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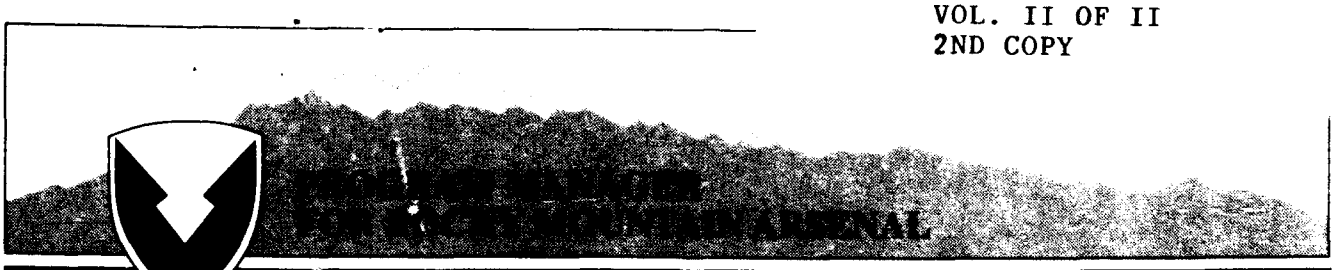
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THE PURPOSE OF THIS PROGRAM WAS TO: (1) ASSESS CHANGES IN THE RATE AND EXTENT OF CONTAMINANT MIGRATION. (2) MONITOR THE EFFECTS OF REMEDIAL ACTIONS. (3) MAINTAIN A DATABASE TO MEET REGULATORY REQUIREMENTS AND SUPPORT REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) VERIFICATION.

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Groundwater Monitoring Program
Final Annual Groundwater Monitoring Report for 1991

Volume II of II

September 18, 1992
Contract No. DAAA15-88-D-0021
Delivery Order 0006

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TECHNICAL SUPPORT FOR ROCKY MOUNTAIN ARSENAL



Groundwater Monitoring Program
Final Annual Groundwater Monitoring Report for 1991

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PREPARED BY

Harding Lawson Associates

PREPARED FOR

PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado



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2	Winter 1990/91 Water-level Monitoring Network, Unconfined Groundwater Flow System

Table 1.1: Comprehensive Monitoring Program Groundwater Monitoring Programs

Water Monitoring Year	Number of Water Levels Measured Quarterly[a]	Number of Wells Sampled Annually[a]	Number of Wells Sampled Semiannually[a]	Number of Wells Sampled Quarterly[a]
1988	1119	466	307	46
1989	1013	488	388	101
1990	1210	621	61	65
1991	1265	282	N/A	70

[a] The actual number of wells measured or sampled can vary from this number of proposed wells.

N/A = not applicable

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Table 1.2: Rocky Mountain Arsenal Comprehensive Monitoring Program
Target Analytes for the 1991 Water Monitoring Year

Organochlorine Pesticides
- 2,2'-bis(p-Chlorophenyl)-1,1-dichloroethene
- 2,2'-bis(p-Chlorophenyl)-1,1,1-trichloroethane
- Aldrin
- Chlordane
- Endrin
- Dieldrin
- Isodrin
- Hexachlorocyclopentadiene

Volatile Organohalogens
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Carbon tetrachloride
- Chlorobenzene
- Chloroform
- Methylene chloride
- Tetrachloroethene
- Trichloroethene

Organosulfur Compounds
- 1,4-Dithiane
- 1,4-Oxithiane
- Benzothiazole
- Dimethyldisulfide
- p-Chlorophenylmethylsulfide
- p-Chlorophenylmethylsulfone
- p-Chlorophenylmethylsulfoxide

Organophosphorus Compounds[a]
- Atrazine
- Malathion
- Parathion
- Supona
- Vapona

Volatile Organic Aromatic Compounds
- Benzene
- Ethylbenzene
- Toluene
- m-Xylene
- o- and p-Xylene

Volatile Hydrocarbon Compounds
- Bicycloheptadiene
- Dicyclopentadiene (DCPD)
- Methylisobutyl Ketone (MIBK)

Organophosphorus Compounds
- Diisopropylmethylphosphonate (DIMP)
- Dimethylmethylphosphonate (DMMP)

Dibromochloropropane (DBCP)

Metals
- Arsenic
- Cadium
- Chromium
- Copper
- Lead
- Mercury
- Zinc

Cations
- Calcium
- Magnesium
- Potassium
- Sodium

Anions
- Chloride
- Fluoride
- Nitrate+nitrite
- Sulfate

Cyanide

---

[a] In the 1988, 1989, and 1990 CMP analytical programs, only Parathion results were reported from the organophosphorous compounds.

Table 3.1: Winter 1990/91, Spring 1991, and Fall 1991
Water Quality Monitoring Networks
(Page 1 of 2)

Section Number	Total Wells	Well Number
Winter 1990/91		
Unconfined Flow System Wells		
01	2	027[a], 075
02	4	020, 023, 034, 505
22	5	008, 011, 043, 051, 053
23	28	047, 049, 057, 085, 095, 108[a], 118, 123, 142, 179, 188, 191, 197, 198, 202, 203, 204, 205, 220, 226, 231, 232, 235, 237, 238[a], 239, 241, 530
24	14	063, 101, 127, 135, 161, 163, 164, 166, 184, 185, 191, 199, 200, 201
26	32	011, 015, 017, 019, 020, 041, 065[a], 071, 073, 076, 083, 085, 127, 133, 145[a], 148, 157, 158, 160, 161, 162, 163, 164[a], 165[a], 166, 167[a], 168, 169, 170, 171 173, 501, 503
27	20	003, 016, 037, 044, 053, 056, 057, 059, 062, 064, 071, 072, 073, 074, 076, 079, 082, 083, 085, 086
28	2	002, 023
33	5	048, 077, 078, 079, 581
35	3	505, 506[a], 507
Offpost	98	37304[a], 37307, 37308, 37309, 37312, 37313, 37320*, 37323, 37327, 37330, 37331, 37332*, 37333, 37334, 37335, 37336*, 37337, 37338, 37339, 37341*, 37342*, 37343, 37345, 37346*, 37347*, 37348*, 37349*, 37350*, 37351*, 37352*, 37353*, 37354*, 37355*, 37356*, 37357*, 37358, 37359*, 37360*, 37361*, 37363*, 37364*, 37366*, 37367*, 37368*, 37369, 37370, 37371, 37373, 37374, 37377, 37378, 37381, 37382, 37383*, 37385, 37386, 37389, 37391, 37392, 37395*, 37396, 37397*, 37402*, 37403*, 37404*, 37405*, 37406*, 37407, 37408*, 37409*, 37410*, 37418*, 37419*, 37420*, 37428*, 37429*, 37430*, 37433*, 37434*, 37435*, 37436*, 37437*, 37438, 37439, 37440*, 37441, 37442*, 37433*, 37444*, 005, 198-608*, 198-611*, 108-614*, DCGW01*, DCGW03*, SACMW03*, SACMW08*, SACMW11*
		Total unconfined flow system wells = 213
Confined Flow System Wells		
01	3	028, 029, 076
02	2	021, 025
22	6	023, 027, 028, 030, 031, 039
23	19	177, 180, 181, 183, 189, 190, 192, 193, 200, 201, 218, 219, 221, 222, 227, 230, 233, 234, 236

Table 3.1: Winter 1990/91, Spring 1991, and Fall 1991
Water Quality Monitoring Networks
(Page 2 of 2)

Section Number	Total Wells	Well Number
Confined Flow System Wells (continued)		
24	6	136, 168, 171, 172, 174, 175
26	15	066, 067, 072, 075, 084, 086, 129, 140, 142, 146, 149, 150, 153, 155, 156
27	3	054, 055, 058
28	1	025
Offpost	14	37316, 37317, 37318, 37319, 37321*, 37322*, 37365, 37372, 37376, 37379, 37380, 37387, 37388, 37390
	Total confined flow system wells = 69	
Spring 1991/Fall 1991		
Unconfined Flow System Wells		
23	13	049, 095, 108[b,c], 142, 179[c], 188, 191, 220, 237, 238[b,c], 239[c], 241, 530[c]
26	31	015, 017, 019, 020, 041, 065[b,c], 071, 073, 083, 085, 127, 133, 145[b,c], 148, 157, 158[b], 160, 161, 162, 163, 164[b,c], 165[b,c], 166, 167[b], 168, 169, 170, 171, 173, 501, 503
27	1	016
35	2	505, 506[b,c]
	Total unconfined flow system wells = 47	
Confined Flow System Wells		
23	8	180[c], 181, 189, 190, 192, 193, 221, 222
26	15	066, 067, 072, 075, 084, 086, 129, 140, 142, 146[c], 149, 150, 153, 155, 156
	Total confined flow system wells = 23	

* Additional Offpost Remedial Investigation well sampled but not in proposed Comprehensive Monitoring Program Network.

[a] No sample obtained in Winter 1990/91.
[b] No sample obtained in Spring 1991.
[c] No sample obtained in Fall 1991.

Table 3.2: Analytical Parameters for Non-Gas Chromatography/Mass Spectrometry Detection Methods
(Page 1 of 2)

Analyte	Analyte Detection Method	DataChem Laboratories PMRMA Method Designation	DataChem Laboratories Certified Reporting Limit (µg/l)	ESE Laboratories PMRMA Method Designation	ESE Laboratories Certified Reporting Limit (µg/l)
Anions	IONCHROM				
Chloride		TT09	278	NN8	1590
Fluoride		TT09	153	NN8	1000
Nitrite, nitrate (nonspecific)		LL8	10	TF22	10
Sulfate		TT09	175	NN8	5000
Cyanide	Colorimetric				
Cyanide		TF34	5	CN1	8.9
Dibromochloropropane	GC/ECD				
Dibromochloropropane		AY8	0.195	Q8	0.13
Metals					
Arsenic	AA	AX8	2.35	R9D	25
Arsenic	AA	SS12	117	SD30	2
Arsenic	AA			VV8	2.5
Cadmium	ICP	SS12	6.78	R9D	5
Calcium	ICP	SS12	105	R9D	50
Chromium	ICP	SS12	16.8	R9D	22
Copper	ICP	SS12	18.8	R9D	10
Lead	ICP	SS12	43.4	R9D	52
Magnesium	ICP	SS12	135	R9D	89.2
Mercury	AA	CC8	0.1	WW8	0.5
Potassium	ICP	SS12	1240	XX8	590
Sodium	ICP	SS12	279	R9D	251
Zinc	ICP	SS12	18	R9D	20
Nitrogen-phosphorus Pesticides	GC/NPD				
Atrazine		UH11	4.03	UN07	0.512
Malathion		UH11	0.373	UN07	0.25
Parathion		UH11	0.647	UN07	0.25
Supona		UH11	0.787	UN07	0.25
Vapona		UN11	0.384	UN07	0.25
Organochlorine Pesticides	GC/ECD				
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane		KK8	0.049	MM8A	0.059
2,2-bis(p-Chlorophenyl)-1,1-dichloroethene		KK8	0.054	MM8A	0.046
Aldrin		KK8	0.05	MM8A	0.083
Chlordane		KK8	0.095	MM8A	0.152
Dieldrin		KK8	0.05	MM8A	0.0539
Endrin		KK8	0.05	MM8A	0.06
Hexachlorocyclopentadiene		KK8	0.048	MM8A	0.083
Isodrin		KK8	0.051	MM8A	0.056
Organosulfur Compounds	GC/FPD				
1,4-Dithiane		AAA8	1.34	PP8A	3.34
1,4-Oxathiane		AAA8	2.38	PP8A	1.35
4-Chlorophenylmethyl sulfide		AAA8	5.69	PP8A	1.08
4-Chlorophenylmethyl sulfone		AAA8	7.46	PP8A	2.24
4-Chlorophenylmethyl sulfoxide		AAA8	11.5	PP8A	1.98

Table 3.2: Analytical Parameters for Non-Gas Chromatography/Mass Spectrometry Detection Methods
(Page 2 of 2)

Analyte	Analyte Detection Method	DataChem Laboratories PMRMA Method Designation	DataChem Laboratories Certified Reporting Limit (µg/l)	ESE Laboratories PMRMA Method Designation	ESE Laboratories Certified Reporting Limit (µg/l)
Organosulfur Compounds (continued)					
Benzothiazole		AAA8	5	PP8A	1.14
Dimethyl disulfide		AAA8	0.55	PP8A	1.16
Phosphonates	GC/FPD				
Diisopropylmethylphosphonate		AT8	0.392	QQ8	10.1
Dimethylmethylphosphonate		AT8	0.188	QQ8	16.3
Volatile Halogenated Compounds	GC/CON				
1,1,1-Trichloroethane		N8	0.76	TT8	1.09
1,1,2-Trichloroethane		N8	0.78	TT8	1.63
1,1-Dichloroethane		N8	0.73	TT8	1.93
1,1-Dichloroethene		N8	1.7	TT8	1.85
1,2-Dichloroethane		N8	1.1	TT8	2.07
1,2-Dichloroethene (total of cis & trans)		N8	0.76	TT8	1.75
Carbon tetrachloride		N8	0.99	TT8	1.69
Chlorobenzene		N8	0.82	TT8	1.36
Chloroform		N8	0.5	TT8	1.88
Methylene chloride		N8	7.4	TT8	2.48
Tetrachloroethene		N8	0.75	TT8	2.76
Trichloroethene		N8	0.56	TT8	1.31
Volatile Hydrocarbons	GC/FID				
Bicyclo[2,2,1]hepta-2-5-diene		P8	5.9	R8	13.9
Dicyclopentadiene		P8	5	R8	9.31
Methylisobutyl ketone		P8	4.9	R8	12.9
Volatile Organic Aromatics	GC/PID				
Benzene		AV8	1.05	SS8	1.92
Ethylbenzene		AV8	1.37	SS8	0.62
Toluene		AV8	1.47	SS8	2.1
m-Xylene		AV8	1.32	SS8	1.04
o,p-Xylene		AV8	1.36	SS8	1.34

AA = atomic absorption spectrometry
ESE = Environmental Science and Engineering, Inc.
GC/CON = gas chromatography/conductivity detector
GC/ECD = gas chromatography/electron capture detector
GC/FID = gas chromatography/flame ionization detector
GC/FPD = gas chromatography/flame photometric detector
GC/MS = gas chromatography/mass spectrometry
GC/NPD = gas chromatography/nitrogen phosphorus detector
GC/PID = gas chromatography/photoionization detector
HPLC = high performance liquid chromatography
ICP = inductively coupled argon plasma screen
IONCHROM = ion chromatography
PMRMA = Program Manager for Rocky Mountain Arsenal
µg/l = micrograms per liter

Table 3.3: Analytical Parameters for Gas Chromatography/Mass Spectrometry Analysis and Certified Reporting Limits
(Page 1 of 4)

Analyte	DataChem Laboratories		ESE Laboratories	
	PMRMA Method Designation	Certified Reporting Limit (µg/l)	PMRMA Method Designation	Certified Reporting Limit (µg/l)
Semivolatile Organic Compounds				
1,2,3-Trichlorobenzene	UM25	5.8		
1,2,4-Trichlorobenzene	UM25	2.4	UM28	1.4
1,2-Dichlorobenzene	UM25	1.2	UM28	1.0
1,2-Diphenylhydrazine	UM25	13		
1,3-Dichlorobenzene	UM25	3.4	UM28	1.1
1,4-Dichlorobenzene	UM25	1.5	UM28	1.0
1,4-Dithiane	UM25	3.3		
1,4-Oxathiane	UM25	27		
2,2-bis (p-Chlorophenyl)-1,1,1-trichloroethane	UM25	18		
2,2-bis (p-Chlorophenyl)-1,1-dichloroethene	UM25	14		
2,2-bis (p-Chlorophenyl)-1,1-dichloroethane	UM25	18		
2,3,6-Trichlorophenol	UM25	1.7		
2,4,5-Trichlorophenol	UM25	2.8	UM28	4.6
2,4,6-Trichlorophenol	UM25	3.6	UM28	4.8
2,4-Dichlorophenol	UM25	8.4	UM28	5.8
2,4-Dimethylphenol	UM25	4.4	UM28	4.6
2,4-Dinitrophenol	UM25	176	UM28	33
2,4-Dinitrotoluene	UM25	5.8	UM28	9.7
2,6-Dinitroaniline	UM25	8.8		
2,6-Dinitrotoluene	UM25	6.7	UM28	5.0
2-Chloronaphthalene	UM25	2.6	UM28	1.6
2-Chlorophenol	UM25	2.8	UM28	2.4
2-Methylnaphthalene	UM25	1.3	UM28	1.9
2-Methylphenol	UM25	3.6	UM28	3.9
2-Nitroaniline			UM28	9.6
2-Nitrophenol	UM25	8.2	UM28	6.7
3,3'-Dichlorobenzidine	UM25	5.0	UM28	32
3-Dinitroaniline	UM25	21		
3-Menthyl-4-chlorophenol	UM25	8.5		
3-Nitroaniline	UM25	15	UM28	30
3-Nitrotoluene	UM25	2.9		
4-Bromophenylphenyl ether	UM25	22	UM28	1.4
4-Chloro-3-methylphenol			UM28	7.0
4-Chloroaniline			UM28	17
4-Chlorophenylmethyl sulfide	UM25	10		
4-Chlorophenylmethyl sulfone	UM25	5.3		
4-Chlorophenylmethyl sulfoxide	UM25	15		
4-Chlorophenylphenyl ether	UM25	23	UM28	4.0
4-Methylphenol	UM25	2.8	UM28	6.1
4-Nitroaniline			UM28	40
4-Nitrophenol	UM25	96	UM28	44

Table 3.3: Analytical Parameters for Gas Chromatography/Mass Spectrometry Analysis and Certified Reporting Limits
(Page 2 of 4)

