7	7	7	6	18	6

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	10	10	10	30	10	10	10	10	30	10	10	10
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	6	5	5	14	5	4	4	4	11	4	3	3

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	10	30	10	10	10	10	30	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	3	9	3	3	3	2	7	19651

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S6
Sheet 1 of 2
(NWBS4B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	18	MO	1000.00				18000				18000	
2) Storage Trailer (1)	18	MO	500.00				9000				9000	
3) Construction Survey	36	LS	15000.00	15000.00	30.00	10.00	15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00	.82	.78	.75	9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	18	MO	4000.00	12345.00	23.52	7.46	72000				72000	
7) Security	18	MO	10000.00				180000				180000	
8) Decontamination Trailer	18	MO	1500.00				27000				27000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	72	WKS	250.00	16.00	17.00	18.00	18000				18000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	18	MO	1200.00				21600				21600	
4) Decon Water	237600	GAL	.20				47520				47520	
5) Personnel Decon Pad	24	26		28.00	29.00	30.00						
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00	.40		30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	3700	CY			.59	1.00			2183	3700	5883	10-50 ppm
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	111150	MI	5.00				555750				555750	247 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	5495	TON	185.00				1016575				1016575	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	87000	CY	35.00				3045000				3045000	
2) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
RESTORATION												
1) Backfill	900	CY		4.00	2.70	7.43		3600	2430	6687	12717	
a) Place, Spread & Compact	900	CY			.84	2.67			756	2403	3159	
2) Revegetation	90	MSF		24.60	8.40	6.68		2214	756	601	3571	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S6
Sheet 2 of 2
(NWBS4B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							6018280	157073	94028	125175	6394555	
Burden @ 30% of Labor Cost									28208		28208	
Labor @ 10% of Labor Cost									9403		9403	
Material @ 10% of Material Cost								15707			15707	
SubContract @ 10% of Sub. Cost							601828				601828	
Total Direct Cost							6620108	172780	131639	125175	7049701	
Indirects @ 75% of Total Direct Labor Cost									98729		98729	
Profit @ 10% of Total Direct Cost											704970	
											7853401	
Health & Safety Monitoring @ 6%											471204	
Total Field Cost											8324605	
Contingency @ 20% of Total Field Cost											1664921	
Engineering @ 8% of Total Field Cost											665968	
TOTAL COST THIS PAGE											10655494	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S6
(OMNWIV6) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Gravel Maintenance	10000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	10000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excation PCB Soil, Offsite Incineration
Excation PCB Soil, Offsite Landfill Disposal
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S6
(PWANAS6) 2/11/94
10865

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	10655.5											
2. O & M COSTS		10										
3. ANNUAL COSTS	10655.5	10	10	10	10	30	10	10	10	10	30	10
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	10656	10	9	9	8	24	7	7	7	6	18	6

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	10	10	10	30	10	10	10	10	30	10	10	10
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	6	5	5	14	5	4	4	4	11	4	3	3

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	10	30	10	10	10	10	30	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	3	9	3	3	3	2	7	10865

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Onsite Consolidation/Capping
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S7
Sheet 1 of 2
(NWBS7)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	18	MO	1000.00				18000				18000	
2) Storage Trailer (1)	18	MO	500.00				9000				9000	
3) Construction Survey	36	LS	15000.00	15000.00	30.00	10.00	15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00	.82	.78	.75	9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	18	MO	4000.00	12345.00	23.52	7.46	72000				72000	
7) Security	18	MO	10000.00				180000				180000	
8) Decontamination Trailer	18	MO	1500.00				27000				27000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	72	WKS	250.00	16.00	17.00	18.00	18000				18000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	18	MO	1200.00				21600				21600	
4) Decon Water	237600	GAL	.20				47520				47520	
5) Personnel Decon Pad	24	26		28.00	29.00	30.00						
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00	.40		30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	3700	CY			.59	1.00			2183	3700	5883	10-50 ppm
ONSITE CONSOLIDATION/CAPPING												
1) Hauling PCBs Contaminated Soil	3700	CY			.55	1.71			2035	6327	8362	
2) Backfill PCBs Contaminated Soil	3700	CY			.84	2.67			3108	9879	12987	
3) Gravel Layer - 6"	417	CY		6.00	2.70	7.43		2502	1126	3098	6726	
a) Place, Spread & Compact	417	CY			.84	2.67			350	1113	1464	
4) Clay Layer - 12"	834	CY		8.00	2.70	7.43		6672	2252	6197	15120	
a) Place, Spread & Compact	834	CY			.84	2.67			701	2227	2927	
5) Gravel Layer - 24"	1667	CY		6.00	2.70	7.43		10002	4501	12386	26889	
a) Place, Spread & Compact	1667	CY			.84	2.67			1400	4451	5851	
6) Filter Fabric	5000	SY	1.70				8500				8500	
7) Drainage Piping - 4"	800	LF		.50	.30			400	240		640	
8) Chain Link Fence	200	LF	18.50				3700				3700	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Onsite Consolidation/Capping
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S7
Sheet 2 of 2
(NWBS7)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	87000	CY	35.00				3045000				3045000	
2) Gravel Layer - 6"	10533	CY		6.00	2.70	7.43		63198	28439	78260	169897	
a) Place, Spread & Compact	10533	CY			.84	2.67			8848	28123	36971	
RESTORATION												
1) Backfill	900	CY		4.00	2.70	7.43		3600	2430	6687	12717	
a) Place, Spread & Compact	900	CY			.84	2.67			756	2403	3159	
2) Revegetation	90	MSF		24.60	8.40	6.68		2214	756	601	3571	
							4458155	176649	109740	170852	4915397	
Burden @ 30% of Labor Cost									32922		32922	
Labor @ 10% of Labor Cost									10974		10974	
Material @ 10% of Material Cost								17665			17665	
SubContract @ 10% of Sub. Cost							445816				445816	
Total Direct Cost							4903971	194314	153637	170852	5422773	
Indirects @ 75% of Total Direct Labor Cost									115227		115227	
Profit @ 10% of Total Direct Cost											542277	
											6080278	
Health & Safety Monitoring @ 6%											364817	
Total Field Cost											6445094	
Contingency @ 20% of Total Field Cost											1289019	
Engineering @ 8% of Total Field Cost											515608	
TOTAL COST THIS PAGE											8249721	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Excavation PCB Soil, Onsite Consolidated Capping
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S7
(OMNWIV7) 2/11/94

Annual Costs

ITEM	ITEM $ ANNUAL COST	ITEM $ COST PER 5 YEARS	NOTES
1. Gravel Maintenance	10000.00		Inspection, Erosion Control, Mowing & Revegetation
2. Site Review		20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	10000.00	20000.00	Post Remedial maintenance be performed for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excation PCB Soil, Offsite Incineration
Excation PCB Soil, Onsite Consolidated/Capping
Insitu Vapor Extraction (Limited VOC'S Scenario)
Alternative S7
(PWANAS7) 2/11/94
8459

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	8249.7											
2. O & M COSTS		10										
3. ANNUAL COSTS	8249.7	10	10	10	10	30	10	10	10	10	30	10
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	8250	10	9	9	8	24	7	7	7	6	18	6

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	10	10	10	30	10	10	10	10	30	10	10	10
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	6	5	5	14	5	4	4	4	11	4	3	3

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	10	30	10	10	10	10	30	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	3	9	3	3	3	2	7	8459

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Excavation Other Metals And Organics, Offsite Landfill Disposal
Current Industrial Use
Alternative S8A
Sheet 1 of 2
(NWBS8A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	24	MO	1000.00				24000				24000	
2) Storage Trailer (1)	24	MO	500.00				12000				12000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00				9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	24	MO	4000.00				96000				96000	
7) Security	24	MO	10000.00				240000				240000	
8) Decontamination Trailer	24	MO	1500.00				36000				36000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	96	WKS	250.00				24000				24000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	24	MO	1200.00				28800				28800	
4) Decon Water	316800	GAL	.20				63360				63360	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	239900	CY	35.00				8396500				8396500	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Excavation Other Metals And Organics, Offsite Landfill Disposal
Current Industrial Use
Alternative S8A
Sheet 2 of 2
(NWBS8A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SOIL REMOVAL												
1) Excavate Other Metals And Organics Contaminated Soil	62600	CY			.59	1.00			36934	62600	99534	
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	1308150	MI	5.00				6540750				6540750	2907 Tr.@ 450 Mi.
2) Landfill Disposal	64746	TON	100.00				6474600				6474600	
OFFSITE MUNICIPAL LANDFILL DISPOSAL												
1) Hauling Waste	126700	MI	5.00				633500				633500	1267 Tr.@ 100 Mi.
2) Landfill Disposal	28215	TON	100.00				2821500				2821500	
RESTORATION												
1) Backfill	63500	CY		4.00	2.70	7.43		254000	171450	471805	897255	
a) Place, Spread & Compact	63500	CY			.84	2.67			53340	169545	222885	
2) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							26398845	344521	313180	710018	27766564	
Burden @ 30% of Labor Cost									93954		93954	
Labor @ 10% of Labor Cost									31318		31318	
Material @ 10% of Material Cost								34452			34452	
SubContract @ 10% of Sub. Cost							2639885				2639885	
Total Direct Cost							29038730	378973	438452	710018	30566172	
Indirects @ 75% of Total Direct Labor Cost									328839		328839	
Profit @ 10% of Total Direct Cost											3056617	
											33951628	
Health & Safety Monitoring @ 4%											1358065	
Total Field Cost											35309693	
Contingency @ 20% of Total Field Cost											7061939	
Engineering @ 6% of Total Field Cost											2118582	
TOTAL COST THIS PAGE											44490214	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Excavation Other Metals And Organics, Offsite Landfill Disposal
Future Residential Use
Alternative S8B
Sheet 1 of 2
(NWBS8B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	24	MO	1000.00				24000				24000	
2) Storage Trailer (1)	24	MO	500.00				12000				12000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	6	SETS	1500.00				9000				9000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	24	MO	4000.00				96000				96000	
7) Security	24	MO	10000.00				240000				240000	
8) Decontamination Trailer	24	MO	1500.00				36000				36000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	96	WKS	250.00				24000				24000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	240	CY		70.00	125.00	5.00		16800	30000	1200	48000	
b) Gravel Base - 6"	180	CY		7.50	3.33	8.00		1350	599	1440	3389	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
d) Collection Sump	6			1450.00	500.00	220.00		8700	3000	1320	13020	
e) Splash Guard	4800	SF		1.25	1.00			6000	4800		10800	
3) Decontamination Services	24	MO	1200.00				28800				28800	
4) Decon Water	316800	GAL	.20				63360				63360	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00	.40		30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION/LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	185.00				164835				164835	
SOIL REMOVAL												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
OFFSITE INCINERATION												
1) Hauling Waste	34000	MI	5.00				170000				170000	20 Tr. @ 1700 Mi.
2) Waste Incineration	445	TON	1200.00				534000				534000	
IN-SITU VAPOR EXTRACTION												
1) In-situ Vapor Extraction	239900	CY	35.00				8396500				8396500	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation PCB Soil, Offsite Incineration
Insitu Vapor Extraction
Excavation Other Metals And Organics, Offsite Landfill Disposal
Future Residential Use
Alternative S8B
Sheet 2 of 2
(NWBS8B)
2/11/94

	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SOIL REMOVAL												
1) Excavate Other Metals And Organics Contaminated Soil	55100	CY			.59	1.00			32509	55100	87609	
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	1260000	MI	5.00				6300000				6300000	2800 Tr. @ 450 Mi.
2) Landfill Disposal	62370	TON	100.00				6237000				6237000	
OFFSITE MUNICIPAL LANDFILL DISPOSAL												
1) Hauling Waste	87400	MI	5.00				437000				437000	874 Tr. @ 100 Mi.
2) Landfill Disposal	19454	TON	100.00				1945400				1945400	
RESTORATION												
1) Backfill	56000	CY		4.00	2.70	7.43		224000	151200	416080	791280	
a) Place, Spread & Compact	56000	CY			.84	2.67			47040	149520	196560	
2) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							24847895	314521	282205	626768	26071389	
Burden @ 30% of Labor Cost									84661		84661	
Labor @ 10% of Labor Cost									28220		28220	
Material @ 10% of Material Cost								31452			31452	
SubContract @ 10% of Sub. Cost							2484790				2484790	
Total Direct Cost							27332685	345973	395087	626768	28700512	
Indirects @ 75% of Total Direct Labor Cost									296315		296315	
Profit @ 10% of Total Direct Cost											2870051	
											31866879	
Health & Safety Monitoring @ 4%											1274675	
Total Field Cost											33141554	
Contingency @ 20% of Total Field Cost											6628311	
Engineering @ 6% of Total Field Cost											1988493	
TOTAL COST THIS PAGE											41758358	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation, Onsite Low Temperature Thermal Stripping
Excavation Other Metals And Organics, Offsite Landfill Disposal
Current Industrial Use
Alternative S9A
Sheet 1 of 2
(NWBS5A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	48	MO	1000.00				48000				48000	
2) Storage Trailer (1)	48	MO	500.00				24000				24000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	8	SETS	1500.00				12000				12000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	48	MO	4000.00				192000				192000	
7) Security	48	MO	10000.00				480000				480000	
8) Decontamination Trailer	48	MO	1500.00				72000				72000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	192	WKS	250.00				48000				48000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	480	CY		70.00	125.00	5.00		33600	60000	2400	96000	
b) Gravel Base - 6"	360	CY		7.50	3.33	8.00		2700	1199	2880	6779	
c) Curb	1440	LF		3.07	1.99	.05		4421	2866	72	7358	
d) Collection Sump	12			1450.00	500.00	220.00		17400	6000	2640	26040	
e) Splash Guard	9600	SF		1.25	1.00			12000	9600		21600	
3) Decontamination Services	48	MO	1200.00				57600				57600	
4) Decon Water	633600	GAL	.20				126720				126720	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	180.00				160380				160380	
LOW TEMPERATURE THERMAL STRIPPING												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
2) Hauling To Thermal Stripping Area	300	CY			.65	2.00			195	600	795	
3) Low Temperature Thermal Stripping	445	TON	220.00				97900				97900	
4) Residue Analysis	15		220.00				3300				3300	
BUILDING FOUNDATION REMOVAL												
1) Concrete Floor Demolition	74000	SF			2.45	.44			181300	32560	213860	
2) Hauling Waste Concrete	11400	MI	5.00				57000				57000	114 Tr. @ 100 Mi.
3) Waste Concrete Disposal	2775	TON	100.00				277500				277500	
LOW TEMPERATURE THERMAL STRIPPING												
1) Excavate VOAs Contaminated Soil	239900	CY			2.15	3.57			515785	856443	1372228	
2) Shoring/Sheet Piling	189000	SF	15.00				2835000				2835000	
3) Hauling To Thermal Stripping Area	263890	CY			.65	2.00			171529	527780	699309	
4) Mobilization/Demobilization		LS	200000.00				200000				200000	
5) Low Temperature Thermal Stripping	356250	TON	110.00				39187500				39187500	
6) Residue Analysis	1400		184.00				257600				257600	1 Sample/Day

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation, Onsite Low Temperature Thermal Stripping
Excavation Other Metals And Organics, Offsite Landfill Disposal
Current Industrial Use
Alternative S9A
Sheet 2 of 2
(NWBS5A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SOIL REMOVAL												
1) Excavate Other Metals And Organics Contaminated Soil	51900	CY			.59	1.00			30621	51900	82521	
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	1849050	MI	5.00				9245250				9245250	4109 Tr.@ 450 Mi.
2) Landfill Disposal	91517	TON	100.00				9151700				9151700	
RESTORATION												
1) Backfill Treated Soil	229200	CY			.26	1.50			59592	343800	403392	
a) Place, Spread & Compact	229200	CY			.84	2.67			192528	611964	804492	
2) Backfill	63500	CY		4.00	2.70	7.43		254000	171450	471805	897255	
a) Place, Spread & Compact	63500	CY			.84	2.67			53340	169545	222885	
3) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							62663450	379581	1467628	3076461	67587120	
Burden @ 30% of Labor Cost									440288		440288	
Labor @ 10% of Labor Cost									146763		146763	
Material @ 10% of Material Cost								37958			37958	
SubContract @ 10% of Sub. Cost							6266345				6266345	
Total Direct Cost							68929795	417539	2054679	3076461	74478474	
Indirects @ 75% of Total Direct Labor Cost									1541009		1541009	
Profit @ 10% of Total Direct Cost											7447847	
											83467330	
Health & Safety Monitoring @ 4%											3338693	
Total Field Cost											86806023	
Contingency @ 20% of Total Field Cost											17361205	
Engineering @ 6% of Total Field Cost											5208361	
TOTAL COST THIS PAGE											109375590	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation, Onsite Low Temperature Thermal Stripping
Excavation Other Metals And Organics, Offsite Landfill Disposal
Future Residential Use
Alternative S9B
Sheet 1 of 2
(NWBS5B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	48	MO	1000.00				48000				48000	
2) Storage Trailer (1)	48	MO	500.00				24000				24000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	8	SETS	1500.00				12000				12000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	48	MO	4000.00				192000				192000	
7) Security	48	MO	10000.00				480000				480000	
8) Decontamination Trailer	48	MO	1500.00				72000				72000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	192	WKS	250.00				48000				48000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	480	CY		70.00	125.00	5.00		33600	60000	2400	96000	
b) Gravel Base - 6"	360	CY		7.50	3.33	8.00		2700	1199	2880	6779	
c) Curb	1440	LF		3.07	1.99	.05		4421	2866	72	7358	
d) Collection Sump	12			1450.00	500.00	220.00		17400	6000	2640	26040	
e) Splash Guard	9600	SF		1.25	1.00			12000	9600		21600	
3) Decontamination Services	48	MO	1200.00				57600				57600	
4) Decon Water	633600	GAL	.20				126720				126720	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
SOIL REMOVAL												
1) Excavate Metals Contaminated Soil	600	CY			.59	1.00			354	600	954	
OFFSITE FIXATION LANDFILL DISPOSAL												
1) Hauling Waste	18000	MI	5.00				90000				90000	40 Tr. @ 450 Mi.
2) Fixation/Landfill Disposal	891	TON	180.00				160380				160380	
LOW TEMPERATURE THERMAL STRIPPING												
1) Excavate PCBs Contaminated Soil	300	CY			.59	1.00			177	300	477	
2) Hauling To Thermal Stripping Area	300	CY			.65	2.00			195	600	795	
3) Low Temperature Thermal Stripping	445	TON	220.00				97900				97900	
4) Residue Analysis	15		220.00				3300				3300	
BUILDING FOUNDATION REMOVAL												
1) Concrete Floor Demolition	74000	SF			2.45	.44			181300	32560	213860	
2) Hauling Waste Concrete	11400	MI	5.00				57000				57000	114 Tr. @ 100 Mi.
3) Waste Concrete Disposal	2775	TON	100.00				277500				277500	
LOW TEMPERATURE THERMAL STRIPPING												
1) Excavate VOAs Contaminated Soil	239900	CY			2.15	3.57			515785	856443	1372228	
2) Shoring/Sheet Piling	189000	SF	15.00				2835000				2835000	
3) Hauling To Thermal Stripping Area	263890	CY			.65	2.00			171529	527780	699309	
4) Mobilization/Demobilization		LS	200000.00				200000				200000	
5) Low Temperature Thermal Stripping	356250	TON	110.00				39187500				39187500	
6) Residue Analysis	1400		184.00				257600				257600	1 Sample/Day

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Fixation Metals, Offsite Landfill Disposal
Excavation, Onsite Low Temperature Thermal Stripping
Excavation Other Metals And Organics, Offsite Landfill Disposal
Future Residential Use
Alternative S9B
Sheet 2 of 2
(NWBS5B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SOIL REMOVAL												
1) Excavate Other Metals And Organics Contaminated Soil	45900	CY			.59	1.00			27081	45900	72981	
OFFSITE LANDFILL DISPOSAL												
1) Hauling Waste	1628100	MI	5.00				8140500				8140500	3618 Tr.@ 450 Mi.
2) Landfill Disposal	80582	TON	100.00				8058200				8058200	
RESTORATION												
1) Backfill Treated Soil	230700	CY			.26	1.50			59982	346050	406032	
a) Place, Spread & Compact	230700	CY			.84	2.67			193788	615969	809757	
2) Backfill	56000	CY		4.00	2.70	7.43		224000	151200	416080	791280	
a) Place, Spread & Compact	56000	CY			.84	2.67			47040	149520	196560	
3) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							60465200	349581	1439188	3000966	65254935	
Burden @ 30% of Labor Cost									431756		431756	
Labor @ 10% of Labor Cost									143919		143919	
Material @ 10% of Material Cost								34958			34958	
SubContract @ 10% of Sub. Cost							6046520				6046520	
Total Direct Cost							66511720	384539	2014863	3000966	71912088	
Indirects @ 75% of Total Direct Labor Cost									1511147		1511147	
Profit @ 10% of Total Direct Cost											7191209	
											80614444	
Health & Safety Monitoring @ 4%											3224578	
Total Field Cost											83839021	
Contingency @ 20% of Total Field Cost											16767804	
Engineering @ 6% of Total Field Cost											5030341	
TOTAL COST THIS PAGE											105637167	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Soil Washing, Onsite Backfill
Current Industrial Use
Alternative S10A
Sheet 1 of 2
(NWBS6A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	48	MO	1000.00				48000				48000	
2) Storage Trailer (1)	48	MO	500.00				24000				24000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	8	SETS	1500.00				12000				12000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	48	MO	4000.00				192000				192000	
7) Security	48	MO	10000.00				480000				480000	
8) Decontamination Trailer	48	MO	1500.00				72000				72000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	192	WKS	250.00				48000				48000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	480	CY		70.00	125.00	5.00		33600	60000	2400	96000	
b) Gravel Base - 6"	360	CY		7.50	3.33	8.00		2700	1199	2880	6779	
c) Curb	1440	LF		3.07	1.99	.05		4421	2866	72	7358	
d) Collection Sump	12			1450.00	500.00	220.00		17400	6000	2640	26040	
e) Splash Guard	9600	SF		1.25	1.00			12000	9600		21600	
3) Decontamination Services	48	MO	1200.00				57600				57600	
4) Decon Water	633600	GAL	.20				126720				126720	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
BUILDING FOUNDATION REMOVAL												
1) Concrete Floor Demolition	74000	SF			2.45	.44			181300	32560	213860	
2) Hauling Waste Concrete	11400	MI	5.00				57000				57000	114 Tr. @ 100 Mi.
3) Waste Concrete Disposal	2775	TON	100.00				277500				277500	
SOIL REMOVAL												
1) Excavate Contaminated Soil	296400	CY			.96	1.58			284544	468312	752856	
2) Shoring/Sheet Piling	189000	SF	15.00				2835000				2835000	
3) Hauling To Soil Washing Area	326040	CY			.55	1.71			179322	557528	736850	
SOIL WASHING												
1) Mobilization/Demobilization		LS	100000.00				100000				100000	
2) Soil Washing	326040	CY	150.00				48906000				48906000	
RESTORATION												
1) Backfill Treated Soil	296400	CY			.26	1.50			77064	444600	521664	
a) Place, Spread & Compact	296400	CY			.84	2.67			248976	791388	1040364	
2) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							53275820	125581	1061963	2303552	56766917	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Soil Washing, Onsite Backfill
Current Industrial Use
Alternative S10A
Sheet 2 of 2
(NWBS6A)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							53275820	125581	1061963	2303552	56766917	
Burden @ 30% of Labor Cost									318589		318589	
Labor @ 10% of Labor Cost									106196		106196	
Material @ 10% of Material Cost								12558			12558	
SubContract @ 10% of Sub. Cost							5327582				5327582	
Total Direct Cost							58603402	138139	1486748	2303552	62531842	
Indirects @ 75% of Total Direct Labor Cost									1115061		1115061	
Profit @ 10% of Total Direct Cost											6253184	
											69900087	
Health & Safety Monitoring @ 4%											2796003	
Total Field Cost											72696091	
Contingency @ 20% of Total Field Cost											14539218	
Engineering @ 6% of Total Field Cost											4361765	
TOTAL COST THIS PAGE											91597075	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Soil Washing, Onsite Backfill
Future Residential Use
Alternative S10B
Sheet 1 of 2
(NWBS6B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
MOBILIZATION/DEMOBILIZATION												
1) Office Trailer (2)	48	MO	1000.00				48000				48000	
2) Storage Trailer (1)	48	MO	500.00				24000				24000	
3) Construction Survey		LS	15000.00				15000				15000	
4) Portable Communication Equipment	8	SETS	1500.00				12000				12000	
5) Equipment Mobilization/Demobilization		LS	25000.00				25000				25000	
6) Site Utilities	48	MO	4000.00				192000				192000	
7) Security	48	MO	10000.00				480000				480000	
8) Decontamination Trailer	48	MO	1500.00				72000				72000	
DECONTAMINATION FACILITIES AND SERVICES												
1) Laundry Service	192	WKS	250.00				48000				48000	
2) Truck Decon Pad												
a) Concrete Pad - 8"	480	CY		70.00	125.00	5.00		33600	60000	2400	96000	
b) Gravel Base - 6"	360	CY		7.50	3.33	8.00		2700	1199	2880	6779	
c) Curb	1440	LF		3.07	1.99	.05		4421	2866	72	7358	
d) Collection Sump	12			1450.00	500.00	220.00		17400	6000	2640	26040	
e) Splash Guard	9600	SF		1.25	1.00			12000	9600		21600	
3) Decontamination Services	48	MO	1200.00				57600				57600	
4) Decon Water	633600	GAL	.20				126720				126720	
5) Personnel Decon Pad												
a) Concrete Pad - 4"	36	CY		70.00	125.00	5.00		2520	4500	180	7200	
b) Gravel Base - 4"	36	CY		7.50	3.33	8.00		270	120	288	678	
c) Curb	720	LF		3.07	1.99	.05		2210	1433	36	3679	
6) Clean Water Storage Tank	6			3000.00	300.00			18000	1800		19800	3000 Gallon
7) Spent Water Storage Tank	6			5000.00	400.00			30000	2400		32400	5000 Gallon
BUILDING FOUNDATION REMOVAL												
1) Concrete Floor Demolition	74000	SF			2.45	.44			181300	32560	213860	
2) Hauling Waste Concrete	11400	MI	5.00				57000				57000	114 Tr. @ 100 Mi.
3) Waste Concrete Disposal	2775	TON	100.00				277500				277500	
SOIL REMOVAL												
1) Excavate Contaminated Soil	290400	CY			.96	1.58			278784	458832	737616	
2) Shoring/Sheet Piling	189000	SF	15.00				2835000				2835000	
3) Hauling To Soil Washing Area	319440	CY			.55	1.71			175692	546242	721934	
SOIL WASHING												
1) Mobilization/Demobilization		LS	100000.00				100000				100000	
2) Soil Washing	319440	CY	150.00				47916000				47916000	
RESTORATION												
1) Backfill Treated Soil	290400	CY			.26	1.50			75504	435600	511104	
a) Place, Spread & Compact	290400	CY			.84	2.67			243936	775368	1019304	
2) Revegetation	100	MSF		24.60	8.40	6.68		2460	840	668	3968	
							52285820	125581	1045973	2257766	55715141	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Excavation, Soil Washing, Onsite Backfill
Future Residential Use
Alternative S10B
Sheet 2 of 2
(NWBS6B)
2/11/94