Analyte	DataChem Laboratories		ESE Laboratories	
	PMRMA Method Designation	Certified Reporting Limit (µg/l)	PMRMA Method Designation	Certified Reporting Limit (µg/l)
Semivolatile Organic Compounds (continued)				
Acenaphthene	UM25	5.8	UM28	3.4
Acenaphthylene	UM25	5.1	UM28	1.1
Aldrin	UM25	13		
Anthracene	UM25	5.2	UM28	1.0
Atrazine	UM25	5.9		
Benzo[A]anthracene	UM25	9.8	UM28	5.8
Benzo[A]pyrene			UM28	1.2
Benzo[B]fluoranthene	UM25	10	UM28	1.3
Benzo[B]pyrene	UM25	14		
Benzo[G,H,I]perylene	UM25	15	UM28	1.1
Benzo[K]fluoranthene	UM25	10	UM28	2.3
Benzoic acid			UM28	24
Benzyl alcohol	UM25	4.0	UM28	12
bis(2-Ethylhexyl) phthalate	UM25	7.7		
Bromacil	UM25	2.9		
Butylbenzylphthalate	UM25	28	UM28	1.1
Chlordane	UM25	37		
Chrysene	UM25	7.4	UM28	2.5
Di-N-butylphthalate	UM25	33	UM28	4.9
Di-N-octylphthalate	UM25	1.5	UM28	8.0
Dibenzo[A,H]anthracene	UM25	12	UM28	2.0
Dibenzofuran	UM25	5.1	UM28	2.6
Dibromochloropropane	UM25	12		
Dicyclopentadiene	UM25	5.5		
Dieldrin	UM25	26		
Diethylphthalate	UM25	5.9	UM28	2.2
Diisopropylmethylphosphonate	UM25	21		
Dimethylmethylphosphonate	UM25	130		
Dimethylphthalate	UM25	2.2	UM28	5.1
Endosulfan sulfate	UM25	50		
Endrin	UM25	18		
Endrin aldehyde	UM25	5.0		
Fluoranthene	UM25	24	UM28	1.0
Fluorene	UM25	9.2	UM28	1.3
Heptachlor	UM25	38		
Heptachlor epoxide	UM25	28		
Hexachlorobenzene	UM25	12	UM28	1.0
Hexachlorobutadiene	UM25	8.7	UM28	1.0
Hexachlorocyclopentadiene	UM25	54	UM28	7.6
Hexachloroethane	UM25	8.3	UM28	1.2
Indeno[1,2,3,-C,D]pyrene	UM25	21	UM28	4.4
Isodrin	UM25	7.8		

Table 3.3: Analytical Parameters for Gas Chromatography/Mass Spectrometry Analysis and Certified Reporting Limits
(Page 3 of 4)

Analyte	DataChem Laboratories		ESE Laboratories	
	PMRMA Method Designation	Certified Reporting Limit (µg/l)	PMRMA Method Designation	Certified Reporting Limit (µg/l)
Semivolatile Organic Compounds (continued)				
Isophorone	UM25	2.4	UM28	1.1
Lindane	UM25	7.2		
Malathion	UM25	21		
Methoxychlor	UM25	11		
Mirex	UM25	24		
N-nitrosodi-N-propylamine	UM25	6.8	UM28	3.2
N-nitrosodimethylamine	UM25	9.7		
N-nitrosodiphenylamine	UM25	3.7	UM28	5.9
Naphthalene	UM25	0.5	UM28	3.8
Nitrobenzene	UM25	3.7	UM28	2.9
Parathion	UM25	37		
Pentachlorophenol	UM25	9.1	UM28	12
Phenanthrene	UM25	9.9	UM28	1.0
Phenol	UM25	2.2	UM28	6.2
Pyrene	UM25	17	UM28	1.0
Supona	UM25	19		
Vapona	UM25	8.5		
alpha-Benzenehexachloride	UM25	5.3		
alpha-Endosulfan	UM25	23		
beta-Benzenehexachloride	UM25	17		
beta-Endosulfan	UM25	42		
bis(2-Chloroethoxy)methane	UM25	6.8		
bis(2-Chloroethyl)ether	UM25	0.68		
bis(2-Chloroisopropyl)ether	UM25	5.0		
bis(2-Chloroethoxyl)methane			UM28	3.8
bis(2-Chloroethyl)ether			UM28	1.8
bis(2-Chloroisopropyl)ether			UM28	1.3
bis(2-Ethylexyl)phthalate			UM28	1.0
Volatile Organic Compounds				
1,1,1-Trichloroethane	UM21	1.0	UM27	3.6
1,1,2,2-Tetrachloroethane	UM21	1.5	UM27	2.0
1,1-Dichloroethane	UM21	1.0	UM27	2.0
1,1-Dichloroethene	UM21	1.0	UM27	21
1,2,3-Trichloropropane			UM27	2.0
1,2-Dichlorobenzene			UM27	17
1,2-Dichloroethane	UM21	1.0	UM27	6.7
1,2-Dichloroethene (total of cis and trans)	UM21	5.0		
1,2-Dichloropropane	UM21	1.0	UM27	2.0
1,3-Dichlorobenzene	UM21	1.0	UM27	10
1,3-Dichloropropane	UM21	4.8		
1,4-Dichlorobenzene			UM27	17

Table 3.3: Analytical Parameters for Gas Chromatography/Mass Spectrometry Analysis and Certified Reporting Limits
(Page 4 of 4)

Analyte	DataChem Laboratories		ESE Laboratories	
	PMRMA Method Designation	Certified Reporting Limit (µg/l)	PMRMA Method Designation	Certified Reporting Limit (µg/l)
Volatile Organic Compounds (continued)				
2-Chloroethylvinyl ether	UM21	3.5	UM27	4.0
2-Hexanone			UM27	4.8
Acetone	UM21	8.0	UM27	17
Acrolein			UM27	20
Acrylonitril	UM21	8.4	UM27	2.3
Benzene	UM21	1.0	UM27	2.8
Bromodichloromethane	UM21	1.0	UM27	2.0
Bromoform	UM21	11	UM27	2.0
Bromomethane	UM21	14	UM27	36
Carbon disulfide			UM27	16
Carbon tetrachloride	UM21	1.0	UM27	4.4
Chlorobenzene	UM21	1.0	UM27	2.0
Chloroethane	UM21	8.0	UM27	8.0
Chloroform	UM21	1.0	UM27	2.0
Chloromethane	UM21	1.2	UM27	9.0
Dibromochloromethane	UM21	1.0	UM27	2.0
Dichlorobenzene (nonspecific)	UM21	2.0		
Dichlorodifluoromethane			UM27	17
Ethylbenzene	UM21	1.0	UM27	2.0
Ethylmethacrylate			UM27	2.0
Methlene bromide			UM27	2.0
Methylene chloride	UM21	1.0	UM27	19
Methylethyl ketone	UM21	10	UM27	6.2
Methylisobutyl ketone	UM21	1.4	UM27	2.0
Styrene			UM27	2.0
Tetrachloroethene	UM21	1.0	UM27	2.0
Toluene	UM21	1.0	UM27	2.0
Trichloroethene	UM21	1.0	UM27	2.2
Trichlorofluoromethane	UM21	1.0	UM27	11
Vinyl acetate			UM27	2.0
Vinyl chloride	UM21	12	UM27	2.0
cis-1,3-Dichloropropene			UM27	2.4
cis-1,4-Dichloro-2-butene			UM27	2.3
m-Xylene	UM21	1.0		
o,p-Xylene	UM21	2.0	UM27	11
trans-1,2-Dichloroethene			UM27	37
trans-1,3-Dichloropropene			UM27	1.6
trans-1,4-Dichloro-2-butene			UM27	3.6

ESE = Environmental Science and Engineering, Inc.
PMRMA = Program Manager for Rocky Mountain Arsenal
µg/l = micrograms per liter

Table 4.1: Comparison Between the 1991 Water Monitoring Network and Previous Water-level Well Networks

Sampling Round	Number of CMP Water-level Measurement Wells	Number of Supplementary Wells[a]	CMP Water-level Measurement Dates
Winter 1987/88	1025	0	11/03/87 to 11/15/87
Spring 1988	916	0	04/20/88 to 05/01/88
Summer 1988	830	0	07/15/88 to 07/25/88
Fall 1988	922	0	10/11/88 to 10/19/88
Winter 1988/89	920	0	01/26/89 to 02/03/89
Spring 1989	984	0	04/24/89 to 05/02/89
Summer 1989	1008	0	07/24/89 to 07/31/89
Fall 1989	1210	0	10/09/89 to 10/19/89
Winter 1989/90	1200	0	02/12/90 to 02/21/90
Spring 1990	1210	0	05/07/90 to 05/15/90
Summer 1990	1216	0	08/06/90 to 08/14/90
Winter 1990/91	1216	135	01/23/91 to 02/04/91
Spring 1991	1171	129	04/01/91 to 04/09/91
Fall 1991	1177	178	09/16/91 to 09/27/91

[a] Water-level data from supplementary wells were collected by Morrison-Knudson Engineers, Inc., Technical Operations Division of the Army, and the U.S. Geological Survey near the boundary systems.

CMP = Comprehensive Monitoring Program

Table 4.2: Summary of Analyses for the Winter 1990/91 Sampling Round
(Page 1 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Volatile Aromatic Compounds					
Benzene	264	20	1.27	210	26133
Ethylbenzene	264	3	2.98	3.89	23049
Toluene	264	15	1.71	>400	26163
m-Xylene	264	5	1.35	7.10	26133
o- and p-Xylenes	264	8	1.50	31.8	26133
Volatile Organohalogen Compounds					
1,1,1-Trichloroethane	273	12	0.828	31.3	23189
1,1,2-Trichloroethane	273	1	6.79	6.79	23189
1,1-Dichloroethane	273	18	1.44	65.7	02505
1,1-Dichloroethene	266	5	2.03	46.9	23189
1,2-Dichloroethane	273	20	1.49	60.2	35507
1,2-Dichloroethene	273	16	1.29	580	26173
Carbon tetrachloride	273	5	1.21	37.3	23189
Chlorobenzene	273	19	0.950	12.6	23189
Chloroform	273	108	0.573	22,000	26148
Methylene chloride	273	6	3.41	430	26133
Tetrachloroethene	273	60	0.841	830	26133
Trichloroethene	273	58	0.793	500	26173
Volatile Hydrocarbon Compounds					
Bicycloheptadiene	205	9	12.0	740	26133
Dicyclopentadiene	261	28	9.84	2300	26133
Methylisobutylketone	256	3	19.3	210	26133
Dibromochloropropane	184	23	0.147	15.0	26157
Organochlorine Pesticides					
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane	173	17	0.0591	1.40	23530
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene	186	3	0.129	0.979	26163
Aldrin	175	16	0.0583	0.566	26085
Chlordane	186	2	2.10	2.20	02034
Dieldrin	168	31	0.0457[b]	3.30	24101
Endrin	186	21	0.0433[b]	3.80	23049
Hexachlorocyclopentadiene	156	6	0.148	5.30	23530
Isodrin	182	5	0.0825	1.10	23530
Organophosphorus Pesticides					
Atrazine	222	66	4.38	170	26163
Malathion	230	16	0.462	3.74	23530
Parathion	268	39	0.824	59.6	37313
Supona	230	3	0.929	1.93	26163
Vapona	220	4	0.627	5.69	26163

Table 4.2: Summary of Analyses for the Winter 1990/91 Sampling Round
(Page 2 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Organophosphorus Compounds					
Diisopropylmethylphosphonate	248	151	0.443	3700	37418
Dimethylmethylphosphate	249	12	0.226	17,000	26041
Organosulfur Compounds					
1,4-Dithiane	272	46	1.63	200	35507
1,4-Oxathiane	233	23	2.00	43.0	26041
Benzothiazole	271	2	6.82	15.7	26163
Dimethyldisulfide	224	3	1.84	4.45	26163
p-Chlorophenylmethylsulfide	270	16	1.29	530	26133
p-Chlorophenylmethylsulfone	268	37	6.50	760	26168
p-Chlorophenylmethylsulfoxide	272	29	2.93	160	23220
Metals					
Arsenic	270	61	2.71	57.2	26163
Cadmium	270	1	15.9	15.9	23530
Chromium	270	24	17.2	151	23530
Copper	270	28	10.9	696	24127
Lead	270	4	44.6	79.0	23530
Mercury	271	76	0.102	3.60	37444
Zinc	270	65	20.5	278	SACMW08
Cations					
Calcium	230	230	2200	950,000	26066
Magnesium	230	224	294	510,000	26041
Potassium	271	259	1290	181,000	26041
Sodium	230	230	54,000	21,000,000	26041
Cyanide	220	12	5.33	16.5	26166
Anions					
Chloride	187	187	3560	11,000,000	26163
Fluoride	172	160	832	130,000	26163
Nitrate/nitrite	260	260	16.5	30,000	23095
Sulfate	214	211	2160	14,000,000	02023

[a] There were 273 groundwater samples collected during the Winter 1990/91 sampling round. The number of analytical results in the final database is often less than 273 due primarily to their rejection. A summary of rejected results is presented in Table 4.7

[b] The reported results are below the certified reporting limit because the method accuracy is above 100 percent.

µg/l = micrograms per liter
< = less than
> = greater than

Table 4.3: Summary of Analyses for the Spring 1991 Sampling Round
(Page 1 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Volatile Aromatic Compounds					
Benzene	61	17	1.26	200	26133
Ethylbenzene	61	1	11.3	11.3	23530
Toluene	61	6	11.2	1800	26163
m-Xylene	61	3	1.55	11.2	23530
o- and p-Xylenes	61	8	1.82	21.7	23530
Volatile Organohalogen Compounds					
1,1,1-Trichloroethane	61	0	-	-	-
1,1,2-Trichloroethane	61	0	-	-	-
1,1-Dichloroethane	61	6	0.935	3.73	26157
1,1-Dichloroethene	61	0	-	-	-
1,2-Dichloroethane	61	5	1.87	23.9	23049
1,2-Dichloroethene	61	2	6.81	470	26173
Carbon tetrachloride	61	2	2.23	4.63	26073
Chlorobenzene	61	6	1.47	9.55	26066
Chloroform	51	22	0.644	73,000	26133
Methylene chloride	61	5	18.3	190	26148
Tetrachloroethene	60	14	1.13	970	26133
Trichloroethene	59	19	0.678	600	26173
Volatile Hydrocarbon Compounds					
Bicycloheptadiene	40	7	12.7	310	26148
Dicyclopentadiene	58	13	22.7	5600	23049
Methylisobutylketone	58	4	9.23	110	26148
Dibromochloropropane	60	11	0.200	22.0	26133
Organochlorine Pesticides					
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane	48	9	0.157	0.706	26148
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene	48	3	0.106	0.161	26173
Aldrin	48	7	0.0682	0.964	26173
Chlordane	48	0	-	-	-
Dieldrin	48	20	0.0681	6.20	23241
Endrin	47	6	0.0589	0.248	26148
Hexachlorocyclopentadiene	9	0	-	-	-
Isodrin	48	4	0.0767	1.70	23241
Organophosphorus Pesticides					
Atrazine	31	19	5.57	240	26163
Malathion	31	15	0.559	7.09	23241
Parathion	49	7	0.966	6.10	26071
Supona	31	3	1.26	11.0	26041
Vapona	31	4	0.433	9.90	26041

Table 4.3: Summary of Analyses for the Spring 1991 Sampling Round
(Page 2 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Organophosphorus Compounds					
Diisopropylmethylphosphonate	59	41	0.998	3200	26071
Dimethylmethylphosphate	59	10	0.272	8300	26041
Organosulfur Compounds					
1,4-Dithiane	53	28	1.76	160	26066
1,4-Oxathiane	52	25	1.65	67.0	26041
Benzothiazole	29	6	2.68	21.9	26041
Dimethyldisulfide	29	3	1.10	4.47	26041
p-Chlorophenylmethylsulfide	48	10	6.88	530	26133
p-Chlorophenylmethylsulfone	53	23	6.26	820	26168
p-Chlorophenylmethylsulfoxide	46	13	5.49	140	26148
Metals					
Arsenic	58	33	2.94	30.8	23049
Cadmium	58	0	-	-	-
Chromium	58	12	23.0	92.6	26133
Copper	58	9	10.5	93.0	23095
Lead	58	0	-	-	-
Mercury	59	22	0.101	1.79	26071
Zinc	58	8	21.4	42.6	26501
Cations					
Calcium	40	40	34,600	960,000	26066
Magnesium	40	40	2060	520,000	26041
Potassium	58	58	1240	142,000	26041
Sodium	40	40	120,000	20,000,000	26041
Cyanide	58	14	5.00	18.5	26168
Anions					
Chloride	60	60	16,000	10,000,000	26041
Fluoride	60	46	1250	250,000	26041
Nitrate/nitrite	58	58	13.4	31,000	23095
Sulfate	60	60	120,000	10,000,000	26041

[a] There were 61 groundwater samples collected during the Spring 1991 sampling round. The number of analytical results in the final database is often less than 61 due primarily to their rejection. A summary of rejected results is presented in Table 4.7.

µg/l = micrograms per liter
- = Because no detections were recorded, no value exists.