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PAGE 1 TOTAL							52285820	125581	1045973	2257766	55715141	
Burden @ 30% of Labor Cost									313792		313792	
Labor @ 10% of Labor Cost									104597		104597	
Material @ 10% of Material Cost								12558			12558	
SubContract @ 10% of Sub. Cost							5228582				5228582	
Total Direct Cost							57514402	138139	1464362	2257766	61374670	
Indirects @ 75% of Total Direct Labor Cost									1098272		1098272	
Profit @ 10% of Total Direct Cost											6137467	
											68610409	
Health & Safety Monitoring @ 4%											2744416	
Total Field Cost											71354825	
Contingency @ 20% of Total Field Cost											14270965	
Engineering @ 6% of Total Field Cost											4281290	
TOTAL COST THIS PAGE											89907080	

GROUNDWATER COST ESTIMATES

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
No Action
Alternative GW1
(OMNWNAG1) 8/10/93

Annual Costs

ITEM	ITEM $ COST PER 5 YEARS	NOTES
1. Site Review	20000.00	Analysis Review performed for years 5,10,15,20,25,30
TOTAL ANNUAL COST	20000.00	Post Remedial monitoring will be performed for years 5,10,15,20,25,30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
No Action
Alternative GW1
(PWANAGW1) 8/10/93
56

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	0											
2. O & M COSTS		0										
3. ANNUAL COSTS	0	0	0	0	0	20	0	0	0	0	20	0
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	0	0	0	0	0	16	0	0	0	0	12	0

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	0	0	0	20	0	0	0	0	20	0	0	0
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	0	0	0	10	0	0	0	0	8	0	0	0

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	0	20	0	0	0	0	20	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	0	6	0	0	0	0	5	56

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Monitoring Of Existing Potable Water Supplies
Alternative GW2
(NWBGW2)
8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
1) Monitoring Wells	1800	LF	80.00				144000				144000	6 @ 300'
							144000	0	0	0	144000	
Burden @ 30% of Labor Cost									0		0	
Labor @ 10% of Labor Cost									0		0	
Material @ 10% of Material Cost								0			0	
SubContract @ 10% of Sub. Cost							14400				14400	
Total Direct Cost							158400	0	0	0	158400	
Indirects @ 75% of Total Direct Labor Cost									0		0	
Profit @ 10% of Total Direct Cost											15840	
											174240	
Health & Safety Monitoring @ 10%											17424	
Total Field Cost											191664	
Contingency @ 20% of Total Field Cost											38333	
Engineering @ 10% of Total Field Cost											19166	
TOTAL COST THIS PAGE											249163	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Monitoring Of Existing Potable Water Supplies
Alternative GW2
(OMNWGW2) 8/3/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	10000.00	6 groundwater samples 30 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	12480.00	8 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	27280.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Monitoring Of Existing Potable Water Supplies
Alternative GW2
(PWANGW2) 8/3/93
669

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	249.2											
2. O & M COSTS		27.3										
3. ANNUAL COSTS	249.2	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	249	26	25	24	22	21	20	19	18	18	17	16

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	15	14	14	13	13	12	11	11	10	10	9	9

	24	25	26	27	28	29	30
O & M COSTS	27.3	27.3	27.3	27.3	27.3	27.3	27.3
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231
PRESENT WORTH =	8	8	8	7	7	7	6

TOTAL PRESENT WORTH (000'S)
669

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Air Stripping
Alternative GW3A
(NWBGW3AS) 8/3/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	9885	16180	36065
2) EQUIPMENT	0	366000	24600	12000	402600
3) PIPING & INSTRUMENTATION	0	91900	37444	6748	136092
4) FOUNDATION & STRUCTURAL	0	8505	15750	945	25200
5) ELECTRICAL	15000	59215	36050	0	110265
	25000	525620	123729	35873	710222
Burden @ 30% of Labor Cost			37119		37119
Labor @ 10% of Labor Cost			12373		12373
Material @ 10% of Material Cost		52562			52562
Subcontract @ 10% of Sub. Cost	2500				2500
Total Direct Cost	27500	578182	173221	35873	814776
Indirects @ 75% of Total Direct Labor Cost			129915		129915
Profit @ 10% Total Direct Cost					81478
Total Field Cost					1026169
Contingency @ 20% of Total Field Cost					205234
Engineering @ 15% of Total Field Cost					153925
Total Cost This Page					1385328

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Air Stripping
Alternative GW3A

(NWBGW3A) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			4000.00	6000.00			4000	6000	10000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	1	AC			1165.00	1840.00			1165	1840	3005	
4) Earthwork Grading	3000	CY			.24	.78			720	2340	3060	
5) Demobilization		LS			4000.00	6000.00			4000	6000	10000	
							10000	0	9885	16180	36065	
EQUIPMENT												
1) Air Stripper System incl. Tower, Packing, Blower	3			110000.00	7000.00	4000.00		330000	21000	12000	363000	14' dia. x 10'
2) Effluent Distribution Pumps	6			6000.00	600.00			36000	3600		39600	
							0	366000	24600	12000	402600	
PIPING & INSTRUMENTATION												
1) Extraction Wells To Air Stripper												
a) Collection Piping - 10"	1500	LF		26.00	9.00			39000	13500		52500	
a) Collection Piping - 12"	900	LF		35.00	12.00			31500	10800		42300	
b) Excavation,Backfill,Compaction	1400	LF			4.36	2.64			6104	3696	9800	
c) Pipe Bedding	1400	LF			1.49	2.09			2086	2926	5012	
d) Revegetation	14	MSF		50.00	11.00	9.00		700	154	126	980	
2) Valves												
a) 12"	15			900.00	200.00			13500	3000		16500	
b) 14"	6			1200.00	300.00			7200	1800		9000	
3) Level Control System	3			2500.00	1000.00							
							0	91900	37444	6748	136092	
FOUNDATION & STRUCTURAL												
1) Air Stripper Foundation	54	CY		135.00	250.00	15.00		7290	13500	810	21600	
2) Pump Foundation	9	CY		135.00	250.00	15.00		1215	2250	135	3600	
							0	8505	15750	945	25200	
ELECTRICAL												
1) Power Supply		LS	15000.00				15000				15000	
2) Starter #2	3			1500.00	720.00			4500	2160		6660	
3) Starter #4	6			4450.00	2400.00			26700	14400		41100	
4) Disconnect Switch	9			375.00	175.00			3375	1575		4950	
5) Conduit, Cable, Control #2	3			930.00	795.00			2790	2385		5175	
6) Conduit, Cable, Control #4	6			1850.00	1130.00			11100	6780		17880	
7) Grounding		LS		2250.00	2250.00			2250	2250		4500	
8) Miscellaneous Wiring		LS		4500.00	4500.00			4500	4500		9000	
9) Instrumentation		LS		4000.00	2000.00			4000	2000		6000	
							15000	59215	36050	0	110265	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Air Stripping
Alternative GW3A
(OMNWGW3A) 8/3/93

Annual Costs

ITEM	ITEM $ ANNUAL SAMPLING	NOTES
1. Sampling	2000.00	3 groundwater samples 20 manhours per sampling period. (annually) plus travel, living & shipping costs.
2. Analysis	1950.00	5 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	2200.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	6150.00	Post Remedial monitoring will be performed annually for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Alternative GW3A
(OMNGW3A1) 8/3/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	1567760	Kw-hr	.085	$133260	Treatment Plan
2. Maintenance				$24400	3% of Capital
3. Operator				$5200	4 hrs/wk
TOTAL ANNUAL COSTS				$162860	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Alternative GW3A
(PWANGW3A) 8/3/93
3984

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	1385.3											
2. O & M COSTS		169										
3. ANNUAL COSTS	1385.3	169	169	169	169	169	169	169	169	169	169	169
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	1385	161	153	146	139	132	126	120	114	109	104	99

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	169	169	169	169	169	169	169	169	169	169	169	169
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	94	90	85	81	77	74	70	67	64	61	58	55

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	169	169	169	169	169	169	169	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	52	50	47	45	43	41	39	3984

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Granulated Activated Carbon
Alternative GW3B
(NWBGW3BS) 8/3/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	9885	16180	36065
2) EQUIPMENT	0	600000	60000	30000	690000
3) PIPING & INSTRUMENTATION	0	76600	33844	6748	117192
4) FOUNDATION & STRUCTURAL	0	10125	18750	1125	30000
	10000	686725	122479	54053	873257
Burden @ 30% of Labor Cost			36744		36744
Labor @ 10% of Labor Cost			12248		12248
Material @ 10% of Material Cost		68673			68673
Subcontract @ 10% of Sub. Cost	1000				1000
Total Direct Cost	11000	755398	171471	54053	991921
Indirects @ 75% of Total Direct Labor Cost			128603		128603
Profit @ 10% Total Direct Cost					99192
Total Field Cost					1219716
Contingency @ 20% of Total Field Cost					243943
Engineering @ 15% of Total Field Cost					182957
Total Cost This Page					1646617

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Granulated Activated Carbon
Alternative GW3B

(NWBGW3B) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			4000.00	6000.00			4000	6000	10000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	1	AC			1165.00	1840.00			1165	1840	3005	
4) Earthwork Grading	3000	CY			.24	.78			720	2340	3060	
5) Demobilization		LS			4000.00	6000.00			4000	6000	10000	
							10000	0	9885	16180	36065	
EQUIPMENT												
1) Granulated Activated Carbon System	3			200000.00	20000.00	10000.00		600000	60000	30000	690000	
							0	600000	60000	30000	690000	
PIPING & INSTRUMENTATION												
1) Extraction Wells To Carbon Unit												
a) Collection Piping - 10"	1500	LF		26.00	9.00			39000	13500		52500	
a) Collection Piping - 12"	900	LF		35.00	12.00			31500	10800		42300	
b) Excavation,Backfill,Compaction	1400	LF			4.36	2.64			6104	3696	9800	
c) Pipe Bedding	1400	LF			1.49	2.09			2086	2926	5012	
d) Revegetation	14	MSF		50.00	11.00	9.00		700	154	126	980	
2) Valves												
a) 12"	6			900.00	200.00			5400	1200		6600	
							0	76600	33844	6748	117192	
FOUNDATION & STRUCTURAL												
1) Activated Carbon Foundation	75	CY		135.00	250.00	15.00		10125	18750	1125	30000	
							0	10125	18750	1125	30000	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Granular Activated Carbon
Alternative GW3B
(OMNWGW3B) 8/3/93

Annual Costs

ITEM	ITEM $ ANNUAL SAMPLING	NOTES
1. Sampling	2000.00	3 groundwater samples 20 manhours per sampling period. (annually) plus travel, living & shipping costs.
2. Analysis	1950.00	5 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	2200.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	6150.00	Post Remedial monitoring will be performed annually for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Alternative GW3B
(OMNGW3B1) 8/3/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Maintenance				$9900	1% of Capital Cost
2. Operator				$5200	4 hrs/wk
3. Activated Carbon					
a. Liquid	3000	LB	1.00	$3000	
TOTAL ANNUAL COSTS				$18100	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Of Existing Potable Water Supplies
Alternative GW3B
(PWANGW3B) 8/3/93
2020

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	1646.6											
2. O & M COSTS		24.3										
3. ANNUAL COSTS	1646.6	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	1647	23	22	21	20	19	18	17	16	16	15	14

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	14	13	12	12	11	11	10	10	9	9	8	8

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	24.3	24.3	24.3	24.3	24.3	24.3	24.3	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	8	7	7	7	6	6	6	2020

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A
(NWBGW4AS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	17823	29086	56909
2) EQUIPMENT	688000	1544400	202700	64500	2499600
3) PIPING & INSTRUMENTATION	0	321150	171916	19762	512828
4) FOUNDATION & STRUCTURAL	308000	73000	135250	6750	523000
5) ELECTRICAL	10000	114175	86450	0	210625
	1016000	2052725	614139	120098	3802962
Burden @ 30% of Labor Cost			184242		184242
Labor @ 10% of Labor Cost			61414		61414
Material @ 10% of Material Cost		205273			205273
Subcontract @ 10% of Sub. Cost	101600				101600
Total Direct Cost	1117600	2257998	859795	120098	4355490
Indirects @ 75% of Total Direct Labor Cost			644846		644846
Profit @ 10% Total Direct Cost					435549
					5435885
Health & Safety Monitoring @ 3%					163077
Total Field Cost					5598962
Contingency @ 20% of Total Field Cost					1119792
Engineering @ 15% of Total Field Cost					839844
Well Installation Field Engineering & Monitoring					30000
Total Cost This Page					7588598

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A

(NWBGW4A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	3	AC			1165.00	1840.00			3495	5520	9015	
4) Earthwork Grading	9700	CY			.24	.78			2328	7566	9894	
5) Demobilization		LS			6000.00	8000.00			6000	8000	14000	
							10000	0	17823	29086	56909	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300' 4 @ 500'
2) Groundwater Extraction Wells	2100	LF	160.00				336000				336000	7 @ 300'
3) Extraction Well Pumps	7			3000.00	600.00			21000	4200		25200	200-300 gpm
4) Equalization Tank	1			30000.00	3000.00	3000.00		30000	3000	3000	36000	30000 gallon
5) Equalization Tank Mixing System	1			18000.00	1800.00			18000	1800		19800	
6) Clarifier Supply Pump	2			4000.00	600.00			8000	1200		9200	1900 gpm
7) Clarifier	1			196000.00	49000.00			196000	49000		245000	
8) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
9) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	10000 gallon
10) Sand Filter	8			110000.00	11000.00	5500.00		880000	88000	44000	1012000	
11) Clearwell	1			12000.00	1200.00			12000	1200		13200	
12) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
13) Thickener	1			30800.00	7700.00			30800	7700		38500	
14) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
15) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	1200 mm
16) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
17) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
18) Stripper Transfer Tank	1			1200.00	300.00			1200	300		1500	
19) Air Stripper Supply Pump	2			3000.00	400.00			6000	800		6800	
20) Air Stripper Tower incl. Packing, Blower (Onsite)	1			130000.00	8000.00	5000.00		130000	8000	5000	143000	14' dia. x 20'
21) Recharge Pumps	2			3000.00	400.00			6000	800		6800	1900 gpm
22) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
23) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
22) Air Compressor	1			6000.00	800.00			6000	800		6800	
23) Sump Pump	2			2000.00	400.00			4000	800		4800	
							688000	1544400	202700	64500	2499600	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A

(NWBGW4A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												
a) Well Piping - 6"	2100	LF		39.00	21.00			81900	44100		126000	
b) Collection Piping - 6"	1000	LF		13.00	6.00			13000	6000		19000	
c) Collection Piping - 8"	1000	LF		15.00	7.00			15000	7000		22000	
d) Collection Piping - 10"	500	LF		26.00	9.00			13000	4500		17500	
e) Collection Piping - 12"	1600	LF		30.00	11.00			48000	17600		65600	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64			17876	10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09			6109	8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00		2050	451	369	2870	
2) System Interconnection Piping												
a) 2"	100			13.00	7.00			1300	700		2000	
b) 3"	200			19.50	10.50			3900	2100		6000	
c) 12"	800			78.00	42.00			62400	33600		96000	
d) 14"	300			91.00	49.00			27300	14700		42000	
3) Air Piping												
a) 2"	300			13.00	7.00			3900	2100		6000	
4) Valves												
a) 1/2"	18			60.00	30.00			1080	540		1620	
b) 2"	4			180.00	60.00			720	240		960	
c) 12"	22			1000.00	250.00			22000	5500		27500	
d) 14"	8			1200.00	300.00			9600	2400		12000	
5) Level Control System	8			2000.00	800.00			16000	6400		22400	
							0	321150	171916	19762	512828	
FOUNDATION & STRUCTURAL												
1) Treatment Building	10000	SF	30.00				300000				300000	60' x 100'
2) Building Foundation	350	CY		170.00	315.00	15.00		59500	110250	5250	175000	
3) Equipment Foundation	100	CY		135.00	250.00	15.00		13500	25000	1500	40000	
4) Loading/Unloading Area	5600	SF	1.00				5600				5600	
5) Parking Area	800	SF	3.00				2400				2400	
							308000	73000	135250	6750	523000	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A

(NWBGW4A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
ELECTRICAL												
1) Power Supply		LS	10000.00				10000				10000	
2) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
3) Starter #2	25			1500.00	720.00			37500	18000		55500	
4) Disconnect Switch	25			375.00	175.00			9375	4375		13750	
5) Conduit, Cable, Control #2	25			930.00	795.00			23250	19875		43125	
6) Grounding		LS		6250.00	6250.00			6250	6250		12500	
7) Miscellaneous Wiring		LS		13500.00	13500.00			13500	13500		27000	
8) Instrumentation		LS		7000.00	3000.00			7000	3000		10000	
9) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							10000	114175	86450	0	210625	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A
(OMNWGW4A) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Air Stripping And Reuse
Alternative GW4A
(OMNGW4A1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	3102900	Kw-hr	.085	$263747	Treatment Plant
2. Maintenance				$130000	3% of Capital Cost
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Activated Carbon					
a. Vapor				$228000	
6. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$1409107	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4A
(PWANGW4A) 8/30/93
29907

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	7588.6											
2. O & M COSTS		1451.7										
3. ANNUAL COSTS	7588.6	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	7589	1382	1317	1254	1195	1138	1083	1032	983	936	891	849

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	809	769	733	698	665	633	604	575	547	521	496	473

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	1451.7	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	450	428	408	389	370	353	335	29907

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse/Reinjection
Alternative GW4B
(NWBGW4BS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	15000	0	32680	49640	97320
2) EQUIPMENT	1846000	2279000	274100	90500	4489600
3) PIPING & INSTRUMENTATION	0	1186100	594618	93026	1873744
4) FOUNDATION & STRUCTURAL	308000	102700	190250	10050	611000
5) ELECTRICAL (Onsite)	10000	110775	84610	0	205385
6) ELECTRICAL (Offsite)	15000	259220	102260	0	376480
	2194000	3937795	1278518	243216	7653529
Burden @ 30% of Labor Cost			383555		383555
Labor @ 10% of Labor Cost			127852		127852
Material @ 10% of Material Cost		393780			393780
Subcontract @ 10% of Sub. Cost	219400				219400
Total Direct Cost	2413400	4331575	1789925	243216	8778116
Indirects @ 75% of Total Direct Labor Cost			1342444		1342444
Profit @ 10% Total Direct Cost					877812
					10998371
Health & Safety Monitoring @ 3%					329951
Total Field Cost					11328322
Contingency @ 20% of Total Field Cost					2265664
Engineering @ 12% of Total Field Cost					1359399
Well Installation Field Engineering & Monitoring					100000
Total Cost This Page					15053385

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripper
And Reuse
Alternative GW4B

(NWBGW4B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			10000.00	12000.00			10000	12000	22000	
2) Site Survey		LS	15000.00				15000				15000	
3) Clearing & Grubbing	8	AC			1165.00	1840.00			9320	14720	24040	
4) Earthwork Grading	14000	CY			.24	.78			3360	10920	14280	
5) Demobilization		LS			10000.00	12000.00			10000	12000	22000	
							15000	0	32680	49640	97320	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300'
												4 @ 500'
2) Groundwater Extraction Wells (Onsite)	3150	LF	160.00				504000				504000	7 @ 450'
3) Groundwater Extraction Wells (Offsite)	4500	LF	220.00				990000				990000	10 @ 450'
4) Extraction Well Pumps (Onsite)	7			4000.00	400.00			28000	2800		30800	300-400 gpm
5) Extraction Well Pumps (Offsite)	2			4000.00	400.00			8000	800		8800	300-400 gpm
6) Extraction Well Pumps (Offsite)	8			6000.00	600.00			48000	4800		52800	800-1200 gpm
7) Equalization Tank	1			50000.00	5000.00	5000.00		50000	5000	5000	60000	40000 gallon
8) Equalization Tank Mixing System	1			22000.00	2500.00			22000	2500		24500	
9) Clarifier Supply Pump	2			5000.00	400.00			10000	800		10800	2700 gpm
10) Clarifier	1			238000.00	60000.00			238000	60000		298000	
11) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
12) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	
13) Sand Filter	10			110000.00	11000.00	5500.00		1100000	110000	55000	1265000	
14) Clearwell	1			15000.00	1500.00			15000	1500		16500	
15) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
16) Thickener	1			36400.00	9100.00			36400	9100		45500	
17) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
18) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	
19) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
20) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
21) Air Stripper Transfer Tank	1			1200.00	300.00			1200	300		1500	
22) Air Stripper Supply Pump	2			3500.00	400.00			7000	800		7800	
23) Air Stripper System incl. Tower, Packing, Blower (Onsite)	1			150000.00	9000.00	6000.00		150000	9000	6000	165000	16' dia. x 20'
24) Air Stripper System incl. Tower, Packing, Blower (Offsite)	8			40000.00	3000.00	1500.00		320000	24000	12000	356000	8' dia. x 10'
25) Recharge Pumps	10			4000.00	600.00			40000	6000		46000	
26) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
27) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
28) Air Compressor	1			6000.00	800.00			6000	800		6800	
29) Sump Pump	2			2000.00	400.00			4000	800		4800	
							1846000	2279000	274100	90500	4489600	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse/Reinjection
Alternative GW4B

(NWBGW4B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												Onsite
a) Well Piping - 8"	3150	LF		52.00	28.00		163800	88200			252000	
b) Collection Piping - 8"	1000	LF		15.00	7.00		15000	7000			22000	
c) Collection Piping - 10"	1000	LF		26.00	9.00		26000	9000			35000	
d) Collection Piping - 12"	500	LF		30.00	11.00		15000	5500			20500	
e) Collection Piping - 14"	1600	LF		40.00	13.00		64000	20800			84800	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64		17876		10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09		6109		8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00	2050	451		369	2870	
2) Extraction Wells To Air Stripper												Offsite
a) Well Piping - 10"	5500	LF		26.00	9.00		143000	49500			192500	
b) Excavation,Backfill,Compaction	1000	LF			4.36	2.64		4360		2640	7000	
c) Pipe Bedding	1000	LF			1.49	2.09		1490		2090	3580	
d) Revegetation	10	MSF		50.00	11.00	9.00	500	110		90	700	
3) Treatment System To Recharge Basin												Offsite
a) Piping - 8"	3400	LF		15.00	7.00		51000	23800			74800	
b) Piping - 10"	4400	LF		26.00	9.00		114400	39600			154000	
c) Piping - 14"	3400	LF		34.00	13.00		115600	44200			159800	
d) Piping - 18"	1800	LF		60.00	20.00		108000	36000			144000	
e) Piping - 24"	1200	LF		75.00	30.00		90000	36000			126000	
f) Excavation,Backfill,Compaction	14200	LF			4.36	2.64		61912		37488	99400	
g) Pipe Bedding	14200	LF			1.49	2.09		21158		29678	50836	
h) Revegetation	142	MSF		50.00	11.00	9.00	7100	1562		1278	9940	
4) System Interconnection Piping												Onsite
a) 2"	200	LF		13.00	7.00		2600	1400			4000	
b) 3"	200	LF		19.50	10.50		3900	2100			6000	
c) 10"	600	LF		65.00	35.00		39000	21000			60000	
d) 14"	800	LF		91.00	49.00		72800	39200			112000	
e) 16"	300	LF		104.00	56.00		31200	16800			48000	
5) Air Piping												
a) 3"	300			19.50	10.50		5850	3150			9000	
6) Valves												Onsite
a) 1/2"	12			60.00	30.00		720	360			1080	
b) 3"	4			220.00	70.00		880	280			1160	
c) 14"	22			1200.00	300.00		26400	6600			33000	
d) 16"	8			1600.00	400.00		12800	3200			16000	
7) Valves												Offsite
e) 10"	30			750.00	170.00		22500	5100			27600	
8) Level Control System	8			2000.00	800.00		16000	6400			22400	Onsite
9) Level Control System	18			2000.00	800.00		36000	14400			50400	Offsite
							0 1186100	594618		93026	1873744	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse/Reinjection
Alternative GW4B