Table 4.4: Summary of Analyses for the Fall 1991 Sampling Round
(Page 1 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Volatile Aromatic Compounds					
Benzene	58	11	3.08	140	26173
Ethylbenzene	58	6	1.15	11.3	26133
Toluene	58	5	3.09	690	26163
m-Xylene	58	3	1.21	7.37	26133
o- and p-Xylenes	58	5	3.65	20.7	26133
Volatile Organohalogen Compounds					
1,1,1-Trichloroethane	58	3	1.91	195	26133
1,1,2-Trichloroethane	33	0	-	-	-
1,1-Dichloroethane	58	5	2.83	9.40	26133
1,1-Dichloroethene	58	2	1.99	2.45	26171
1,2-Dichloroethane	58	2	4.67	46.0	23095
1,2-Dichloroethene	58	2	5.32	30.2	26133
Carbon tetrachloride	58	1	5.84	5.84	26073
Chlorobenzene	58	6	1.56	31.7	26148
Chloroform	58	18	2.25	55,000	26173
Methylene chloride	58	6	11.3	570	26173
Tetrachloroethene	58	12	2.71	196	23241
Trichloroethene	58	14	1.46	198	26133
Volatile Hydrocarbon Compounds					
Dicyclopentadiene	58	11	10.5	900	26133
Methylisobutylketone	58	3	17.3	98.2	26133
Dibromochloropropane	58	8	0.934	71.0	26173
Organochlorine Pesticides					
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane	58	3	0.193	1.90	26163
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene	58	2	0.174	0.270	23095
Aldrin	58	4	0.133	2.40	26127
Chlordane	58	0	-	-	-
Dieldrin	58	32	0.0529[b]	7.40	26127
Endrin	58	8	0.0735	1.42	26127
Hexachlorocyclopentadiene	58	0	-	-	-
Isodrin	58	4	0.0887	0.181	35505
Organophosphorus Pesticides					
Parathion	56	0	-	-	-
Organophosphorus Compounds					
Diisopropylmethylphosphonate	57	34	14.5	5400	23095
Dimethylmethylphosphate	57	4	34.3	8000	26041

Table 4.4: Summary of Analyses for the Fall 1991 Sampling Round
(Page 2 of 2)

Group/Analyte	Number of Analyses[a]	Number of Detections	Minimum Detection (µg/l)	Maximum Detection (µg/l)	Well Number of Maximum Detection
Organosulfur Compounds					
1,4-Dithiane	58	24	4.35	200	26066
1,4-Oxathiane	58	27	2.01	28.2	26148
Benzothiazole	58	4	1.32	2.75	26066
Dimethyldisulfide	58	2	6.06	13.1	26173
p-Chlorophenylmethylsulfide	58	16	1.27	960	26173
p-Chlorophenylmethylsulfone	58	32	3.52	2900	26167
p-Chlorophenylmethylsulfoxide	58	13	3.81	350	26167
Metals					
Arsenic	55	26	2.04	130	26041
Cadmium	55	0	-	-	-
Chromium	55	0	-	-	-
Copper	55	0	-	-	-
Lead	55	0	-	-	-
Mercury	55	6	0.504	25.0	26019
Zinc	55	0	-	-	-
Cations					
Calcium	55	55	22,000	1,300,000	26167
Magnesium	55	51	1630	460,000	26041
Potassium	55	55	1280	130,000	26041
Sodium	55	55	130,000	17,000,000	26041
Cyanide	55	14	10.4	28.2	26020
Anions					
Chloride	58	58	17,100	22,000,000	26041
Fluoride	58	28	955	220,000	26041
Nitrate/nitrite	58	58	22.7	28,000	26020
Sulfate	58	58	120,000	9,000,000	26041

[a] There were 58 groundwater samples collected during the Fall 1991 sampling round. The number of analytical results in the final database is often less than 58 due primarily to their rejection. A summary of rejected results is presented in Table 4.7

[b] The reported results are below the certified reporting limit because the method accuracy is above 100 percent.

µg/l = micrograms per liter
- = Because no detections were recorded, no value exists.

Table 4.5: Summary of Specific Analyte Data for the 1991 Water Monitoring Year

Compound	Aquifer	Number of Samples	Number of Detections	Certified Reporting Limits (Number of Samples Analyzed)	Range of Detections
Diisopropylmethylphosphonate (DIMP)	Total	364	226	0.392(248),10.1(116)	0.443 - 5400
	UFS	260	203		
	CFS	104	23		
Dibromochloropropane (DBCP)	Total	302	42	0.195(185),0.130(117)	0.147 - 71.0
	UFS	218	39		
	CFS	84	3		
Chloroform (CHCL3)	Total	382	148	0.5(264),1.8(118)	0.573 - 73,000
	UFS	270	132		
	CFS	112	16		
Dieldrin (DLDRN)	Total	276	85	0.0500(158),0.0539(118)	0.0457 - 7.40
	UFS	191	76		
	CFS	85	9		
Fluoride (F)	Total	291	235	153(157),1000(134)	832 - 250,000
	UFS	204	164		
	CFS	87	71		

CFS = confined flow system
UFS = unconfined flow system

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Table 4.6: Tentatively Identified Compounds
Spring 1991 Sampling Round

Compound	Number of Detections	Concentration ($\mu g/l$)[a]	Well Identification
1-Chloro-4-(methylsulfonyl)-benzene	2	4.8	26169
		45	26166
2-Chloro-5-methylphenol	1	130	26163
2-Chloro-6-methylphenol	1	81	26163
4-Dioxide-1,4-oxathiane	1	7.9	26129
4-Methyl-2-pentanone/methylisobutyl ketone[b]	1	69	26133
(Methylsulfonyl)-benzene	1	27	26166
Tetrachloroethene[b]	1	140	26133

[a] Reported concentrations are estimated values.
[b] CMP target analytes

$\mu g/l$ = micrograms per l'ter

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Table 4.7: Summary of Data Rejected for the 1991 Water Monitoring Year
(Page 1 of 2)

Method/Analyte	Number of Rejected Values[a]
Winter 1990/91	
Method: N8 Volatile Organohalogen Compounds	
1,1-Dichloroethene	7
Method: P8 Volatile Hydrocarbon Compounds	
Bicycloheptadiene	25
Dicyclopentadiene	2
Methylisobutylketone	16
Method: R8 Volatile Hydrocarbon Compounds	
Dicyclopentadiene	9
Method: AY8 Dibromochloropropane	
Dibromochloropropane	87
Method: KK8 Organochlorine Pesticides	
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane	100
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene	87
Aldrin	98
Chlordane	87
Dieldrin	116
Endrin	87
Hexachlorocyclopentadiene	100
Isodrin	91
Method: MM8A Organochlorine Pesticides	
Hexachlorocyclopentadiene	17
Method: UH11 Organophosphorus Pesticides	
Atrazine	9
Malathion	1
Parathion	3
Supona	1
Vapona	11
Method: AT8 Organophosphorus Compounds	
Diisopropylmethylphosphonate	25
Dimethylmethylphosphate	24
Method: AAA8 Organosulfur Compounds	
1,4-Oxathiane	36
Dimethyldisulfide	36
Method: PP8A Organosulfur Compounds	
1,4-Oxathiane	3
Dimethyldisulfide	12
p-Chlorophenylmethylsulfide	2
p-Chlorophenylmethylsulfone	4

Table 4.7: Summary of Data Rejected for the 1991 Water Monitoring Year
(Page 2 of 2)

Method/Analyte	Number of Rejected Values[a]
Winter 1990/91 (continued)	
Method: TF34 Cyanide	
Cyanide	52
Method: LL8 Anions	
Nitrate/nitrite	13
Method: TT09 Anions	
Chloride	71
Fluoride	86
Sulfate	44
Spring 1991	
Method: N8 Volatile Organohalogen Compound	
Chloroform	10
Method: KK8 Organochlorine Pesticides	
Endrin	1
Hexachlorocyclopentadiene	23
Method: MM8A Organochlorine Pesticides	
Hexachlorocyclopentadiene	18
Method: AAA8 Organosulfur Compounds	
1,4-Oxathiane	8
Benzothiazole	31
Dimethyldisulfide	31
Dithiane	7
p-Chlorophenylmethylsulfide	12
p-Chlorophenylmethylsulfone	7
p-Chlorophenylmethylsulfoxide	14

[a] Number of rejected values includes quality control samples.

Table 4.8: Quality Control Blank Artifact Summary, Volatile Organic Analyses
1991 Water Monitoring Year

Sampling Round	Blank Well Number[a]	Affected Well Number[b]	Chemical Abbreviation	Blank Artifact Concentration (µg/l)	Investigative Sample Concentration[c] (µg/l)	Affected Investigative Sample Concentration[d] (µg/l)
Rinse Blank						
Winter 1991						
	23232	23235	CH2CL2	3.15	<2.48	<2.48
	33077	33078	CLC6H5	1.20	<0.82	<0.82
			CHCL3	0.649	0.78	0.694
	37334	37337	CHCL3	1.83	2.78	<0.50
			CLC6H5	1.64	2.35	<0.82
			DBCP	0.220	0.24	<0.195
Fall 1991						
	26157	26171	CHCL3	65.4	27,000	<1.88
			TCLEE	6.07	>196	3.45
Field Blank						
Winter 1991						
	26086		CHCL3	2.00	<0.50	
	33077		CLC6H5	1.18	<0.82	
Spring 1991						
	26127		TCLEE	1.01	<0.75	

[a] The well that was sampled before the blank sample was collected.
[b] For rinse blanks, the well that was sampled with the same sampling equipment after the blank sample was collected.
[c] For trip blanks and field blanks, this is the concentration detected in the investigative sample collected at the same time the blank was collected. For rinse blanks, this is the concentration detected in the investigative sample that was collected before the blank was collected.
[d] For rinse blanks, the concentration in the well that was sampled with the same sampling equipment after the blank sample was collected.

< = less than
> = greater than
CH2CL2 = methylene chloride
CHCL3 = chloroform
CLC6H5 = chlorobenzene
DBCP = dibrochloropropane
TCLEE = tetrachloroethene
µg/l = micrograms per liter

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Table 4.9: Quality Control Blank Artifact Summary, Semivolatile Organic Compound and Pesticide Analyses, 1991 Water Monitoring Year

Sampling Round	Blank Well Number[a]	Affected Well Number[b]	Chemical Abbreviation	Blank Artifact Concentration (µg/l)	Investigative Sample Concentration[c] (µg/l)	Affected Investigative Sample Concentration[d] (µg/l)
Trip Blank						
Winter 1991						
	23204		DIMP	1.05	5.54	
	26086		ALDRN	0.0973	<0.05	
Rinse Blank						
Winter 1991						
	26086	26153	PPDDT	0.0770	0.589	<0.059
Fall 1991						
	26127	26075	ENDRN	0.0681	1.42	<0.060
			ALDRN	0.351	2.40	<0.083
			DLDRN	0.267	7.40	0.0692
			CPMS	1.30	<1.08	<1.08
Field Blank						
Winter 1991						
	23142		ALDRN	0.0942	<0.05	
	26086		ENDRN	0.261	0.0774	
			PPDDT	0.173	0.589	
	37368		ALDRN	0.0645	<0.05	

[a] The well that was sampled before the blank sample was collected.
[b] For rinse blanks, the well that was sampled with the same sampling equipment after the blank sample was collected
[c] For trip blanks and field blanks, this is the concentration detected in the investigative sample collected at the same time the blank was collected. For rinse blanks, this is the concentration detected in the investigative sample that was collected before the blank was collected.
[d] For rinse blanks, the concentration in the well that was sampled with the same sampling equipment after the blank sample was collected.

< = less than
ALDRN = aldrin
CPMS = p-chlorophenylmethyl sulfide
DIMP = diisopropylmethyl phosphonate
DLDRN = dieldrin
ENDRN = endrin
PPDDT = 2,2-bis(para-chlorophenyl)-1,1,1-trichloroethane
µg/l = micrograms per liter

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Table 4 10 Quality Control Blank Artifact Summary, Trace Inorganic Constituent Analyses
1991 Water Monitoring Year
(Page 1 of 2)

Sampling Round	Well Number[a]	Affected Well Number[b]	Chemical Abbreviation	Blank Artifact Concentration (µg/l)	Investigative Sample Concentration[c] (µg/l)	Affected Investigative Sample Concentration[d] (µg/l)
Trip Blank						
Winter 1990/91						
	01075	01075	HG	0.124	<0.10	
	24166	24166	HG	0.136	<0.10	
	37353	37353	HG	1.08	1.02	
Spring 1991						
	23191	23191	HG	0.364	<0.10	
	26015	26015	AS	3.22	6.69	
	26127	26127	HG	0.447	<0.10	
Fall 1991						
	26127	26127	F	1560	<1000[a]	
Rinse Blank						
Winter 1990/91						
	33077	33078	ZN	46.4	64.6[e]	50.3[e]
			ZN	22.9	42.3[e]	39.5[e]
			CU	26.6	<18.0[e]	<18.8[e]
			CU	29.9	<18.0[e]	<18.8[e]
			HG	0.212	0.818	0.401
	37334	37337	ZN	437	<18.0	24.5
			HG	0.879	280	0.687
	37353	37397	HG	0.508	1.02	0.741
	37368		HG	0.705	0.466	
	37408	37409[f]	HG	0.605	1.22	0.771
			ZN	166	32.6	25.8
Spring 1991						
	36015	26161	ZN	33.2	<20.0	<20.0
	26127	26168	HG	1.10	<0.100	0.366
Fall 1991						
	26127	26075	CU	17.4	<1000[g]	<500[g]

Table 4.10: Quality Control Blank Artifact Summary, Trace Inorganic Compound Analyes
1991 Water Monitoring Year
(Page 2 of 2)

Sampling Round	Well Number[a]	Affected Well Number[b]	Chemical Abbreviation	Blank Artifact Concentration (µg/l)	Investigative Sample Concentration[c] (µg/l)	Affected Investigative Sample Concentration[d] (µg/l)
Field Blank						
Winter 1990/91						
	23232	23232	ZN	24.4	<20.0	
	24161	24161	ZN	120	<20.0	
	26086	26086	CR	18.0	<16.8	
	33077	33077	HG	0.363	0.818	
	37334	37334	HG	1.03	0.280	
	37368	37368	HG	0.323	0.466	
	37408	37408	HG	1.18	1.22	
Spring 1991						
	26127	26127	HG	1.26	<0.10	

[a] The well that was sampled before the blank sample was collected.
[b] For rinse blanks, the well that was sampled with the same sampling equipment after the sample was collected.
[c] For trip blanks and field blanks, this is the concentration detected in the investigative sample collected at the same time the blank was collected. For rinse blanks, this is the concentration detected in the investigative sample that was collected before the blank was collected.
[d] For rinse blanks, the concentration in the well that was sampled with the same sampling equipment after the blank sample was collected.
[e] This sample was analyzed in two separate lots on different dates. Both values from the database are reported.
[f] The well was sampled on the last day of the Winter 1990/91 monitoring round. Therefore, there is no affected investigative well associated with the rinse blank.
[g] Elevated certified reporting limit.

< = less than
AS = arsenic
CR = chromium
CU = copper
F = fluoride
HG = mercury
ZN = zinc
µg/l = micrograms per liter

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Table 4.11: Statistical Summary for Duplicate Sample Analyses
1991 Water Monitoring Year
(Page 2 of 2)

Target Analyte	Number of Detection Pairs	Low RPD (Percent)	High RPD (Percent)	Average RPD (Percent)
Trace Inorganic Compounds (continued)				
Magnesium	34	0.0	170	9.7
Sodium	35	0.0	170	17
Nitrite nitrate (nonspecific)	42	0.0	190	21
Sulfate	36	0.0	190	10
Zinc	9	6.6	87	41
Total of all analytes	325[a]			16[b]

[a] Total number of detection pairs.
[b] Geometric mean of the average RPDs.

RPD = r lative percent difference

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Table 4.12: Certified Reporting Limits for Different Analytical Methods
1991 Water Monitoring Year

Analyte	Method Designation		Certified Reporting Limit (µg/l)		Number of Detections Between Certified Reporting Limits[a]
	DataChem	ESE-Denver	DataChem	ESE-Denver	
Chloroform	N8	TT8	0.500	1.88	47
Dibromochloropropane	AY8	Q8	0.195	0.130	3
Diisopropylmethylphosphonate	AT8	QQ8	0.392	10.1	78
Dieldrin	KK8	MM8A	0.0500	0.0539	3
Fluoride	TT09	NN8	153	1000	4

[a] Value of concentration reported is in between the values of Certified Reporting Limits.

ESE = Environmental Science and Engineering, Inc.
DataChem = DataChem Laboratories
µg/l = micrograms per liter

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Table 4.13: Dilution Differences for Certified Reporting Limits
1991 Water Monitoring Year

Analyte	Laboratory	Method Designation	Dilution Factor	Certified Reporting Limit[a] (µg/l)	Number of Analyses Reported below the Given CRL[b]
Dieldrin	DataChem	KK8	1	0.0500	171
			10	0.500	10
	ESE-Denver	MM8A	1	0.0539	104
			4	0.220	2
			5	0.270	2
Fluoride	DataChem	TT09	1	153	34
			32	4900	1
			104	16,000	1
	ESE-Denver	NN8	1	1000	34
			10	10,000	45
			25	25,000	7
			50	50,000	19
			100	100,000	3

[a] CRL obtained through dilution factor calculations. A dilution factor of 1 corresponds to an undiluted sample.
[b] The quantity listed is the number of results reported as less than the corresponding CRL.

CRL = Certified Reporting Limit
DataChem = DataChem Laboratories
ESE = Environmental Science and Engineering, Inc.
µg/l = micrograms per liter

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Table 4.14: Approximate Vertical Gradients Between Stratigraphically Adjacent Unconfined Flow System Wells and Confined Flow System Wells at Cluster Sites, 1991 Water Monitoring Year
(Page 1 of 4)

Unconfined Flow System Well	Confined Flow System Well	Stratigraphic Unit of Confined Flow System Well	Number of Vertical Hydraulic Gradient Measurements[a]								Approximate Yearly Vertical Gradient
			First Quarter		Second Quarter		Third Quarter		Fourth Quarter		
			Up	Down	Up	Down	Up	Down	Up	Down	
11002	11003	Denver B				2		1		2	0.047
12002	12003	Denver B				2		2		2	0.011
01014	01015	Denver AU				2		4		2	0.062
01021	01022	Denver AM				2		2		2	0.039
01024	01025	Denver AU				2		4		3	0.029
01038	01039	Denver AU				2		2		2	0.040
01049	01050	Denver A	2		2		2	2	3		-0.012
01075	01076	Denver					2	2	3		-0.010
01078	01079	Denver A				2		2		2	0.283
02003	02004	Denver A				2		2		2	0.304
02020	02021	Denver AL and AM				2		4		8	0.065
02023	02024	Denver AM				2		4	1	3	0.014
02026	02027	Denver AM				2		4		3	0.003
02034	02035	Denver AMU			2		2		4	2	-0.004
02037	02038	Denver AM				2		3		3	0.008
02040	02041	Denver AM				2		2		2	0.014
02058	02057	Denver A				2		4		2	0.094
02059	02060	Denver A			2		4		3		-0.151
06003	06004	Denver ASH				2		2	2		0.007
31005	31006	Denver AM			2		2		2		-0.007
31009	31010	Denver AL			2		2		2		-0.006
35026	35027	Denver ALSH				2		2		2	0.240
35061	35062	Denver AL				2		2		2	0.163
35065	35066	Denver AL			2		2		2		-0.013
35077	35008	Denver A			2		2		2		-0.153
36065	36066	Denver AL				2		2			0.092
36069	36105	Denver AM				2		2		2	0.292

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Table 4.14: Approximate Vertical Gradients Between Stratigraphically Adjacent Unconfined Flow System Wells and Confined Flow System Wells at Cluster Sites, 1991 Water Monitoring Year
(Page 2 of 4)

Unconfined Flow System Well	Confined Flow System Well	Stratigraphic Unit of Confined Flow System Well	Number of Vertical Hydraulic Gradient Measurements[a]								Approximate Yearly Vertical Gradient
			First Quarter		Second Quarter		Third Quarter		Fourth Quarter		
			Up	Down	Up	Down	Up	Down	Up	Down	
36077	36078	Denver ASH				2		2		2	0.021
36109	36110	Denver A				2		2		2	0.101
36141	36140	Denver A				2		2		2	0.299
02011	02012	Denver IU			2		2			2	-0.001
25038	25039	Denver IU			2		2		2		-0.008
25042	25049	Denver IU				2		2		2	0.002
25044	25050	Denver IU				2		2		2	0.099
25047	25051	Denver IU				2	2		2		0.001
26063	26057	Denver IU		3		2		2		2	0.017
26073	26074	Denver IU				2		2	2		0.018
35020	35021	Denver IU				2		2		2	0.434
35058	35059	Denver IU			2		2		2		-0.006
35069	35070	Denver IU				2	2			2	0.109
35079	35081	Denver IU		6		2		2		2	0.082
35088	35089	Denver IU				2		2		2	0.250
36146	36147	Denver IUSH				2		2		2	0.265
25011	25012	Denver I			2			2	2		-0.013
25028	25029	Denver ISH				2		2		2	0.468
26065	26066	Denver I				2		2	2		0.008
26085	26086	Denver I				2		2		2	0.187
26127	26128	Denver I			2		2		2		-0.012
26143	26144	Denver I				2		2		2	0.157
35031	35032	Denver I				2		2		2	0.151
35037	35038	Denver I				2		2		2	0.047
09002	09003	Denver 2				2		2		1	0.099
23122	23227	Denver 2				2		2	2	1	0.009
23123	23233	Denver 2	1	17	1	11	1	13	6	9	0.005

11793,600(2) - T-X.GMP
0826091492

Table 4.14: Approximate Vertical Gradients Between Stratigraphically Adjacent Unconfined Flow System Wells and Confined Flow System Wells at Cluster Sites, 1991 Water Monitoring Year
(Page 3 of 4)

Unconfined Flow System Well	Confined Flow System Well	Stratigraphic Unit of Confined Flow System Well	Number of Vertical Hydraulic Gradient Measurements[a]								Approximate Yearly Vertical Gradient
			First Quarter		Second Quarter		Third Quarter		Fourth Quarter		
			Up	Down	Up	Down	Up	Down	Up	Down	
23178	23176	Denver 2	11	14	9	13	20	6	12	14	-0.005
23179	23180	Denver 2			2		2		3		-0.007
23185	23186	Denver 2				2		2		2	0.337
23188	23189	Denver 2				2		2	2		0.003
24192	24167	Denver 2		26		15		26		27	0.114
25015	25016	Denver 2				2		2		2	0.188
25018	25019	Denver 2				2		2		2	0.045
26068	26069	Denver 2				2		2		2	0.176
26071	26072	Denver 2				2		2		2	0.091
26076	26077	Denver 2				2		2		2	0.015
26081	26082	Denver 2				2		2		2	0.049
26088	26089	Denver 2				2		2		2	0.002
03002	03003	Denver 3	1		3		3		19		-0.017
23191	23192	Denver 3				2		2		2	0.019
23226	23236	Denver 3		8		2		2		2	0.072
24135	24136	Denver 3				2		2		2	0.008
24177	24206	Denver 3	5	7		13		12		1	0.017
24178	24203	Denver 3	13	36		14	12	3	16		-0.004
24179	24205	Denver 3	15	32	8	6	4	10	9	7	0.007
24193	24202	Denver 3	4	42		14		14		14	0.030
24194	24204	Denver 3	10	21		13		14		15	0.029
37338	37376	Denver 3			2			2	2		0.058
37374	37379	Denver 3				2		1		2	0.034
22021	22023	Denver 4				3		2		5	0.045
27053	27054	Denver 4				3		1		7	0.020
27057	27058	Denver 4				2		2		2	0.010
28027	28028	Denver 4	1			5		15		7	0.007

Table 4.14: Approximate Vertical Gradients Between Stratigraphically Adjacent Unconfined Flow System Wells and Confined Flow System Wells at Cluster Sites, 1991 Water Monitoring Year
(Page 4 of 4)

Unconfined Flow System Well	Confined Flow System Well	Stratigraphic Unit of Confined Flow System Well	Number of Vertical Hydraulic Gradient Measurements[a]								Approximate Yearly Vertical Gradient
			First Quarter		Second Quarter		Third Quarter		Fourth Quarter		
			Up	Down	Up	Down	Up	Down	Up	Down	
33033	33034	Denver 4		3		7		15		7	0.154
34008	34010	Denver 4	1		2	1	2	1	2		-0.001
37320	37321	Denver 4				2		2		2	0.043
37343	37365	Denver 4				2		2		2	0.010

[a] The total number of times either of the wells in the cluster was measured.

Table 5.1: Direction of Vertical Hydraulic Gradients at Well Clusters Near the North Boundary Containment/Treatment System September 1991

Well Cluster[a]	Aquifer Designation (zone)	Direction of Vertical Hydraulic Gradient
North of NBS		
24511, 24512/24172	UFS/CFS(2)	Down
24511, 24512/24171	UFS/CFS(5)	Down
24172/24171	CFS(2)/CFS(5)	Up
24503, 24192/24167	UFS/CFS(2)	Down
24503, 24192/24168	UFS/CFS(3)	Down
24194/24204	UFS/CFS(3)	Down
South of NBS		
24179/24205	UFS/CFS(3)	Up
23178/23176	UFS/CFS(2)	Up
23178/23177	UFS/CFS(2)	Up
24178/24203	UFS/CFS(3)	Up

[a] A cluster is defined as a set of wells completed at different depth intervals within the confined and unconfined systems that are close to one another.

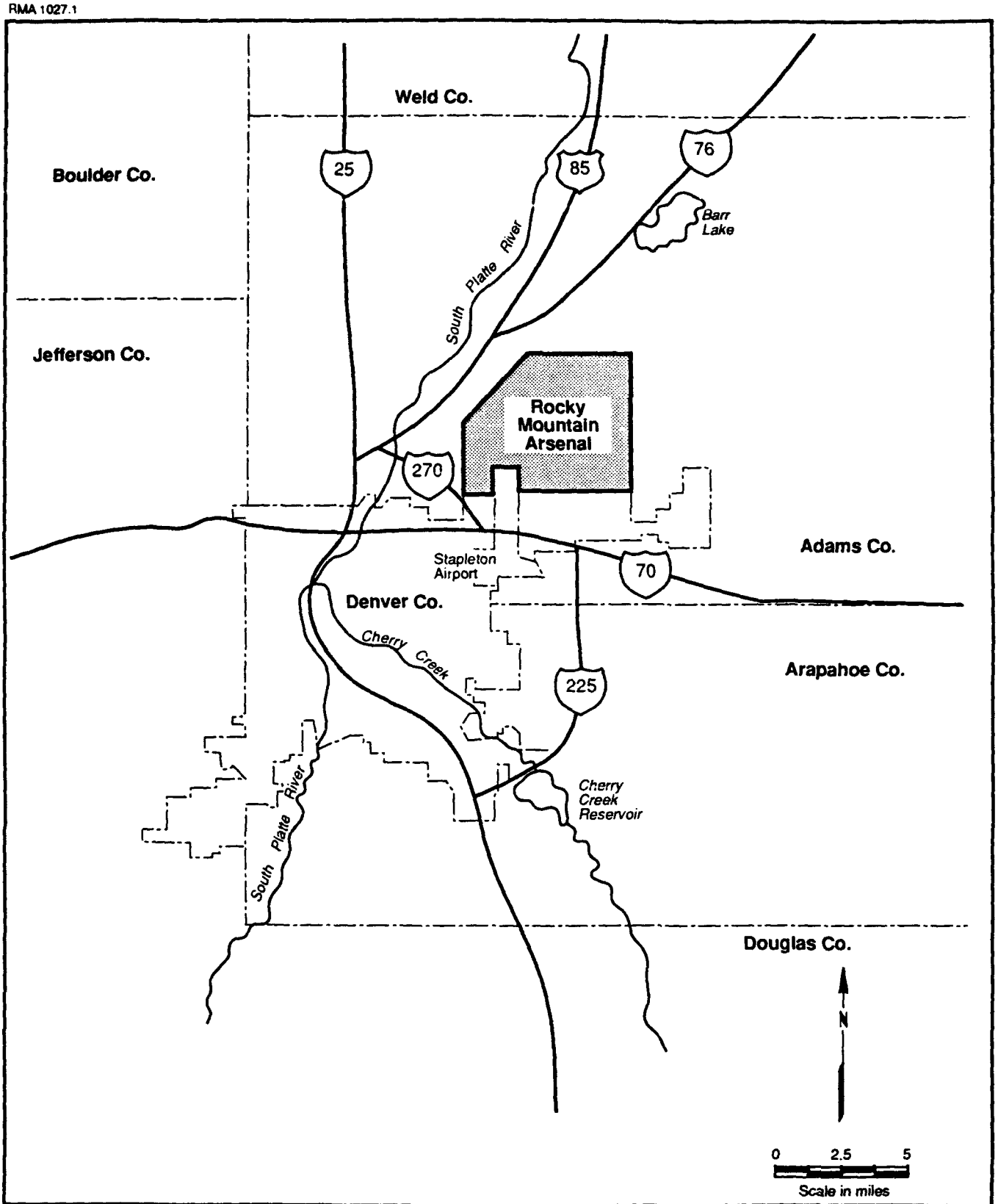
CFS = confined flow system
NBS = North Boundary Containment/Treatment System
UFS = unconfined flow system

Table 5.2: Contaminant Concentrations in Samples From the Confined Flow System Near the North Boundary Containment/Treatment System, Fall 1989 and Winter 1990/91

Well Number (Zone)	DIMP		Dieldrin		DBCP		Chloroform	
	Fall 1989	Winter 1990/91	Fall 1989	Winter 1990/91	Fall 1989	Winter 1990/91	Fall 1989	Winter 1990/91
23177(2)	LT	0.475	LT	LT	LT	LT	1.34	1.55
23200(3)	LT	LT	LT	LT	LT	LT	LT	LT
23201(4)	LT	LT	LT	LT	LT	LT	LT	LT
23218(2)	0.559	LT	LT	NA	LT	LT	LT	LT
23219(3)	LT	LT	LT	LT	LT	NA	LT	LT
23227(2)	LT	LT	0.176	LT	LT	LT	LT	LT
23233(2)	LT	LT	LT	LT	LT	LT	LT	LT
23234(3)	LT	LT	LT	LT	LT	NA	LT	LT
23236(3)	LT	LT	LT	LT	LT	NA	LT	LT
24136(2)	LT	LT	LT	LT	LT	LT	LT	LT
24168(3)	LT	LT	LT	LT	2.81	LT	10.8	LT
24171(3)	LT	LT	0.179	LT	LT	0.283	LT	6.06
24172(5)	LT	LT	LT	LT	LT	LT	15.2	0.585
24174(3)	LT	LT	0.101	LT	LT	LT	LT	LT
24175(4)	LT	LT	LT	LT	2.99	LT	8.08	LT
37316(5)	20.4	4.74	LT	NA	LT	NA	LT	LT
37317(4)	LT	.443	LT	NA	LT	NA	LT	LT
37318(3)	10.3	16.9	LT	NA	LT	NA	LT	LT
37319(6)	NS	11.7	NS	NA	NS	LT	NS	LT
37321(4)	0.451	1.37	LT	LT	LT	LT	LT	LT
37322(5)	LT	LT	LT	LT	LT	LT	NA	LT
37365(4)	17.6	46.0	LT	NA	LT	NA	LT	0.889
37372(4)	0.705	LT	LT	LT	0.274	0.199	LT	LT
37376(3)	LT	LT	LT	NA	LT	NA	LT	LT
37379(3)	50.0	31.7	0.0533	NA	LT	LT	1.41	1.51
37380(4)	5.35	4.27	LT	LT	LT	NA	0.675	LT
37388(4)	0.496	LT	LT	NA	LT	LT	LT	0.631
37390(3)	NS	9.06	NS	NA	NS	LT	NS	1.30

DBCP = dibromochloropropane
DIMP = diisopropylmethylphosphonate
LT = less than Certified Reporting Limit
NS = well was not sampled
NA = well was sampled but results are not available because analyses were cancelled or results were rejected.