(NWBGW4B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
FOUNDATION & STRUCTURAL												
1) Treatment Building	10000	SF	30.00				300000				300000	100' x 100'
2) Building Foundation	350	CY		170.00	315.00	15.00		59500	110250	5250	175000	
3) Equipment Foundation	200	CY		135.00	250.00	15.00		27000	50000	3000	80000	
4) Air Stripper Foundation	120	CY		135.00	250.00	15.00		16200	30000	1800	48000	Offsite
5) Loading/Unloading Area	5600	SF	1.00				5600				5600	
6) Parking Area	800	SF	3.00				2400				2400	
							308000	102700	190250	10050	611000	
ELECTRICAL												Onsite
1) Power Supply		LS	10000.00				10000				10000	
2) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
3) Starter #1	8			1350.00	550.00			10800	4400		15200	
4) Starter #2	17			1500.00	720.00			25500	12240		37740	
5) Disconnect Switch	25			375.00	175.00			9375	4375		13750	
6) Conduit, Cable, Control #1	8			655.00	735.00			5240	5880		11120	
7) Conduit, Cable, Control #2	17			930.00	795.00			15810	13515		29325	
8) Grounding		LS		6250.00	6250.00			6250	6250		12500	
9) Miscellaneous Wiring		LS		13500.00	13500.00			13500	13500		27000	
10) Instrumentation		LS		7000.00	3000.00			7000	3000		10000	
11) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							10000	110775	84610	0	205385	
ELECTRICAL												Offsite
1) Power Supply		LS	15000.00				15000				15000	
2) Well Pump Feeder Cable	1000	LF		3.00	4.50			3000	4500		7500	
3) Starter #2	20			1500.00	720.00			30000	14400		44400	
4) Starter #6	8			13000.00	800.00			104000	6400		110400	
5) Disconnect Switch	20			375.00	175.00			7500	3500		11000	
6) Disconnect Switch	8			600.00	400.00			4800	3200		8000	
7) Conduit, Cable, Control #2	20			930.00	795.00			18600	15900		34500	
8) Conduit, Cable, Control #6	8			5540.00	2170.00			44320	17360		61680	
9) Grounding		LS		7000.00	7000.00			7000	7000		14000	
10) Miscellaneous Wiring		LS		14000.00	14000.00			14000	14000		28000	
11) Instrumentation		LS		6000.00	3000.00			6000	3000		9000	
12) Outdoor Lighting		LS		20000.00	13000.00			20000	13000		33000	
							15000	259220	102260	0	376480	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4B
(OMNWGW4B) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Air Stripping And Reuse
Alternative GW4B
(OMNGW4B1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	18061900	Kw-hr	.085	$1535262	Treatment Plant
2. Maintenance				$262600	3% of Capital Cost
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Activated Carbon					
a. Vapor				$228000	
6. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$2813222	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration, Air Stripping
And Reuse
Alternative GW4B
(PWANGW4B) 8/30/93
58960

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	15053.4											
2. O & M COSTS		2855.9										
3. ANNUAL COSTS	15053.4	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	15053	2719	2590	2467	2350	2239	2131	2031	1933	1842	1754	1671

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	1591	1514	1442	1374	1308	1245	1188	1131	1077	1025	977	931

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	2855.9	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	885	842	803	765	728	694	660	58960

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A
(NWBGW5AS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	17823	29086	56909
2) EQUIPMENT	688000	2022400	255100	120100	3085600
3) PIPING & INSTRUMENTATION	0	321150	171916	19762	512828
4) FOUNDATION & STRUCTURAL	308000	73000	135250	6750	523000
5) ELECTRICAL	10000	109620	83010	0	202630
	1016000	2526170	663099	175698	4380967
Burden @ 30% of Labor Cost			198930		198930
Labor @ 10% of Labor Cost			66310		66310
Material @ 10% of Material Cost		252617			252617
Subcontract @ 10% of Sub. Cost	101600				101600
Total Direct Cost	1117600	2778787	928339	175698	5000424
Indirects @ 75% of Total Direct Labor Cost			696254		696254
Profit @ 10% Total Direct Cost					500042
					6196720
Health & Safety Monitoring @ 3%					185902
Total Field Cost					6382622
Contingency @ 20% of Total Field Cost					1276524
Engineering @ 15% of Total Field Cost					957393
Well Installation Field Engineering & Monitoring					30000
Total Cost This Page					8646539

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A

(NWBGW5A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	3	AC			1165.00	1840.00			3495	5520	9015	
4) Earthwork Grading	9700	CY			.24	.78			2328	7566	9894	
5) Demobilization		LS			6000.00	8000.00			6000	8000	14000	
							10000	0	17823	29086	56909	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300' 4 @ 500'
2) Groundwater Extraction Wells	2100	LF	160.00				336000				336000	7 @ 300'
3) Extraction Well Pumps	7			3000.00	600.00			21000	4200		25200	200-300 gpm
4) Equalization Tank	1			30000.00	3000.00	3000.00		30000	3000	3000	36000	20000 gallon
5) Equalization Tank Mixing System	1			18000.00	1800.00			18000	1800		19800	
6) Clarifier Supply Pump	1			4000.00	600.00			4000	600		4600	
7) Clarifier	1			196000.00	49000.00			196000	49000		245000	
8) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
9) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	10000 gallon
10) Sand Filter Transfer Tank	1			1200.00	300.00			1200	300		1500	
11) Sand Filter Supply Pump	2			3000.00	400.00			6000	800		6800	
12) Sand Filter	8			110000.00	11000.00	5500.00		880000	88000	44000	1012000	
13) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
14) Thickener	1			30800.00	7700.00			30800	7700		38500	
15) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
16) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	1200 mm
17) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
18) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
19) Granular Activated Carbon System	3			200000.00	20000.00	20000.00		600000	60000	60000	720000	
20) Clearwell Effluent Distribution Tank	1			18000.00	1800.00	600.00		18000	1800	600	20400	
21) Effluent Recharge Pump	2			6000.00	600.00			12000	1200		13200	
22) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
23) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
24) Air Compressor	1			6000.00	800.00			6000	800		6800	
25) Sump Pump	2			2000.00	400.00			4000	800		4800	
							688000	2022400	255100	120100	3085600	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A

(NWBGW5A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												
a) Well Piping - 6"	2100	LF		39.00	21.00			81900	44100		126000	
b) Collection Piping - 6"	1000	LF		13.00	6.00			13000	6000		19000	
c) Collection Piping - 8"	1000	LF		15.00	7.00			15000	7000		22000	
d) Collection Piping - 10"	500	LF		26.00	9.00			13000	4500		17500	
e) Collection Piping - 12"	1600	LF		30.00	11.00			48000	17600		65600	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64			17876	10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09			6109	8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00		2050	451	369	2870	
2) System Interconnection Piping												
a) 2"	100			13.00	7.00			1300	700		2000	
b) 3"	200			19.50	10.50			3900	2100		6000	
c) 12"	800			78.00	42.00			62400	33600		96000	
d) 14"	300			91.00	49.00			27300	14700		42000	
3) Air Piping												
a) 2"	300			13.00	7.00			3900	2100		6000	
4) Valves												
a) 1/2"	18			60.00	30.00			1080	540		1620	
b) 2"	4			180.00	60.00			720	240		960	
c) 12"	22			1000.00	250.00			22000	5500		27500	
d) 14"	8			1200.00	300.00			9600	2400		12000	
5) Level Control System	8			2000.00	800.00			16000	6400		22400	
							0	321150	171916	19762	512828	
FOUNDATION & STRUCTURAL												
1) Treatment Building	10000	SF	30.00				300000				300000	60' x 100'
2) Building Foundation	350	CY		170.00	315.00	15.00		59500	110250	5250	175000	
3) Equipment Foundation	100	CY		135.00	250.00	15.00		13500	25000	1500	40000	
4) Loading/Unloading Area	5600	SF	1.00				5600				5600	
5) Parking Area	800	SF	3.00				2400				2400	
							308000	73000	135250	6750	523000	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A

(NWBGW5A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
ELECTRICAL												
1) Power Supply		LS	10000.00				10000				10000	
2) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
3) Starter #2	24			1500.00	720.00			36000	17280		53280	
4) Disconnect Switch	24			375.00	175.00			9000	4200		13200	
5) Conduit, Cable, Control #2	24			930.00	795.00			22320	19080		41400	
6) Grounding		LS		6000.00	6000.00			6000	6000		12000	
7) Miscellaneous Wiring		LS		12000.00	12000.00			12000	12000		24000	
8) Instrumentation		LS		7000.00	3000.00			7000	3000		10000	
9) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							10000	109620	83010	0	202630	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A
(OMNWGW5A) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A
(OMNGW5A1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	2514950	Kw-hr	.085	$213771	Treatment Plant
2. Maintenance				$150000	3% of Capital Cost
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Activated Carbon					
a. Liquid	735840	LB	.80	$588672	
6. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$1739803	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5A
(PWANGW5A) 8/30/93
36049

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	8646.5											
2. O & M COSTS		1593.2										
3. ANNUAL COSTS	8646.5	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	8647	1697	1617	1540	1467	1397	1330	1267	1207	1150	1094	1043

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	993	945	900	857	816	777	741	706	672	640	610	581

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	1782.4	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	**553**	**526**	**501**	**478**	**455**	**433**	**412**	**36049**

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5B
(NWBGW5BS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	15000	0	32680	49640	97320
2) EQUIPMENT	1846000	4155000	475800	297900	6774700
3) PIPING & INSTRUMENTATION	0	1190100	596218	93026	1879344
4) FOUNDATION & STRUCTURAL	308000	100000	185250	9750	603000
5) ELECTRICAL (Onsite)	10000	114175	86450	0	210625
6) ELECTRICAL (Offsite)	15000	256340	81220	0	352560
	2194000	5815615	1457618	450316	9917549
Burden @ 30% of Labor Cost			437285		437285
Labor @ 10% of Labor Cost			145762		145762
Material @ 10% of Material Cost		581562			581562
Subcontract @ 10% of Sub. Cost	219400				219400
Total Direct Cost	2413400	6397177	2040665	450316	11301558
Indirects @ 75% of Total Direct Labor Cost			1530499		1530499
Profit @ 10% Total Direct Cost					1130156
					13962212
Health & Safety Monitoring @ 3%					418866
Total Field Cost					14381079
Contingency @ 20% of Total Field Cost					2876216
Engineering @ 12% of Total Field Cost					1725729
Well Installation Field Engineering & Monitoring					100000
Total Cost This Page					19083024

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5B

(NWBGW5B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			10000.00	12000.00			10000	12000	22000	
2) Site Survey		LS	15000.00				15000				15000	
3) Clearing & Grubbing	8	AC			1165.00	1840.00			9320	14720	24040	
4) Earthwork Grading	14000	CY			.24	.78			3360	10920	14280	
5) Demobilization		LS			10000.00	12000.00			10000	12000	22000	
							15000	0	32680	49640	97320	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300'
												4 @ 500'
2) Groundwater Extraction Wells (Onsite)	3150	LF	160.00				504000				504000	7 @ 450'
3) Groundwater Extraction Wells (Offsite)	4500	LF	220.00				990000				990000	10 @ 450'
4) Extraction Well Pumps (Onsite)	7			4000.00	400.00			28000	2800		30800	300-400 gpm
5) Extraction Well Pumps (Offsite)	2			4000.00	400.00			8000	800		8800	300-400 gpm
6) Extraction Well Pumps (Offsite)	8			6000.00	600.00			48000	4800		52800	800-1200 gpm
7) Equalization Tank	1			50000.00	5000.00	5000.00		50000	5000	5000	60000	40000 gallon
8) Equalization Tank Mixing System	1			22000.00	2500.00			22000	2500		24500	
9) Clarifier Supply Pump	2			5000.00	400.00			10000	800		10800	2700 gpm
10) Clarifier	1			238000.00	60000.00			238000	60000		298000	
11) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
12) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	
13) Sand Filter Transfer Tank	1			1200.00	300.00			1200	300		1500	
14) Sand Filter Supply Pump	2			3000.00	400.00			6000	800		6800	
15) Sand Filter	10			110000.00	11000.00	5500.00		1100000	110000	55000	1265000	
16) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
17) Thickener	1			36400.00	9100.00			36400	9100		45500	
18) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
19) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	
20) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
21) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
22) Granular Activated Carbon System	3			200000.00	20000.00	20000.00		600000	60000	60000	720000	Onsite
23) Granular Activated Carbon System	8			200000.00	20000.00	20000.00		1600000	160000	160000	1920000	Offsite
24) Clearwell Effluent Distribution Tank	9			18000.00	1800.00	600.00		162000	16200	5400	183600	
25) Recharge Pumps	10			4000.00	600.00			40000	6000		46000	
26) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
27) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
28) Air Compressor	1			6000.00	800.00			6000	800		6800	
29) Sump Pump	2			2000.00	400.00			4000	800		4800	
							1846000	4155000	475800	297900	6774700	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5B