RMA 1027.1



Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

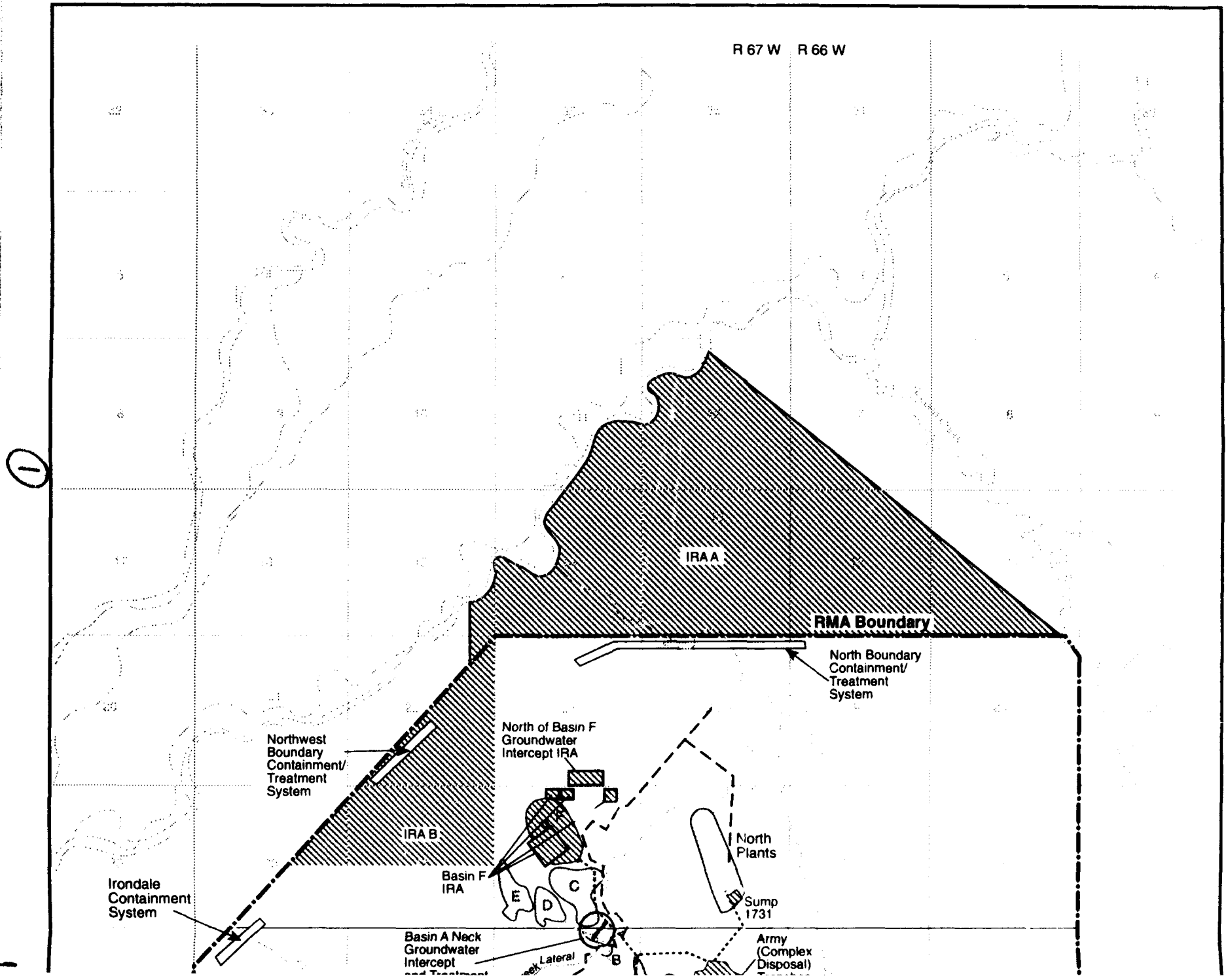
Prepared by:
Harding Lawson Associates

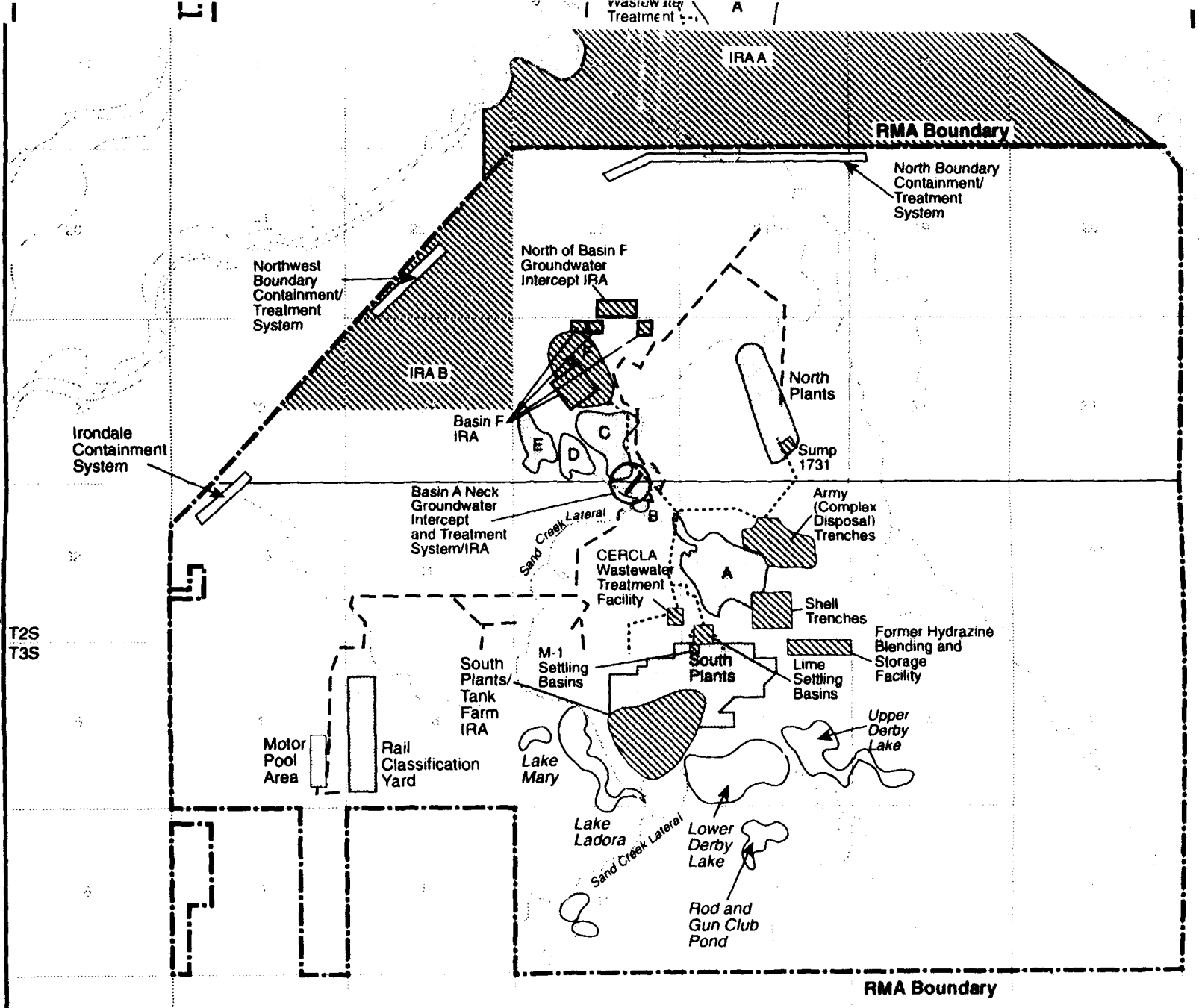
Figure 1.1

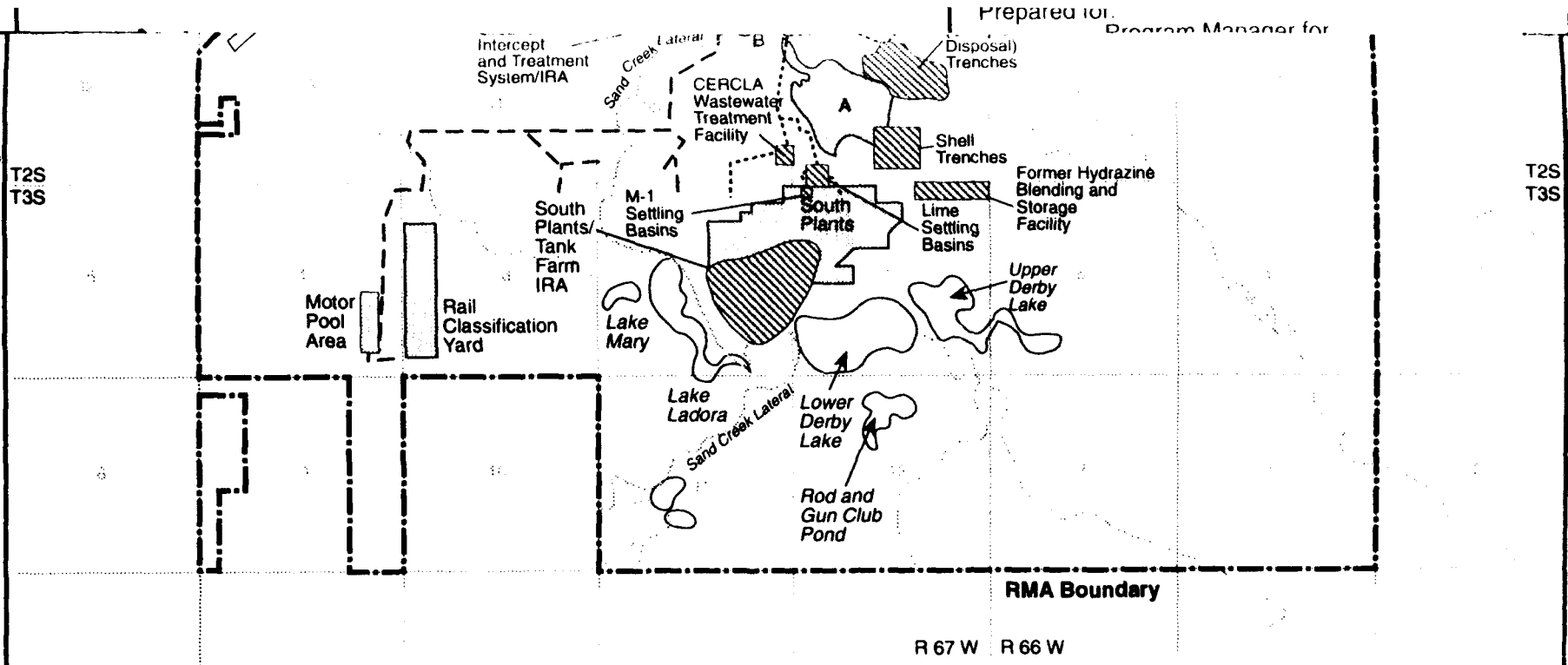
Location Map
Rocky Mountain Arsenal
Commerce City, Colorado

GWAR FY91

RMAB 1011.4


R 67 W
R 66 W
IRA A
RMA Boundary
North Boundary
Containment/
Treatment
System
North of Basin F
Groundwater
Intercept IRA
Northwest
Boundary
Containment/
Treatment
System
IRA B
North
Plants
Basin F
IRA
Irondale
Containment
System
E
D
C
Sump
1731
Basin A Neck
Groundwater
Intercept
Lateral
B
Army
(Complex
Disposal)


Wastewater Treatment
A
IRA A
RMA Boundary
North Boundary Containment/ Treatment System
Northwest Boundary Containment/ Treatment System
North of Basin F Groundwater Intercept IRA
IRA B
Basin F IRA
North Plants
Sump 1731
Irondale Containment System
E
D
C
B
Basin A Neck Groundwater Intercept and Treatment System/IRA
Sand Creek Lateral
Army (Complex Disposal) Trenches
CERCLA Wastewater Treatment Facility
A
Shell Trenches
Former Hydrazine Blending and Storage Facility
T2S
T3S
M-1 Settling Basins
South Plants
Lime Settling Basins
South Plants/ Tank Farm IRA
Upper Derby Lake
Motor Pool Area
Rail Classification Yard
Lake Mary
Lake Ladora
Sand Creek Lateral
Lower Derby Lake
Rod and Gun Club Pond
RMA Boundary
R 67 W
R 66 W



N

0 1/2 1

Scale in miles

EXPLANATION

- Major potential contamination site
- Interim response action (IRA) area
- Sanitary sewer system
- Chemical sewer system

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

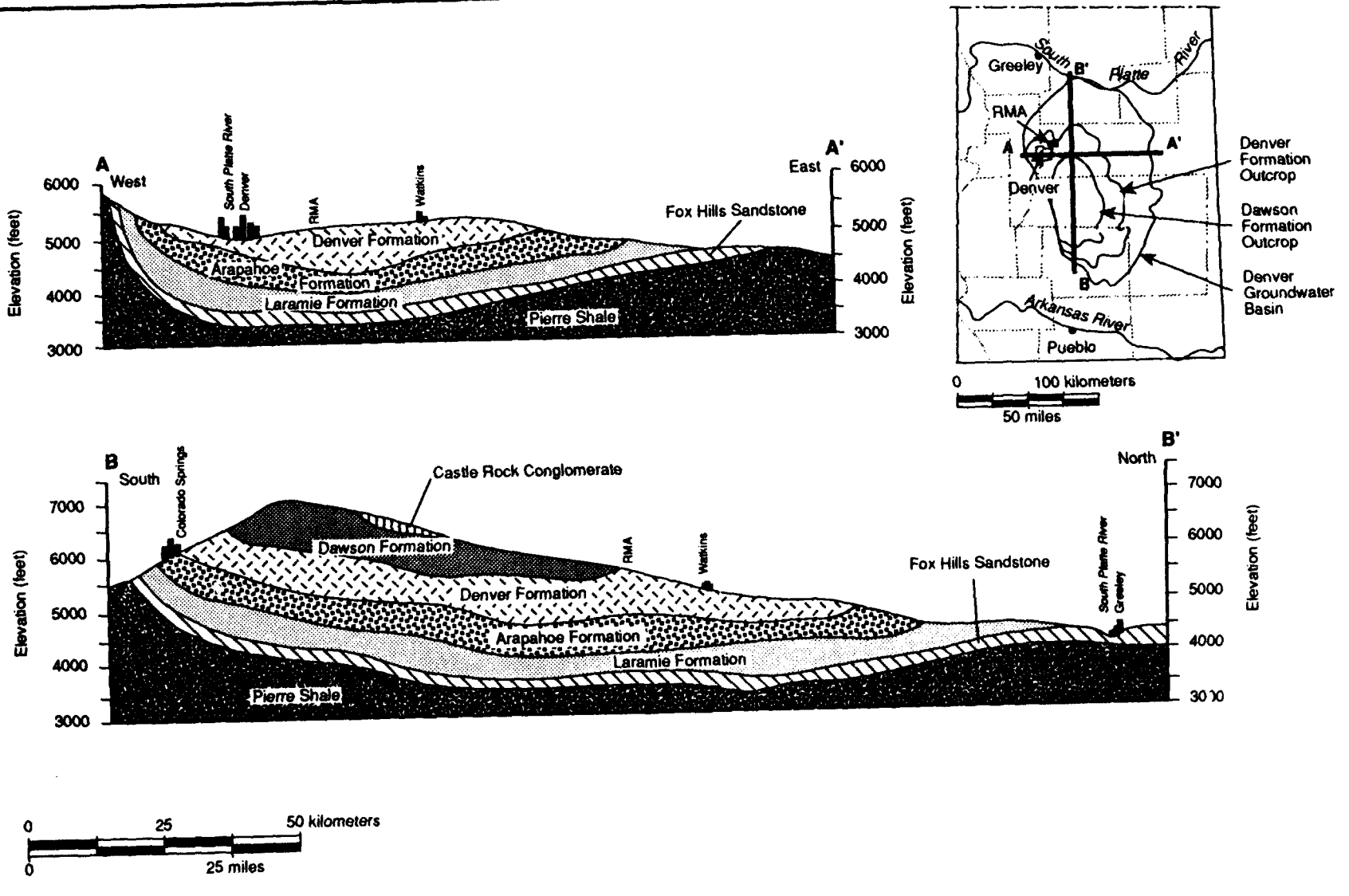
Prepared by:
Harding Lawson Associates

Figure 1.2

Locations of Major Potential Contamination Sites, Lakes, Containment Systems, and Interim Response Action Areas

GWAR FY91

RMA 1037.1



Source: Robson and Romero, 1981

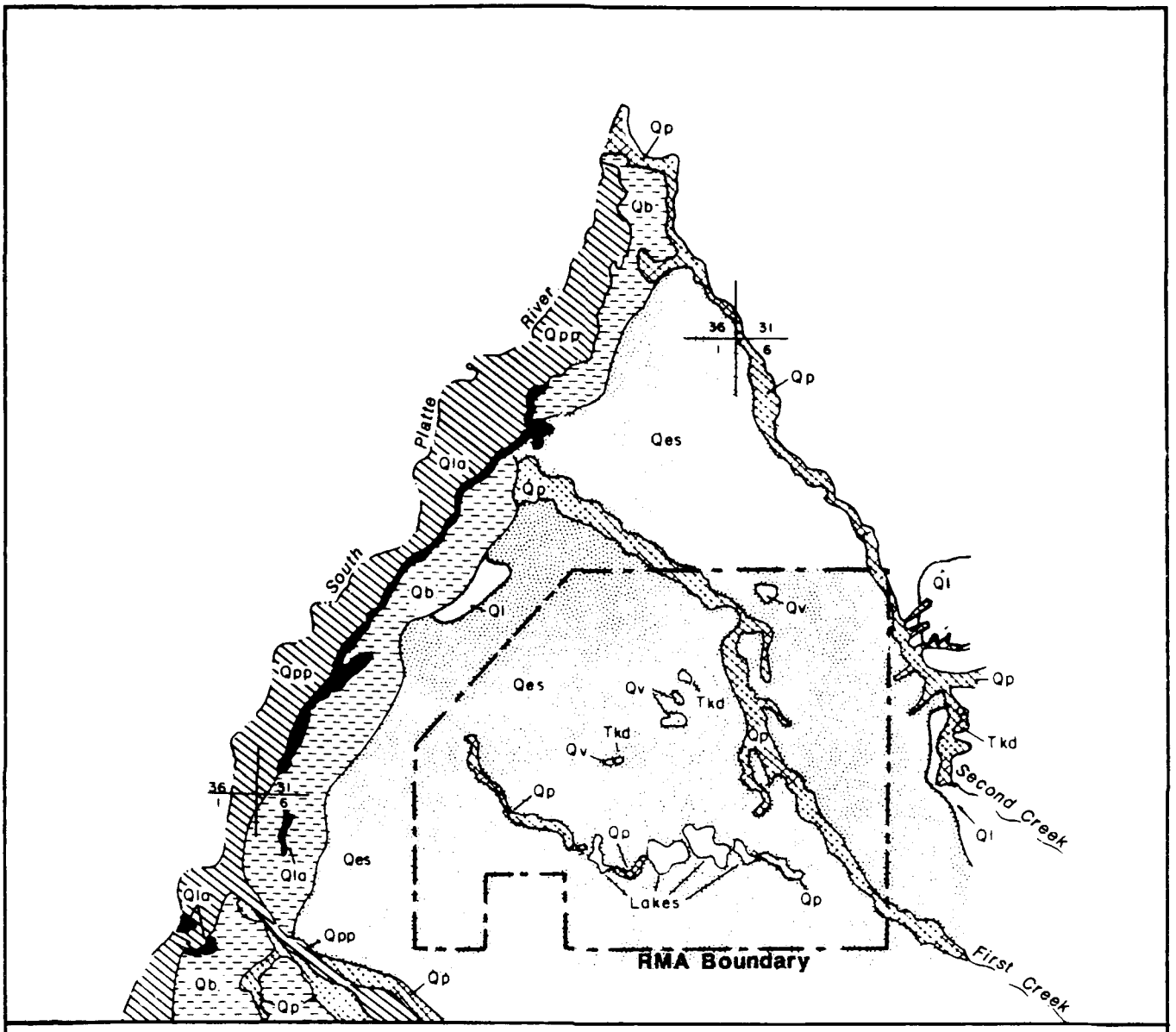
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:
Harding Lawson Associates

Figure 2.1

Upper Stratigraphic Sections of the Denver Basin

GWAR FY91



EXPLANATION

- Qpp — Post Piney Creek Alluvium (Quaternary)
- Qp — Piney Creek Alluvium (Quaternary)
- Qes — Eolian Sand (Quaternary)
- Ql — Loess (Quaternary)
- Qb — Broadway Alluvium (Quaternary)
- Q-g — Louviers Alluvium (Quaternary)
- Qv — Verdos Alluvium (Quaternary)
- Tkd — Denver Formation (Upper Cretaceous & Tertiary)