(NWBGW5B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												Onsite
a) Well Piping - 8"	3150	LF		52.00	28.00			163800	88200		252000	
b) Collection Piping - 8"	1000	LF		15.00	7.00			15000	7000		22000	
c) Collection Piping - 10"	1000	LF		26.00	9.00			26000	9000		35000	
d) Collection Piping - 12"	500	LF		30.00	11.00			15000	5500		20500	
e) Collection Piping - 14"	1600	LF		40.00	13.00			64000	20800		84800	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64			17876	10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09			6109	8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00		2050	451	369	2870	
2) Extraction Wells To Activated Carbon												Offsite
a) Well Piping - 10"	5500	LF		26.00	9.00			143000	49500		192500	
b) Excavation,Backfill,Compaction	1000	LF			4.36	2.64			4360	2640	7000	
c) Pipe Bedding	1000	LF			1.49	2.09			1490	2090	3580	
d) Revegetation	10	MSF		50.00	11.00	9.00		500	110	90	700	
3) Treatment System To Recharge Basin												Offsite
a) Piping - 8"	3400	LF		15.00	7.00			51000	23800		74800	
b) Piping - 10"	4400	LF		26.00	9.00			114400	39600		154000	
c) Piping - 14"	3400	LF		34.00	13.00			115600	44200		159800	
d) Piping - 18"	1800	LF		60.00	20.00			108000	36000		144000	
e) Piping - 24"	1200	LF		75.00	30.00			90000	36000		126000	
f) Excavation,Backfill,Compaction	14200	LF			4.36	2.64			61912	37488	99400	
g) Pipe Bedding	14200	LF			1.49	2.09			21158	29678	50836	
h) Revegetation	142	MSF		50.00	11.00	9.00		7100	1562	1278	9940	
4) System Interconnection Piping												Onsite
a) 2"	200	LF		13.00	7.00			2600	1400		4000	
b) 3"	200	LF		19.50	10.50			3900	2100		6000	
c) 10"	600	LF		65.00	35.00			39000	21000		60000	
d) 14"	800	LF		91.00	49.00			72800	39200		112000	
e) 16"	300	LF		104.00	56.00			31200	16800		48000	
5) Air Piping												
a) 3"	300			19.50	10.50			5850	3150		9000	
6) Valves												Onsite
a) 1/2"	12			60.00	30.00			720	360		1080	
b) 3"	4			220.00	70.00			880	280		1160	
c) 14"	22			1200.00	300.00			26400	6600		33000	
d) 16"	8			1600.00	400.00			12800	3200		16000	
7) Valves												Offsite
e) 10"	30			750.00	170.00			22500	5100		27600	
8) Level Control System	8			2000.00	800.00			16000	6400		22400	Onsite
9) Level Control System	20			2000.00	800.00			40000	16000		56000	Offsite
							0	1190100	596218	93026	1879344	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon and Reuse
Alternative GW5B

(NWBGW5B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
FOUNDATION & STRUCTURAL												
1) Treatment Building	10000	SF	30.00				300000				300000	60' x 100'
2) Building Foundation	350	CY		170.00	315.00	15.00		59500	110250	5250	175000	
3) Equipment Foundation	100	CY		135.00	250.00	15.00		13500	25000	1500	40000	
4) Activated Carbon Foundation	200	CY		135.00	250.00	15.00		27000	50000	3000	80000	Offsite
5) Loading/Unloading Area	5600	SF	1.00				5600				5600	
6) Parking Area	800	SF	3.00				2400				2400	
							308000	100000	185250	9750	603000	
ELECTRICAL												Onsite
1) Power Supply		LS	10000.00				10000				10000	
2) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
3) Starter #2	25			1500.00	720.00			37500	18000		55500	
4) Disconnect Switch	25			375.00	175.00			9375	4375		13750	
5) Conduit, Cable, Control #2	25			930.00	795.00			23250	19875		43125	
6) Grounding		LS		6250.00	6250.00			6250	6250		12500	
7) Miscellaneous Wiring		LS		13500.00	13500.00			13500	13500		27000	
8) Instrumentation		LS		7000.00	3000.00			7000	3000		10000	
9) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							10000	114175	86450	0	210625	
ELECTRICAL												Offsite
1) Power Supply		LS	15000.00				15000				15000	
2) Well Pump Feeder Cable	1000	LF		3.00	4.50			3000	4500		7500	
3) Starter #2	8			1500.00	720.00			12000	5760		17760	
4) Starter #6	10			13000.00	800.00			130000	8000		138000	
5) Disconnect Switch	8			375.00	175.00			3000	1400		4400	
6) Disconnect Switch	10			600.00	400.00			6000	4000		10000	
7) Conduit, Cable, Control #2	8			930.00	795.00			7440	6360		13800	
8) Conduit, Cable, Control #6	10			5540.00	2170.00			55400	21700		77100	
9) Grounding		LS		4500.00	4500.00			4500	4500		9000	
10) Miscellaneous Wiring		LS		9000.00	9000.00			9000	9000		18000	
11) Instrumentation		LS		6000.00	3000.00			6000	3000		9000	
12) Outdoor Lighting		LS		20000.00	13000.00			20000	13000		33000	
							15000	256340	81220	0	352560	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5B
(OMNWGW5B) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granulate Activated Carbon And Reuse
Alternative GW5B
(OMNGW5B1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	17278018	Kw-hr	.085	$1468632	Treatment Plant
2. Maintenance				$339100	3% of Capital Cost
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Activated Carbon					
a. Liquid	1997280	LB	.80	$1597824	
6. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$4192916	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Granular Activated Carbon And Reuse
Alternative GW5B
(PWANGW5B) 8/30/93
84201

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	19083											
2. O & M COSTS		4235.6										
3. ANNUAL COSTS	19083	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	19083	4032	3842	3660	3486	3321	3160	3012	2868	2732	2601	2478

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	2359	2245	2139	2037	1940	1847	1762	1677	1597	1521	1449	1381

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	4235.6	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	1313	1250	1190	1135	1080	1029	978	84201

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A
(NWBGW6AS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	17823	29086	56909
2) EQUIPMENT	688000	9404600	796800	660100	11549500
3) PIPING & INSTRUMENTATION	0	321150	171916	19762	512828
4) FOUNDATION & STRUCTURAL	368000	91650	169800	8550	638000
5) ELECTRICAL	50000	130395	97210	0	277605
	1116000	9947795	1253549	717498	13034842
Burden @ 30% of Labor Cost			376065		376065
Labor @ 10% of Labor Cost			125355		125355
Material @ 10% of Material Cost		994780			994780
Subcontract @ 10% of Sub. Cost	111600				111600
Total Direct Cost	1227600	10942575	1754969	717498	14642641
Indirects @ 75% of Total Direct Labor Cost			1316226		1316226
Profit @ 10% Total Direct Cost					1464264
					17423132
Health & Safety Monitoring @ 3%					522694
Total Field Cost					17945826
Contingency @ 20% of Total Field Cost					3589165
Engineering @ 12% of Total Field Cost					2153499
Well Installation Field Engineering & Monitoring					30000
Total Cost This Page					23718490

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A

(NWBGW6A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	3	AC			1165.00	1840.00			3495	5520	9015	
4) Earthwork Grading	9700	CY			.24	.78			2328	7566	9894	
5) Demobilization		LS			6000.00	8000.00			6000	8000	14000	
							10000	0	17823	29086	56909	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300' 4 @ 500'
2) Groundwater Extraction Wells	2100	LF	160.00				336000				336000	7 @ 300'
3) Extraction Well Pumps	7			3000.00	600.00			21000	4200		25200	200-300 gpm
4) Equalization Tank	1			30000.00	3000.00	3000.00		30000	3000	3000	36000	20000 gallon
5) Equalization Tank Mixing System	1			18000.00	1800.00			18000	1800		19800	
6) Clarifier Supply Pump	2			4000.00	400.00			8000	800		8800	1900 gpm
7) Clarifier	1			1960000.00	49000.00			1960000	49000		2009000	
8) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
9) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	
10) Sand Filter Transfer Tank	1			1200.00	300.00			1200	300		1500	
11) Sand Filter Supply Pump	2			3000.00	400.00			6000	800		6800	
12) Sand Filter	8			110000.00	11000.00	5500.00		880000	88000	44000	1012000	
13) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
14) Thickener	1			30800.00	7700.00			30800	7700		38500	
15) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
16) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	
17) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
18) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
19) Enhanced Oxidation Transfer Tank	1			1200.00	300.00			1200	300		1500	
20) Enhanced Oxidation Supply Pump	2			5000.00	600.00			10000	1200		11200	
21) Enhanced Oxidation System	1			6200000.00	600000.00	600000.00		6200000	600000	600000	7400000	
22) Clearwell Effluent Distribution Tank	1			18000.00	1800.00	600.00		18000	1800	600	20400	
24) Effluent Recharge Pump	2			7500.00	600.00			15000	1200		16200	1900 gpm
25) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
26) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
27) Air Compressor	1			6000.00	800.00			6000	800		6800	
28) Sump Pump	2			2000.00	400.00			4000	800		4800	
							688000	9404600	796800	660100	11549500	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A

(NWBGW6A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												
a) Well Piping - 6"	2100	LF		39.00	21.00			81900	44100		126000	
b) Collection Piping - 6"	1000	LF		13.00	6.00			13000	6000		19000	
c) Collection Piping - 8"	1000	LF		15.00	7.00			15000	7000		22000	
d) Collection Piping - 10"	500	LF		26.00	9.00			13000	4500		17500	
e) Collection Piping - 12"	1600	LF		30.00	11.00			48000	17600		65600	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64			17876	10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09			6109	8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00		2050	451	369	2870	
2) System Interconnection Piping												
a) 2"	100			13.00	7.00			1300	700		2000	
b) 3"	200			19.50	10.50			3900	2100		6000	
c) 12"	800			78.00	42.00			62400	33600		96000	
d) 14"	300			91.00	49.00			27300	14700		42000	
3) Air Piping												
a) 2"	300			13.00	7.00			3900	2100		6000	
4) Valves												
a) 1/2"	18			60.00	30.00			1080	540		1620	
b) 2"	4			180.00	60.00			720	240		960	
c) 12"	22			1000.00	250.00			22000	5500		27500	
d) 14"	8			1200.00	300.00			9600	2400		12000	
5) Level Control System	8			2000.00	800.00			16000	6400		22400	
							0	321150	171916	19762	512828	
FOUNDATION & STRUCTURAL												
1) Treatment Building	12000	SF	30.00				360000				360000	100' x 100'
2) Building Foundation	420	CY		170.00	315.00	15.00		71400	132300	6300	210000	
3) Equipment Foundation	150	CY		135.00	250.00	15.00		20250	37500	2250	60000	
4) Loading/Unloading Area	5600	SF	1.00				5600				5600	
5) Parking Area	800	SF	3.00				2400				2400	
							368000	91650	169800	8550	638000	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A

(NWBGW6A) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
ELECTRICAL												
1) Power Supply		LS	10000.00				10000				10000	
2) Substation - 1500 KVA		LS	40000.00				40000				40000	
3) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
4) Starter #2	29			1500.00	720.00			43500	20880		64380	
5) Disconnect Switch	29			375.00	175.00			10875	5075		15950	
6) Conduit, Cable, Control #2	29			930.00	795.00			26970	23055		50025	
7) Grounding		LS		7250.00	7250.00			7250	7250		14500	
8) Miscellaneous Wiring		LS		14500.00	14500.00			14500	14500		29000	
9) Instrumentation		LS		10000.00	5000.00			10000	5000		15000	
10) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							50000	130395	97210	0	277605	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A
(OMNWGW6A) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A
(OMNGW6A1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	2514950	Kw-hr	.085	$213771	Treatment Plant
b. Enhanced Oxidation	1944720000	GAL	$3.15/1000 Gal	$6125868	Onsite
2. Maintenance				$439300	3% of Capital Co
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$7566299	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6A
(PWANGW6A) 8/30/93
140698

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	23718.5											
2. O & M COSTS		7608.9										
3. ANNUAL COSTS	23718.5	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	23719	7244	6901	6574	6262	5965	5676	5410	5151	4908	4672	4451

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	4238	4033	3842	3660	3485	3317	3165	3013	2869	2732	2602	2481

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	7608.9	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	2359	2245	2138	2039	1940	1849	1758	140698

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B
(NWBGW6BS) 8/30/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	15000	0	32680	49640	97320
2) EQUIPMENT	1846000	10433200	1102900	933100	14315200
3) PIPING & INSTRUMENTATION	0	1190100	596218	93026	1879344
4) FOUNDATION & STRUCTURAL	368000	145650	269800	14550	798000
5) ELECTRICAL (Onsite)	50000	130395	97210	0	277605
6) ELECTRICAL (Offsite)	15000	340550	135900	0	491450
	2294000	12239895	2234708	1090316	17858919
Burden @ 30% of Labor Cost			670412		670412
Labor @ 10% of Labor Cost			223471		223471
Material @ 10% of Material Cost		1223990			1223990
Subcontract @ 10% of Sub. Cost	229400				229400
Total Direct Cost	2523400	13463885	3128591	1090316	20206192
Indirects @ 75% of Total Direct Labor Cost			2346443		2346443
Profit @ 10% Total Direct Cost					2020619
					24573254
Health & Safety Monitoring @ 3%					737198
Total Field Cost					25310452
Contingency @ 20% of Total Field Cost					5062090
Engineering @ 10% of Total Field Cost					2531045
Well Installation Field Engineering & Monitoring					100000
Total Cost This Page					33003587

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B

(NWBGW6B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			10000.00	12000.00			10000	12000	22000	
2) Site Survey		LS	15000.00				15000				15000	
3) Clearing & Grubbing	8	AC			1165.00	1840.00			9320	14720	24040	
4) Earthwork Grading	14000	CY			.24	.78			3360	10920	14280	
5) Demobilization		LS			10000.00	12000.00			10000	12000	22000	
							15000	0	32680	49640	97320	
EQUIPMENT												
1) Monitoring Wells	4400	LF	80.00				352000				352000	8 @ 300' 4 @ 500'
2) Groundwater Extraction Wells (Onsite)	3150	LF	160.00				504000				504000	7 @ 450'
3) Groundwater Extraction Wells (Offsite)	4500	LF	220.00				990000				990000	10 @ 450'
4) Extraction Well Pumps (Onsite)	7			4000.00	400.00			28000	2800		30800	300-400 gpm
5) Extraction Well Pumps (Offsite)	2			4000.00	400.00			8000	800		8800	300-400 gpm
6) Extraction Well Pumps (Offsite)	8			6000.00	600.00			48000	4800		52800	800-1200 gpm
7) Equalization Tank	1			50000.00	5000.00	5000.00		50000	5000	5000	60000	40000 gallon
8) Equalization Tank Mixing System	1			22000.00	2500.00			22000	2500		24500	
9) Clarifier Supply Pump	2			5000.00	400.00			10000	800		10800	2700 gpm
10) Clarifier	1			238000.00	60000.00			238000	60000		298000	
11) Clarifier Underflow Pump	2			2000.00	300.00			4000	600		4600	
12) Sludge Decant Tank	1			20000.00	2000.00			20000	2000		22000	
13) Sand Filter Transfer Tank	1			1200.00	300.00			1200	300		1500	
14) Sand Filter Supply Pump	2			3000.00	400.00			6000	800		6800	
15) Sand Filter	10			110000.00	11000.00	5500.00		1100000	110000	55000	1265000	
16) Dirty Backwash Tank	1			12000.00	1200.00			12000	1200		13200	
17) Thickener	1			36400.00	9100.00			36400	9100		45500	
18) Filter Press Feed Pump	2			5000.00	800.00			10000	1600		11600	
19) Filter Press	1			125000.00	25000.00	12500.00		125000	25000	12500	162500	
20) Filtrate Recycle Tank	1			3800.00	600.00			3800	600		4400	
21) Filtrate Recycle Pump	2			1800.00	300.00			3600	600		4200	
22) Enhanced Oxidation Transfer Tank	1			1200.00	300.00			1200	300		1500	
23) Enhanced Oxidation Supply Pump	2			6500.00	600.00			13000	1200		14200	
24) Enhanced Oxidation System (Onsite)	1			7000000.00	700000.00	700000.00		7000000	700000	700000	8100000	
25) Enhanced Oxidation System (Offsite)	8			200000.00	20000.00	20000.00		1600000	160000	160000	1920000	
26) Clearwell Effluent Distribution Tank	1			18000.00	1800.00	600.00		18000	1800	600	20400	
27) Effluent Recharge Pump (Onsite)	2			8000.00	600.00			16000	1200		17200	
28) Effluent Recharge Pump (Offsite)	8			4000.00	600.00			32000	4800		36800	
29) Ferrous Sulfate Feed System	1			10000.00	2500.00			10000	2500		12500	
30) Polymer Feed System	1			7000.00	1000.00			7000	1000		8000	
31) Air Compressor	1			6000.00	800.00			6000	800		6800	
32) Sump Pump	2			2000.00	400.00			4000	800		4800	
							1846000	10433200	1102900	933100	14315200	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B

(NWBGW6B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
PIPING & INSTRUMENTATION												
1) Extraction Wells To Equalization Tank												Onsite
a) Well Piping - 8"	3150	LF		52.00	28.00			163800	88200		252000	
b) Collection Piping - 8"	1000	LF		15.00	7.00			15000	7000		22000	
c) Collection Piping - 10"	1000	LF		26.00	9.00			26000	9000		35000	
d) Collection Piping - 12"	500	LF		30.00	11.00			15000	5500		20500	
e) Collection Piping - 14"	1600	LF		40.00	13.00			64000	20800		84800	
e) Excavation,Backfill,Compaction	4100	LF			4.36	2.64			17876	10824	28700	
f) Pipe Bedding	4100	LF			1.49	2.09			6109	8569	14678	
g) Revegetation	41	MSF		50.00	11.00	9.00		2050	451	369	2870	
2) Extraction Wells To Enhanced Oxidation												Offsite
a) Well Piping - 10"	5500	LF		26.00	9.00			143000	49500		192500	
b) Excavation,Backfill,Compaction	1000	LF			4.36	2.64			4360	2640	7000	
c) Pipe Bedding	1000	LF			1.49	2.09			1490	2090	3580	
d) Revegetation	10	MSF		50.00	11.00	9.00		500	110	90	700	
3) Treatment System To Recharge Basin												Offsite
a) Piping - 8"	3400	LF		15.00	7.00			51000	23800		74800	
b) Piping - 10"	4400	LF		26.00	9.00			114400	39600		154000	
c) Piping - 14"	3400	LF		34.00	13.00			115600	44200		159800	
d) Piping - 18"	1800	LF		60.00	20.00			108000	36000		144000	
e) Piping - 24"	1200	LF		75.00	30.00			90000	36000		126000	
f) Excavation,Backfill,Compaction	14200	LF			4.36	2.64			61912	37488	99400	
g) Pipe Bedding	14200	LF			1.49	2.09			21158	29678	50836	
h) Revegetation	142	MSF		50.00	11.00	9.00		7100	1562	1278	9940	
4) System Interconnection Piping												Onsite
a) 2"	200	LF		13.00	7.00			2600	1400		4000	
b) 3"	200	LF		19.50	10.50			3900	2100		6000	
c) 10"	600	LF		65.00	35.00			39000	21000		60000	
d) 14"	800	LF		91.00	49.00			72800	39200		112000	
e) 16"	300	LF		104.00	56.00			31200	16800		48000	
5) Air Piping												
a) 3"	300			19.50	10.50			5850	3150		9000	
6) Valves												Onsite
a) 1/2"	12			60.00	30.00			720	360		1080	
b) 3"	4			220.00	70.00			880	280		1160	
c) 14"	22			1200.00	300.00			26400	6600		33000	
d) 16"	8			1600.00	400.00			12800	3200		16000	
7) Valves												Offsite
e) 10"	30			750.00	170.00			22500	5100		27600	
8) Level Control System	8			2000.00	800.00			16000	6400		22400	Onsite
9) Level Control System	20			2000.00	800.00			40000	16000		56000	Offsite
							0	1190100	596218	93026	1879344	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B

(NWBGW6B) 8/30/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
FOUNDATION & STRUCTURAL												
1) Treatment Building	12000	SF	30.00				360000				360000	100' x 120'
2) Building Foundation	420	CY		170.00	315.00	15.00		71400	132300	6300	210000	
3) Equipment Foundation	150	CY		135.00	250.00	15.00		20250	37500	2250	60000	
4) Enhanced Oxidation Foundation	400	CY		135.00	250.00	15.00		54000	100000	6000	160000	Offsite
5) Loading/Unloading Area	5600	SF	1.00				5600				5600	
6) Parking Area	800	SF	3.00				2400				2400	
							368000	145650	269800	14550	798000	
ELECTRICAL												Onsite
1) Power Supply		LS	10000.00				10000				10000	
2) Substation - 1500 KVA		LS	40000.00				40000				40000	
3) Well Pump Feeder Cable	4100	LF		3.00	4.50			12300	18450		30750	
4) Starter #2	29			1500.00	720.00			43500	20880		64380	
5) Disconnect Switch	29			375.00	175.00			10875	5075		15950	
6) Conduit, Cable, Control #2	29			930.00	795.00			26970	23055		50025	
7) Grounding		LS		7250.00	7250.00			7250	7250		14500	
8) Miscellaneous Wiring		LS		14500.00	14500.00			14500	14500		29000	
9) Instrumentation		LS		10000.00	5000.00			10000	5000		15000	
10) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							50000	130395	97210	0	277605	
ELECTRICAL												Offsite
1) Power Supply		LS	15000.00				15000				15000	
2) Well Pump Feeder Cable	1000	LF		3.00	4.50			3000	4500		7500	
3) Starter #2	30			1500.00	720.00			45000	21600		66600	
4) Starter #6	10			13000.00	800.00			130000	8000		138000	
5) Disconnect Switch	30			375.00	175.00			11250	5250		16500	
6) Disconnect Switch	10			600.00	400.00			6000	4000		10000	
7) Conduit, Cable, Control #2	30			930.00	795.00			27900	23850		51750	
8) Conduit, Cable, Control #6	10			5540.00	2170.00			55400	21700		77100	
9) Grounding		LS		10000.00	10000.00			10000	10000		20000	
10) Miscellaneous Wiring		LS		20000.00	20000.00			20000	20000		40000	
11) Instrumentation		LS		16000.00	8000.00			16000	8000		24000	
12) Outdoor Lighting		LS		16000.00	9000.00			16000	9000		25000	
							15000	340550	135900	0	491450	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B
(OMNWGW6B) 8/30/93

Annual Costs

ITEM	ITEM $ QUARTERLY SAMPLING	NOTES
1. Sampling	16000.00	12 groundwater samples 60 manhours per sampling period. (quarterly) plus travel, living & shipping costs.
2. Analysis	21840.00	14 groundwater samples, per sampling period. (inc. blank & duplicate) Volatile Organics
3. Reporting	4800.00	20 manhours per report plus other direct costs
TOTAL ANNUAL COST	42640.00	Post Remedial monitoring will be performed quarterly for years 1 thru 30

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B
(OMNGW6B1) 8/30/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	18450000	Kw-hr	.085	$1568250	Treatment Plant
b. Enhanced Oxidation	2365200000	GAL	$3.15/1000 Gal	$7450380	Onsite
c. Enhanced Oxidation	4204800000	GAL	$.61/1000 Gal	$2564928	Offsite
2. Maintenance				$606200	3% of Capital Cost
3. Operator	3	EA.	40000.00	$120000	1 Operator 2 Shifts/Day
4. Chemical					
a. Polymer	16680	LB	2.00	$33360	
a. Ferrous Sulfate	167	TON	2000.00	$334000	
5. Sludge Disposal					
a. Hauling	70	LD	2250.00	$157500	
b. Disposal	1425	TON	100.00	$142500	
TOTAL ANNUAL COSTS				$12977118	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Precipitation/Filtration,
Enhanced Oxidation And Reuse
Alternative GW6B
(PWANGW6B) 8/30/93
233170

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	33003.6											
2. O & M COSTS		13019.8										
3. ANNUAL COSTS	33003.6	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	33004	12395	11809	11249	10715	10208	9713	9257	8814	8398	7994	7617

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	7252	6900	6575	6263	5963	5677	5416	5156	4908	4674	4453	4244

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	13019.8	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	4036	3841	3659	3489	3320	3164	3008	233170