N

0 1 2

Scale in miles

Source: Lindvall, 1980

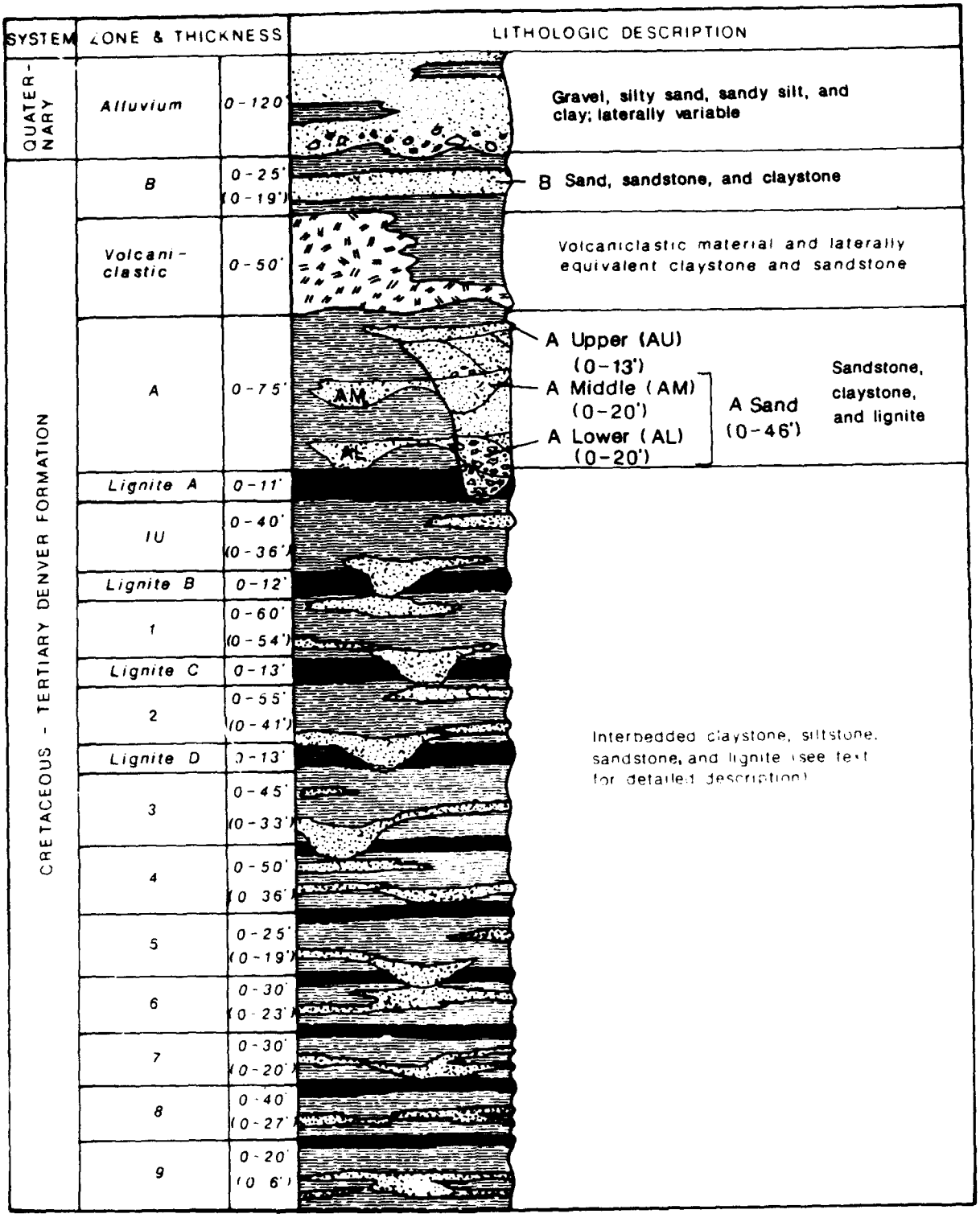
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:
Harding Lawson Associates

Figure 2.2

Surficial Geologic Map of the Rocky Mountain Arsenal Area

GWAR FY91



Source: Environmental Science and Engineering, 1988

Note: Thickness not to scale; net sandstone thickness shown in parentheses.

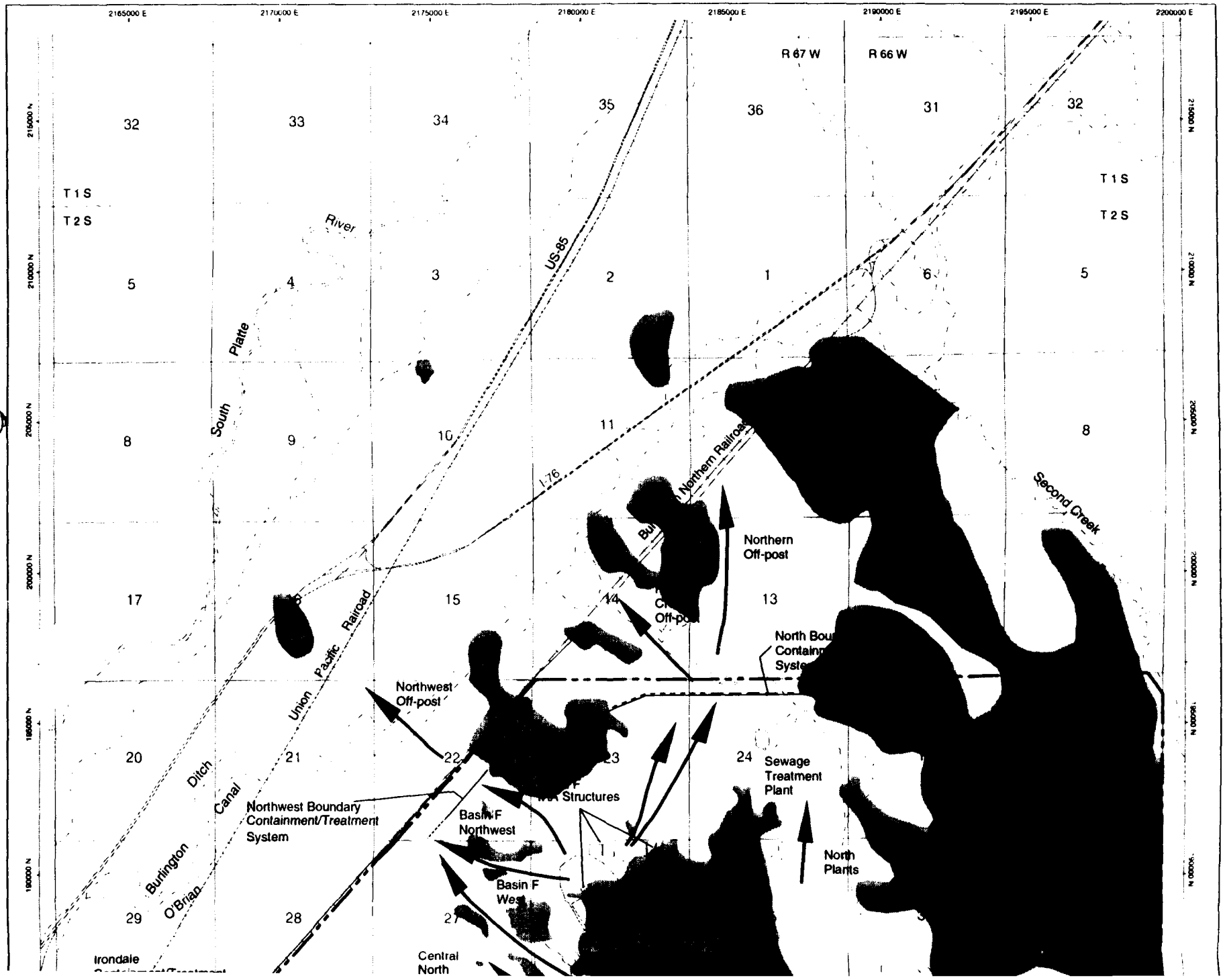
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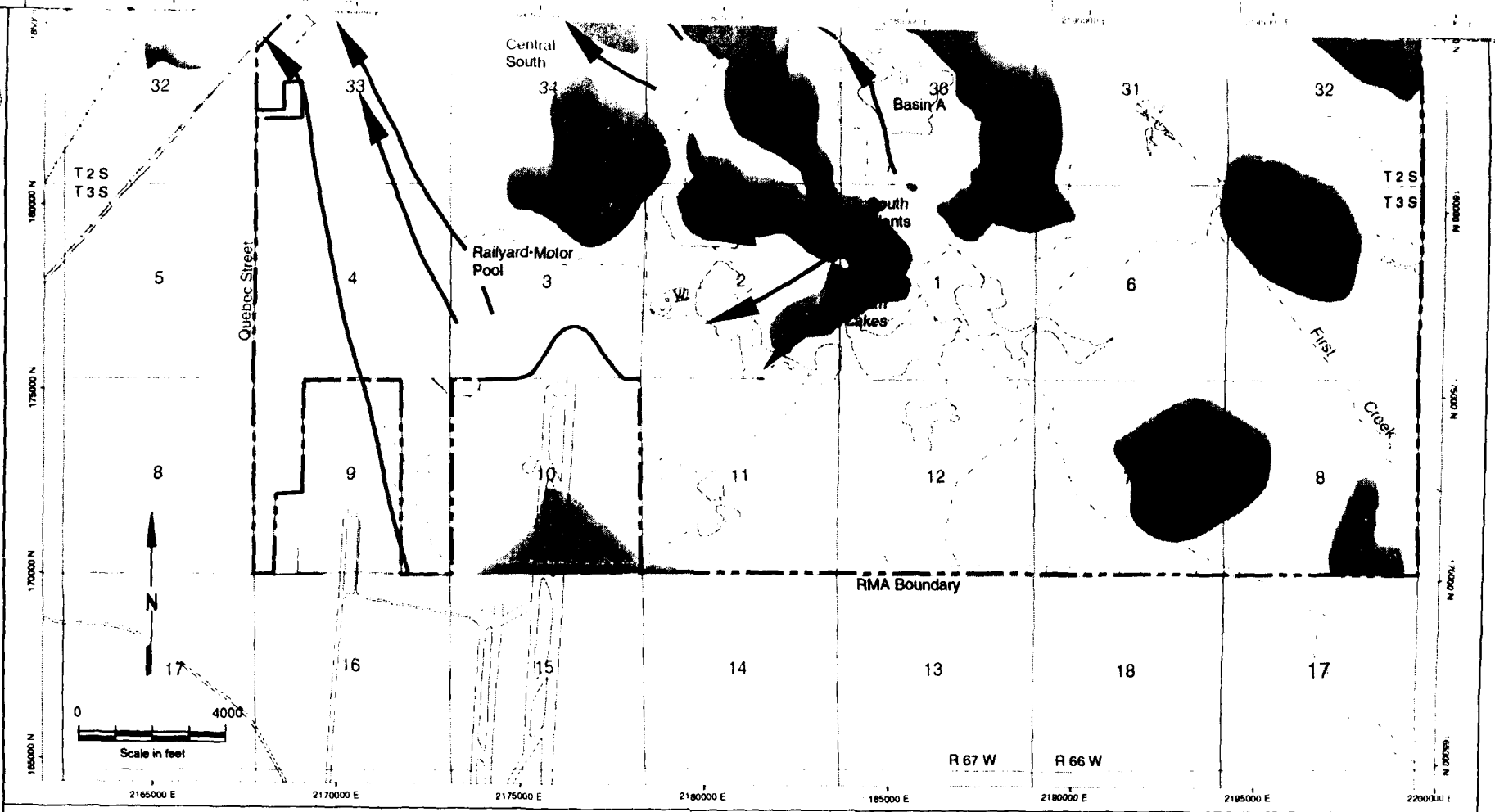
Figure 2.3

Denver Formation Stratigraphic Column

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
8
17
15
14
13
20
21
22
23
24
29
28
27
South Platte River
US-85
I-76
Union Pacific Railroad
Second Creek
Northern Off-post
Northwest Off-post
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F Northwest
Basin F West
North Plants
Burlington Ditch
O'Brian Canal
Irondale
Central North


Northern
Off-post
Northwest
Off-post
Union Pacific Railroad
Ditch
Canal
Burlington
O'Brian
Northwest Boundary
Containment/Treatment
System
Basin F
Northwest
Basin F
West
Structures
Sewage
Treatment
Plant
North
Plants
Irondale
Containment/Treatment
System
Central
North
Central
South
Basin A
T2S
T3S
Railyard-Motor
Pool
Quebec Street
First
Creek
N
17
16
15
14
13
18
17
8
9
10
11
12
8
5
4
3
2
1
6
29
28
27
32
33
34
36
31
32
20
21
22
23
24
15
14
13



EXPLANATION

Approximate Areas of Unsaturated Alluvium (*Based on Winter* 1990 /1991 Data)

Migration Pathway

Containment system

Physical barrier

Hydraulic barrier

Recharge trenches

Barrier wall

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

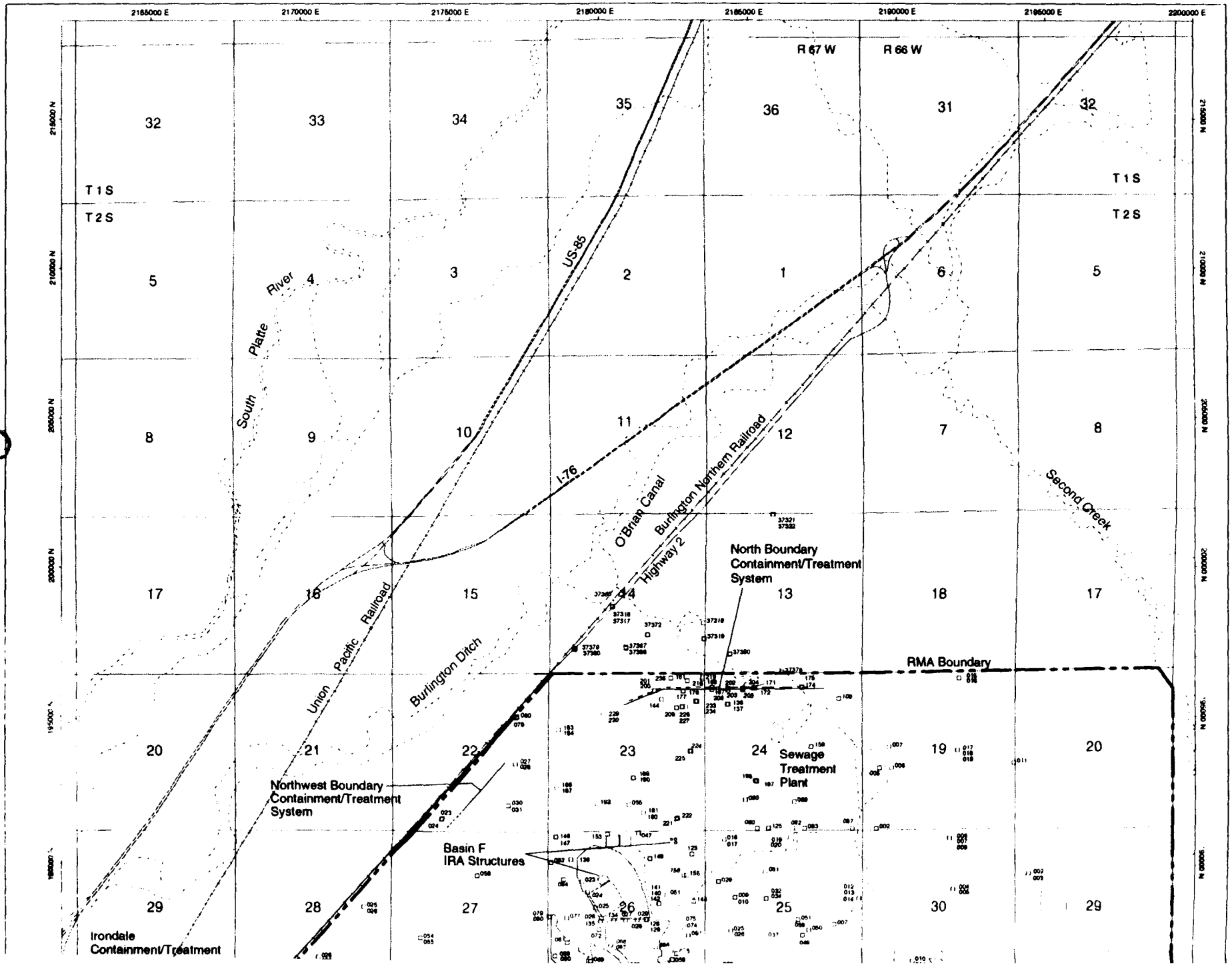
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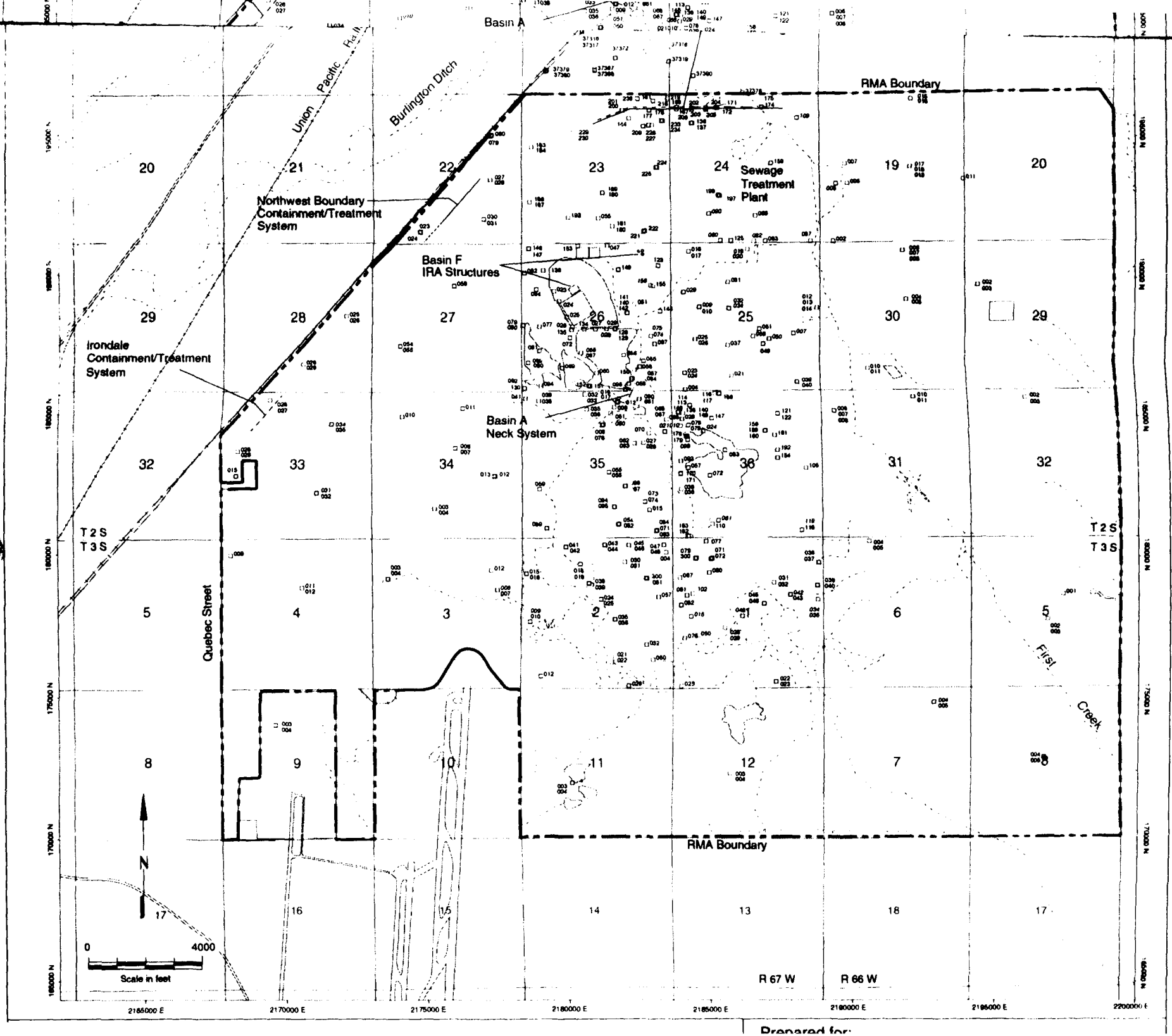
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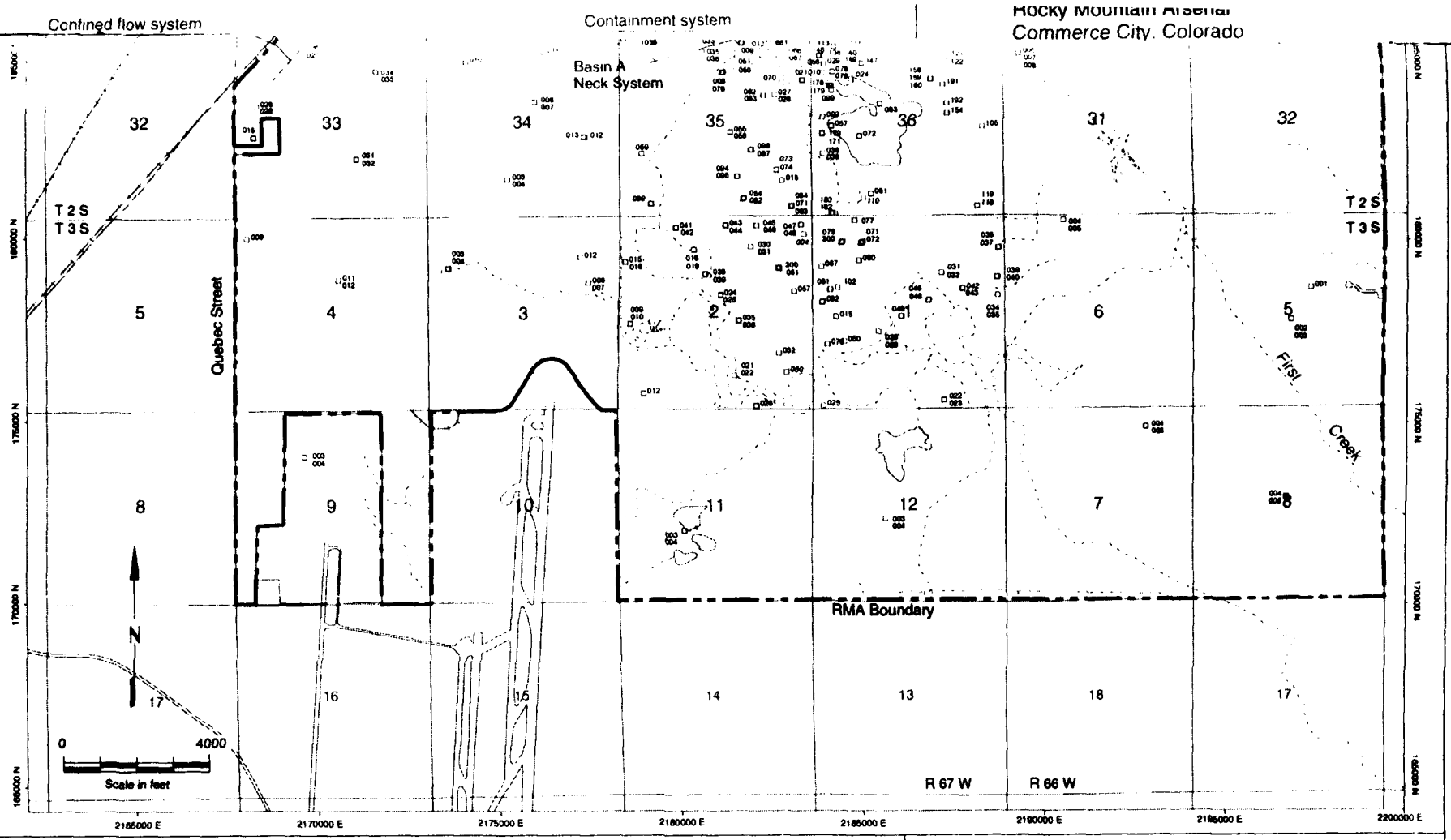
Rocky Mountain Arsenal
Contaminant Migration Pathways