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Air Stripping And Reuse
(Vinyl Chloride Well)
Alternative GW4AB
(NWBG4ABS) 8/3/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	12823	17700	40523
2) EQUIPMENT	0	464000	78800	38000	580800
3) PIPING & INSTRUMENTATION	0	113000	58420	14460	185880
4) FOUNDATION & STRUCTURAL	90000	19000	35200	1800	146000
5) ELECTRICAL	10000	33885	22080	0	65965
	110000	629885	207323	71960	1019168
Burden @ 30% of Labor Cost			62197		62197
Labor @ 10% of Labor Cost			20732		20732
Material @ 10% of Material Cost		62989			62989
Subcontract @ 10% of Sub. Cost	11000				11000
Total Direct Cost	121000	692874	290252	71960	1176086
Indirects @ 75% of Total Direct Labor Cost			217689		217689
Profit @ 10% Total Direct Cost					117609
Total Field Cost					1511383
Contingency @ 20% of Total Field Cost					302277
Engineering @ 15% of Total Field Cost					226708
Total Cost This Page					2040368

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Air Stripping And Reuse
(Vinyl Chloride Well)
Alternative GW4AB

(NWBGW4AB) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	.5	AC			1165.00	1840.00			583	920	1503	
4) Earthwork Grading	1000	CY			.24	.78			240	780	1020	
5) Demobilization		LS			6000.00	8000.00			6000	8000	14000	
							10000	0	12823	17700	40523	
EQUIPMENT												
1) Air Stripper Supply Tank	1			20000.00	2000.00			20000	2000		22000	13000 gallon
2) Air Stripper Supply Pump	2			3000.00	400.00			6000	800		6800	
3) Air Stripper Tower incl. Packing, Blower	1			70000.00	4000.00	3000.00		70000	4000	3000	77000	8'dia. x 8'
4) Vapor Thermal Destruct System	1			350000.00	70000.00	35000.00		350000	70000	35000	455000	
5) Effluent Tank	1			8000.00	400.00			8000	400		8400	
6) Effluent Pump	2			3000.00	400.00			6000	800		6800	
6) Sump Pump	2			2000.00	400.00			4000	800		4800	
							0	464000	78800	38000	580800	
PIPING & INSTRUMENTATION												
1) Extraction Wells To Transfer Tank												
a) Collection Piping - 10"	2500	LF		26.00	9.00			65000	22500		87500	
b) Excavation,Backfill,Compaction	2500	LF			4.36	2.64			10900	6600	17500	
c) Pipe Bedding	2500	LF			1.49	2.09			3725	5225	8950	
d) Revegetation	25	MSF		50.00	11.00	9.00		1250	275	225	1750	
2) System Interconnection Piping												
a) 10	200			65.00	35.00			13000	7000		20000	
b) 12"	50			78.00	42.00			3900	2100		6000	
3) Effluent Tank To Recharge Basin												
a) Piping - 10"	500	LF		26.00	9.00			13000	4500		17500	
b) Excavation,Backfill,Compaction	500	LF			4.36	2.64			2180	1320	3500	
c) Pipe Bedding	500	LF			1.49	2.09			745	1045	1790	
d) Revegetation	5	MSF		50.00	11.00	9.00		250	55	45	350	
4) Valves												
a) 10"	12			750.00	170.00			9000	2040		11040	
b) 12"	4			900.00	200.00			3600	800		4400	
5) Level Control System	2			2000.00	800.00			4000	1600		5600	
							0	113000	58420	14460	185880	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Air Stripping And Reuse
(Vinyl Chloride Well)
Alternative GW4AB

(NWBGW4AB) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
FOUNDATION & STRUCTURAL												
1) Treatment Building	3000	SF	30.00				90000				90000	
2) Building Foundation	80	CY		170.00	315.00	15.00		13600	25200	1200	40000	
3) Equipment Foundation	40	CY		135.00	250.00	15.00		5400	10000	600	16000	
							90000	19000	35200	1800	146000	
ELECTRICAL												
1) Power Supply		LS	10000.00				10000				10000	
2) Starter #2	7			1500.00	720.00			10500	5040		15540	
3) Disconnect Switch	7			375.00	175.00			2625	1225		3850	
4) Conduit, Cable, Control #2	7			930.00	795.00			6510	5565		12075	
5) Grounding		LS		1750.00	1750.00			1750	1750		3500	
6) Miscellaneous Wiring		LS		3500.00	3500.00			3500	3500		7000	
7) Instrumentation		LS		4000.00	2000.00			4000	2000		6000	
9) Outdoor Lighting		LS		5000.00	3000.00			5000	3000		8000	
							10000	33885	22080	0	65965	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Air Stripping And Reuse
(Vinyl Chloride Well)
Alternative GW4AB
(OMNGW4AB) 8/3/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	346200	Kw-hr	.085	$29427	Treatment Plant
b. Fuel Oil	139000	GAL	1.00	$139000	Thermal Destruct
2. Maintenance				$35300	3% of Capital Cost
3. Operator				$10000	2 hrs/day-5 days/w
TOTAL ANNUAL COSTS				$213727	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Air Stripping And Reuse
(Vinyl Chloride Well)
Alternative GW4AB
(PWAGW4AB) 8/3/93
5326

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	2040.4											
2. O & M COSTS		213.7										
3. ANNUAL COSTS	2040.4	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	2040	203	194	185	176	168	159	152	145	138	131	125

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7	213.7
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	119	113	108	103	98	93	89	85	81	77	73	70

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	213.7	213.7	213.7	213.7	213.7	213.7	213.7	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	66	63	60	57	54	52	49	5326

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW5AB
(NWBG5ABS) 8/3/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	13645	19400	43045
2) EQUIPMENT	0	604000	54800	50000	708800
3) PIPING & INSTRUMENTATION	0	113000	58420	14460	185880
4) FOUNDATION & STRUCTURAL	90000	19000	35200	1800	146000
5) ELECTRICAL	10000	40550	27400	0	77950
	110000	776550	189465	85660	1161675
Burden @ 30% of Labor Cost			56840		56840
Labor @ 10% of Labor Cost			18947		18947
Material @ 10% of Material Cost		77655			77655
Subcontract @ 10% of Sub. Cost	11000				11000
Total Direct Cost	121000	854205	265251	85660	1326116
Indirects @ 75% of Total Direct Labor Cost			198938		198938
Profit @ 10% Total Direct Cost					132612
Total Field Cost					1657666
Contingency @ 20% of Total Field Cost					331533
Engineering @ 15% of Total Field Cost					248650
Total Cost This Page					2237849

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW5AB

(NWBGW5AB) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	1	AC			1165.00	1840.00			1165	1840	3005	
4) Earthwork Grading	2000	CY			.24	.78			480	1560	2040	
5) Demobilization		LS			6000.00	8000.00			6000	8000	14000	
							10000	0	13645	19400	43045	
EQUIPMENT												
1) Enhanced Oxidation Supply Tank	1			20000.00	2000.00			20000	2000		22000	13000 gallon
2) Enhanced Oxidation Supply Pump	2			3000.00	400.00			6000	800		6800	900 gpm
3) Enhanced Oxidation System	1			560000.00	50000.00	50000.00		560000	50000	50000	660000	
4) Effluent Tank	1			8000.00	400.00			8000	400		8400	
5) Effluent Pump	2			3000.00	400.00			6000	800		6800	
6) Sump Pump	2			2000.00	400.00			4000	800		4800	
							0	604000	54800	50000	708800	
PIPING & INSTRUMENTATION												
1) Production Wells To Transfer Tank												
a) Piping - 10"	2500	LF		26.00	9.00			65000	22500		87500	
b) Excavation,Backfill,Compaction	2500	LF			4.36	2.64			10900	6600	17500	
c) Pipe Bedding	2500	LF			1.49	2.09			3725	5225	8950	
d) Revegetation	25	MSF		50.00	11.00	9.00		1250	275	225	1750	
2) System Interconnection Piping												
a) 10"	200			65.00	35.00			13000	7000		20000	
b) 12"	50			78.00	42.00			3900	2100		6000	
3) Effluent Tank To Recharge Basin												
a) Piping - 10"	500	LF		26.00	9.00			13000	4500		17500	
b) Excavation,Backfill,Compaction	500	LF			4.36	2.64			2180	1320	3500	
c) Pipe Bedding	500	LF			1.49	2.09			745	1045	1790	
d) Revegetation	5	MSF		50.00	11.00	9.00		250	55	45	350	
4) Valves												
a) 10"	12			750.00	170.00			9000	2040		11040	
b) 12"	4			900.00	200.00			3600	800		4400	
5) Level Control System	2			2000.00	800.00			4000	1600		5600	
							0	113000	58420	14460	185880	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW5AB

(NWBGW5AB) 8/3/93

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Direct Cost	Comments
FOUNDATION & STRUCTURAL												
1) Treatment Building	3000	SF	30.00				90000				90000	
2) Building Foundation	80	CY		170.00	315.00	15.00		13600	25200	1200	40000	
3) Equipment Foundation	40	CY		135.00	250.00	15.00		5400	10000	600	16000	
							90000	19000	35200	1800	146000	
ELECTRICAL												
1) Power Supply		LS	10000.00				10000				10000	
2) Starter #2	10			1500.00	720.00			15000	7200		22200	
3) Disconnect Switch	10			375.00	175.00			3750	1750		5500	
4) Conduit, Cable, Control #2	10			930.00	795.00			9300	7950		17250	
5) Grounding		LS		2500.00	2500.00			2500	2500		5000	
6) Miscellaneous Wiring		LS		5000.00	5000.00			5000	5000		10000	
7) Instrumentation		LS		5000.00	3000.00			5000	3000		8000	
							10000	40550	27400	0	77950	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW5AB
(OMNGW5AB) 8/3/93

Annual Costs - (24 hr/day - 365 days/year)

ITEM	QTY	UNIT	UNIT$	ITEM $	NOTES
1. Energy					
a. Electric	261290	Kw-hr	.085	$22210	Treatment Plant
b. Enhanced Oxidation	473040000	GAL	$1/1000 Gal	$473040	
2. Maintenance				$39800	3% of Capital Cos
3. Operator				$10000	2 hrs/day-5 days/
TOTAL ANNUAL COSTS				$545050	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW5AB
(PWAGW5AB) 8/3/93
10618

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	2237.9											
2. O & M COSTS		545.1										
3. ANNUAL COSTS	2237.9	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1
4. ANNUAL DISCOUNT RATE=5%	1	.952	.907	.864	.823	.784	.746	.711	.677	.645	.614	.585
PRESENT WORTH =	2238	519	494	471	449	427	407	388	369	352	335	319

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1	545.1
ANNUAL DISCOUNT RATE=5%	.557	.53	.505	.481	.458	.436	.416	.396	.377	.359	.342	.326
PRESENT WORTH =	304	289	275	262	250	238	227	216	206	196	186	178

	24	25	26	27	28	29	30	TOTAL PRESENT WORTH (000'S)
O & M COSTS	545.1	545.1	545.1	545.1	545.1	545.1	545.1	
ANNUAL DISCOUNT RATE=5%	.31	.295	.281	.268	.255	.243	.231	
PRESENT WORTH =	169	161	153	146	139	132	126	10618

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW6AB
(NWBG6ABS) 8/3/93

SUMMARY

Item	Sub.	Mat.	Labor	Equip.	
1) SITE PREPARATION	10000	0	13645	19400	43045
2) EQUIPMENT	0	604000	54800	50000	708800
3) PIPING & INSTRUMENTATION	0	113000	58420	14460	185880
4) FOUNDATION & STRUCTURAL	90000	19000	35200	1800	146000
5) ELECTRICAL	10000	40550	27400	0	77950
	110000	776550	189465	85660	1161675
Burden @ 30% of Labor Cost			56840		56840
Labor @ 10% of Labor Cost			18947		18947
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NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
Bethpage, New York
Groundwater Treatment System
Extraction, Enhanced Oxidation And Reuse
(Vinyl Chloride Well)
Alternative GW6AB

(NWBGW6AB) 8/3/93

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SITE PREPARATION												
1) Mobilization		LS			6000.00	8000.00			6000	8000	14000	
2) Site Survey		LS	10000.00				10000				10000	
3) Clearing & Grubbing	1	AC			1165.00	1840.00			1165	1840	3005	
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EQUIPMENT												
1) Enhanced Oxidation Supply Tank	1			20000.00	2000.00			20000	2000		22000	13000 gallon
2) Enhanced Oxidation Supply Pump	2			3000.00	400.00			6000	800		6800	900 gpm
3) Enhanced Oxidation System	1			560000.00	50000.00	50000.00		560000	50000	50000	660000	
4) Effluent Tank	1			8000.00	400.00			8000	400		8400	
5) Effluent Pump	2			3000.00	400.00			6000	800		6800	
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6) Miscellaneous Wiring		LS		5000.00	5000.00			5000	5000		10000	
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