GWAR FY91

7/12/92 rma/arusat DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
South Platte River
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment


Basin A
Union Pacific Rd N
Burlington Ditch
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
Basin A Neck System
T2S T3S
Quebec Street
First Creek
RMA Boundary
N
0 4000
Scale in feet
R 67 W
R 66 W
2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E



EXPLANATION

Confined flow system

□ 300 Confined Denver Formation for onpost wells

Note: For onpost wells, the section number precedes the three-digit well number shown (*i.e.*, wells in Section 3 - 03001)
Offpost wells are preceded by 37 (*i.e.*, 37012)

Containment system

Physical barrier
Hydraulic barrier
Recharge trenches
Barrier wall

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

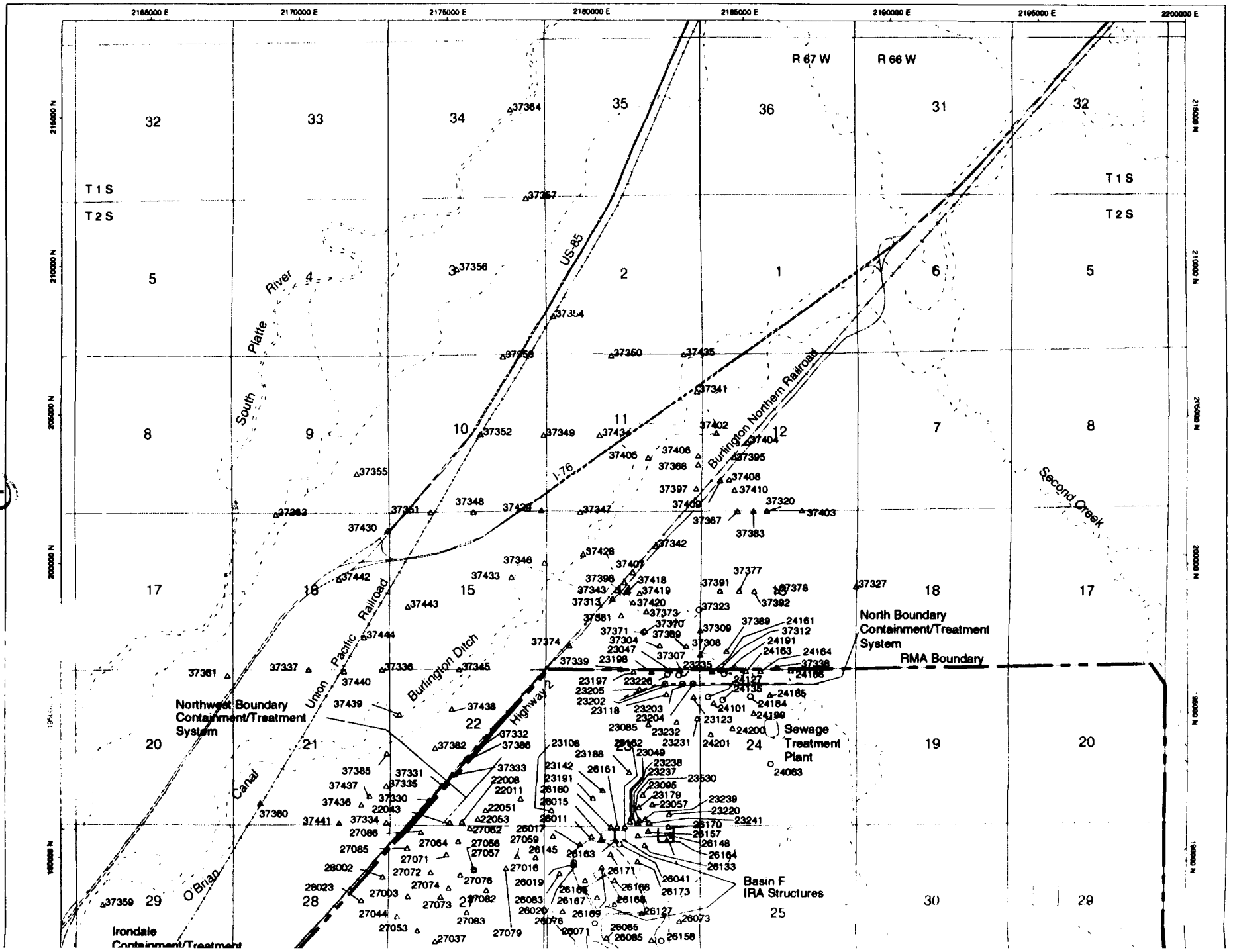
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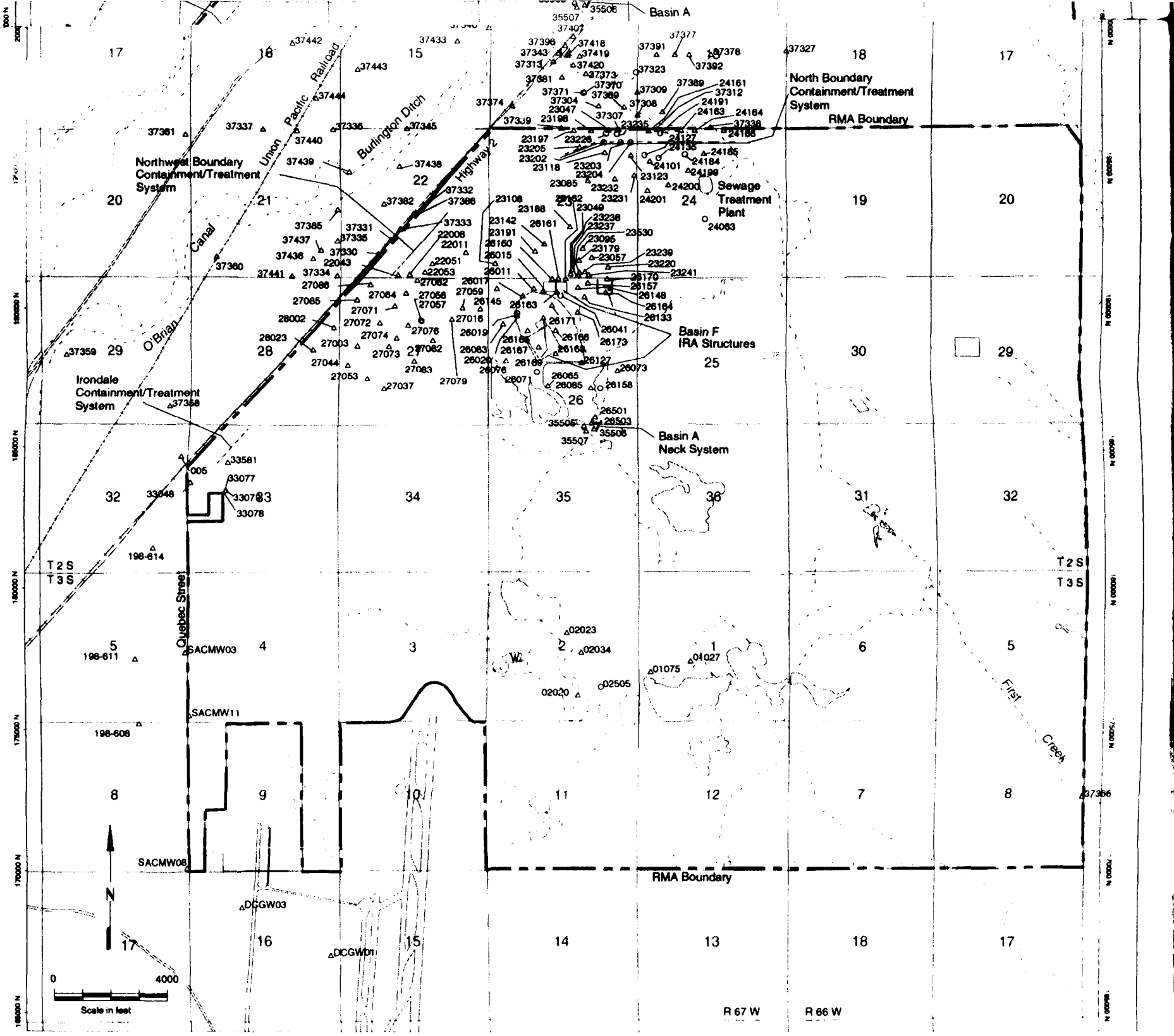
Figure 3.1

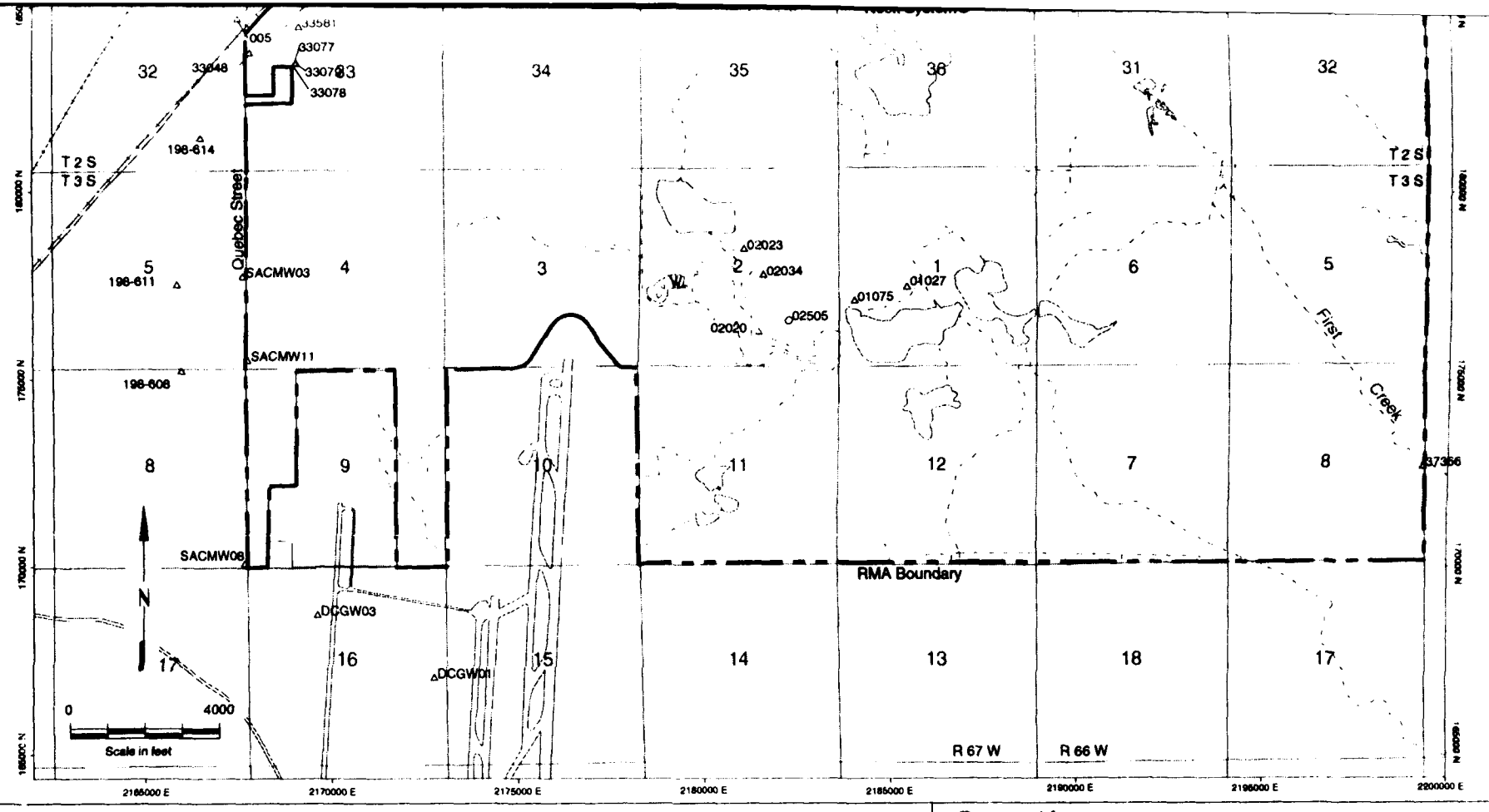
Winter 1990/1991 Water-level Monitoring Network, Confined Groundwater Flow System

GWAR FY91

8/27/92 RMA/CNFNETR.AWJ


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T1S
T2S
32
33
34
35
36
31
32
5
4
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24
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20
29
28
27
26
25
30
29
South Platte River
US-85
I-76
Burlington Northern Railroad
Second Creek
Union Pacific Railroad
Burlington Ditch
Highway 2
O'Brian Canal
Northwest Boundary Containment/Treatment System
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Basin F IRA Structures
Irondale Containment/Treatment


Basin A
North Boundary
Containment/Treatment
System
RMA Boundary
Northwest Boundary
Containment/Treatment
System
Union Pacific Railroad
Burlington Ditch
Highway 2
Canal
O'Brian
Sewage
Treatment
Plant
Basin F
IRA Structures
Irondale
Containment/Treatment
System
Basin A
Neck System
Quebec Street
First Creek
SACMW03
SACMW11
SACMW08
DCGW03
DCGW01
198-614
198-611
198-608
RMA Boundary
T 2 S
T 3 S
R 67 W
R 66 W
N
0
4000
Scale in feet



EXPLANATION

△SACMW11 Alluvial well location and well identification number

○26158 Unconfined Denver Formation well location and well identification number

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

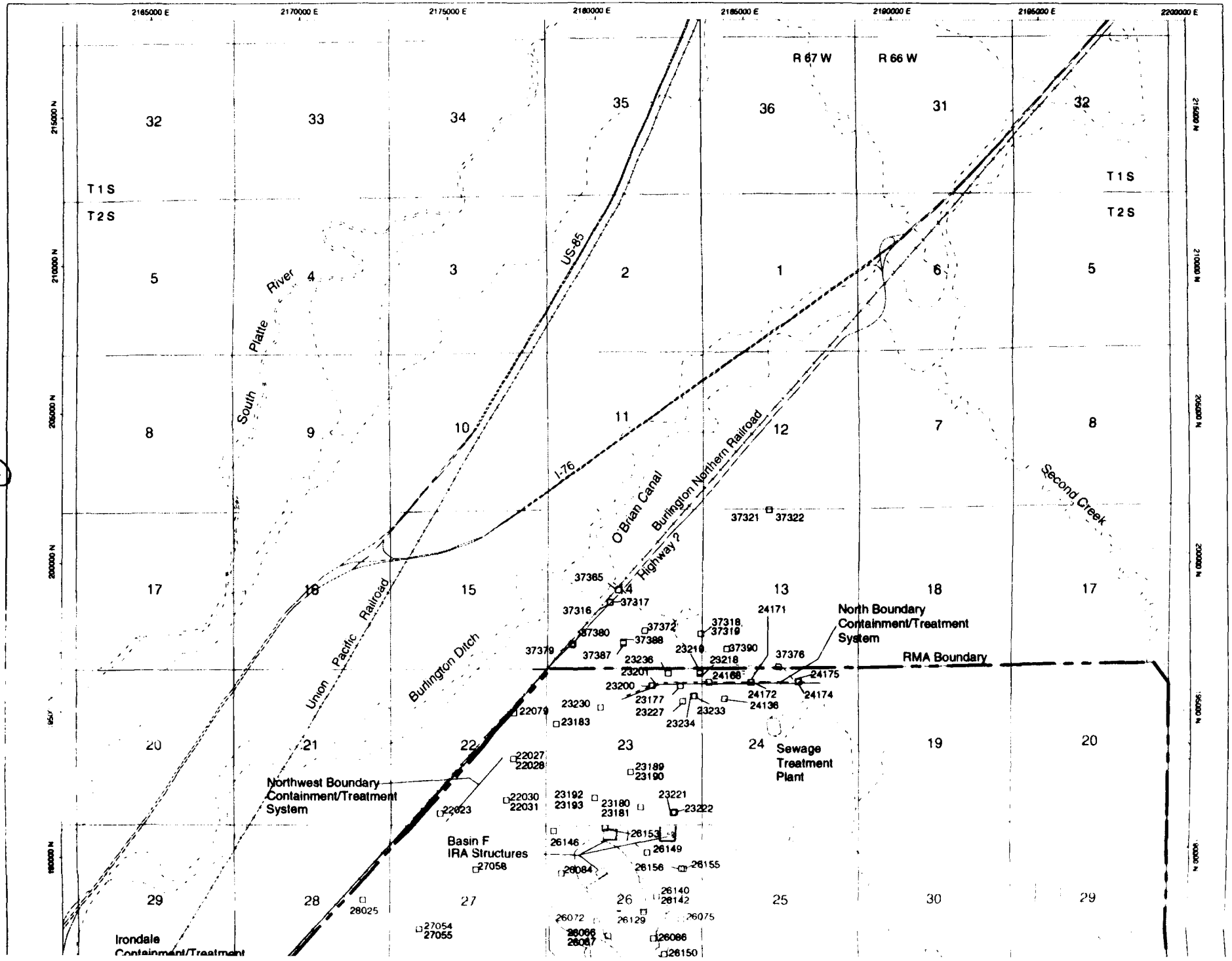
Harding Lawson Associates

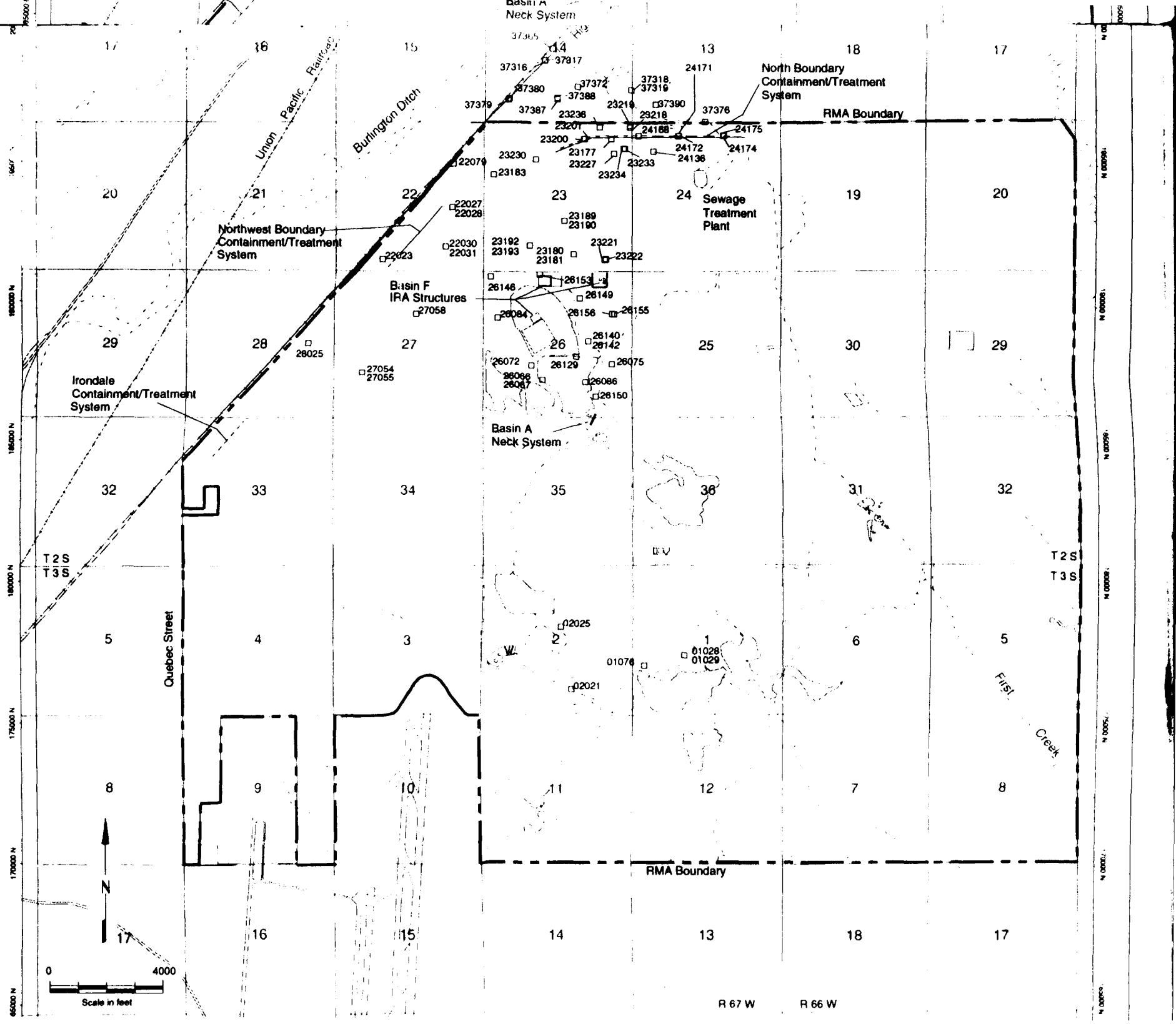
Figure 3.2

Winter 1990/1991 Sampling Network, Unconfined Groundwater Flow System

GWAR FY91

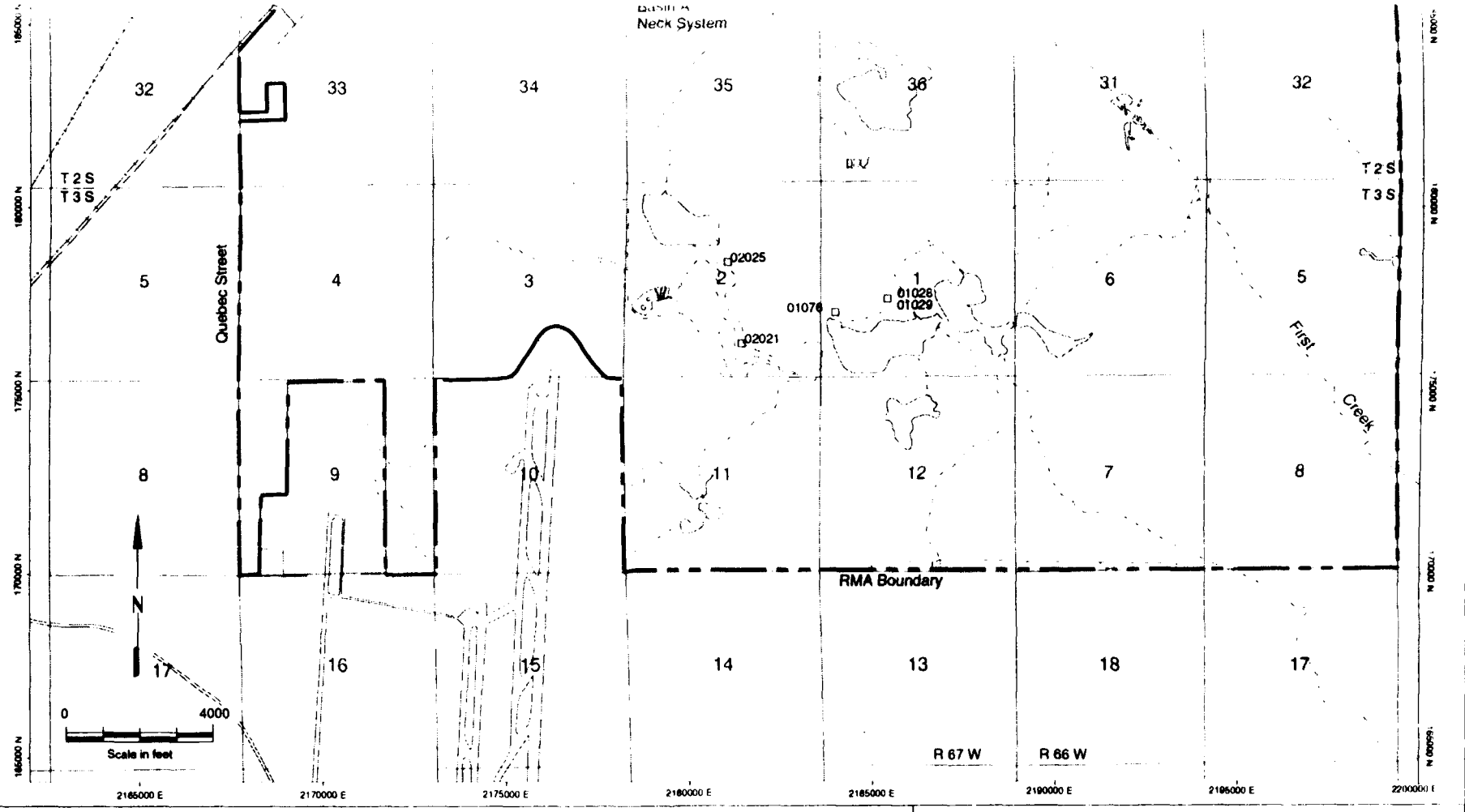
8/27/92 rma/uncsampr JWJ


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T1S
T2S
215000 N
210000 N
205000 N
200000 N
195000 N
190000 N
32
33
34
35
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South Platte River
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Highway 7
Second Creek
Union Pacific Railroad
Burlington Ditch
RMA Boundary
North Boundary Containment/Treatment System
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment
37321
37322
37365
37317
37316
37372
37318
37319
37380
37388
37379
37387
23236
23218
37390
37376
23201
24168
24175
23200
24171
24172
24174
23177
24136
23230
23227
23233
22079
23183
23234
22027
22028
23189
23190
22030
22031
23192
23193
23180
23181
23221
23222
22023
26146
26153
26149
26156
26155
27058
26084
26140
26142
26072
26129
26075
26066
26067
26086
26150
27054
27055
28025


Basin A
Neck System
North Boundary
Containment/Treatment
System
RMA Boundary
Union Pacific Railroad
Burlington Ditch
Northwest Boundary
Containment/Treatment
System
Sewage
Treatment
Plant
Basin F
IRA Structures
Irondale
Containment/Treatment
System
Basin A
Neck System
Quebec Street
First Creek
RMA Boundary
T2S
T3S
R 67 W
R 66 W
N
0
4000
Scale in feet

EXPLANATION

Prepared for:



EXPLANATION

01076 □ Confined flow system well location and well identification number

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Prepared for:
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Rocky Mountain Arsenal
Commerce City, Colorado

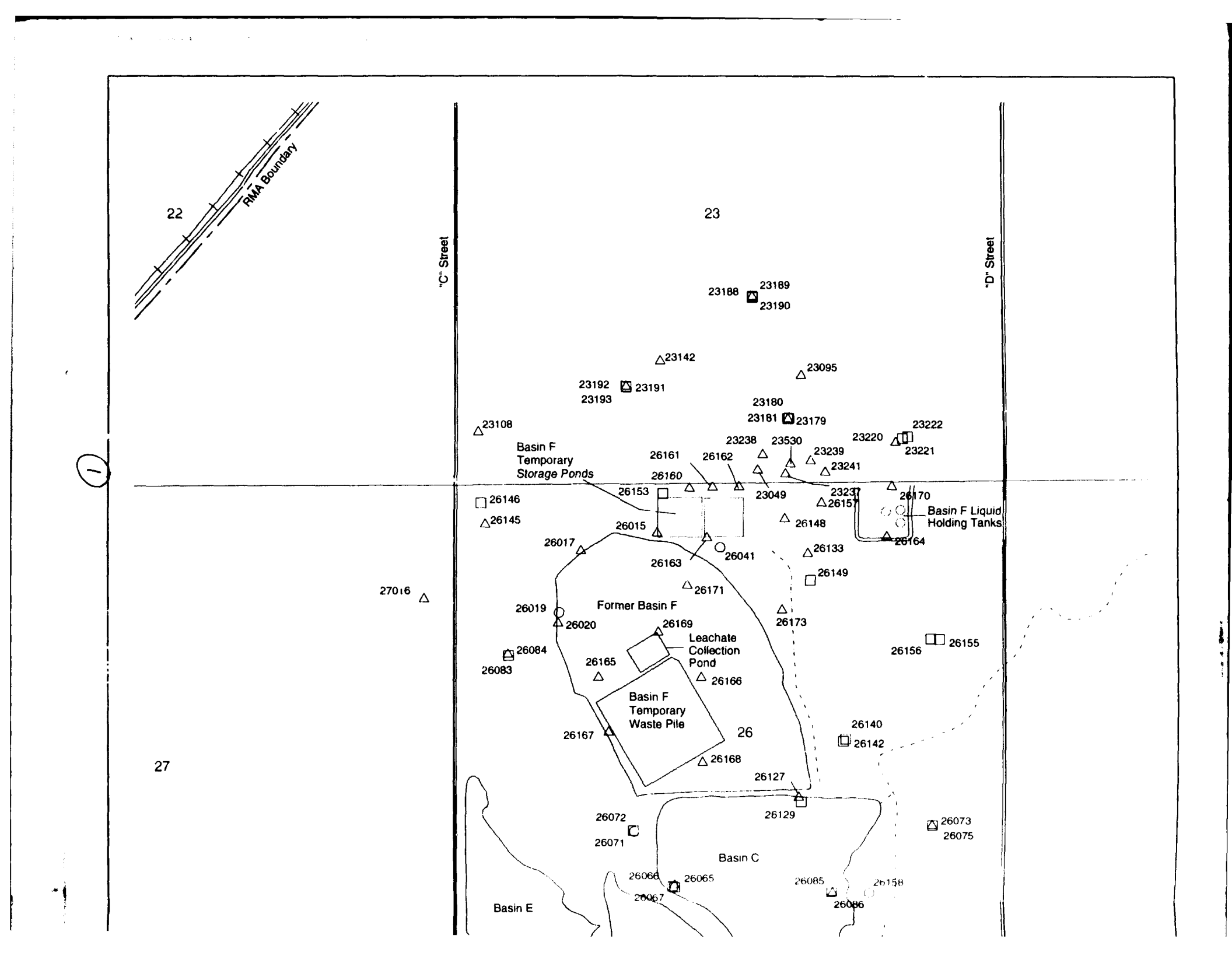
Prepared by:
Harding Lawson Associates

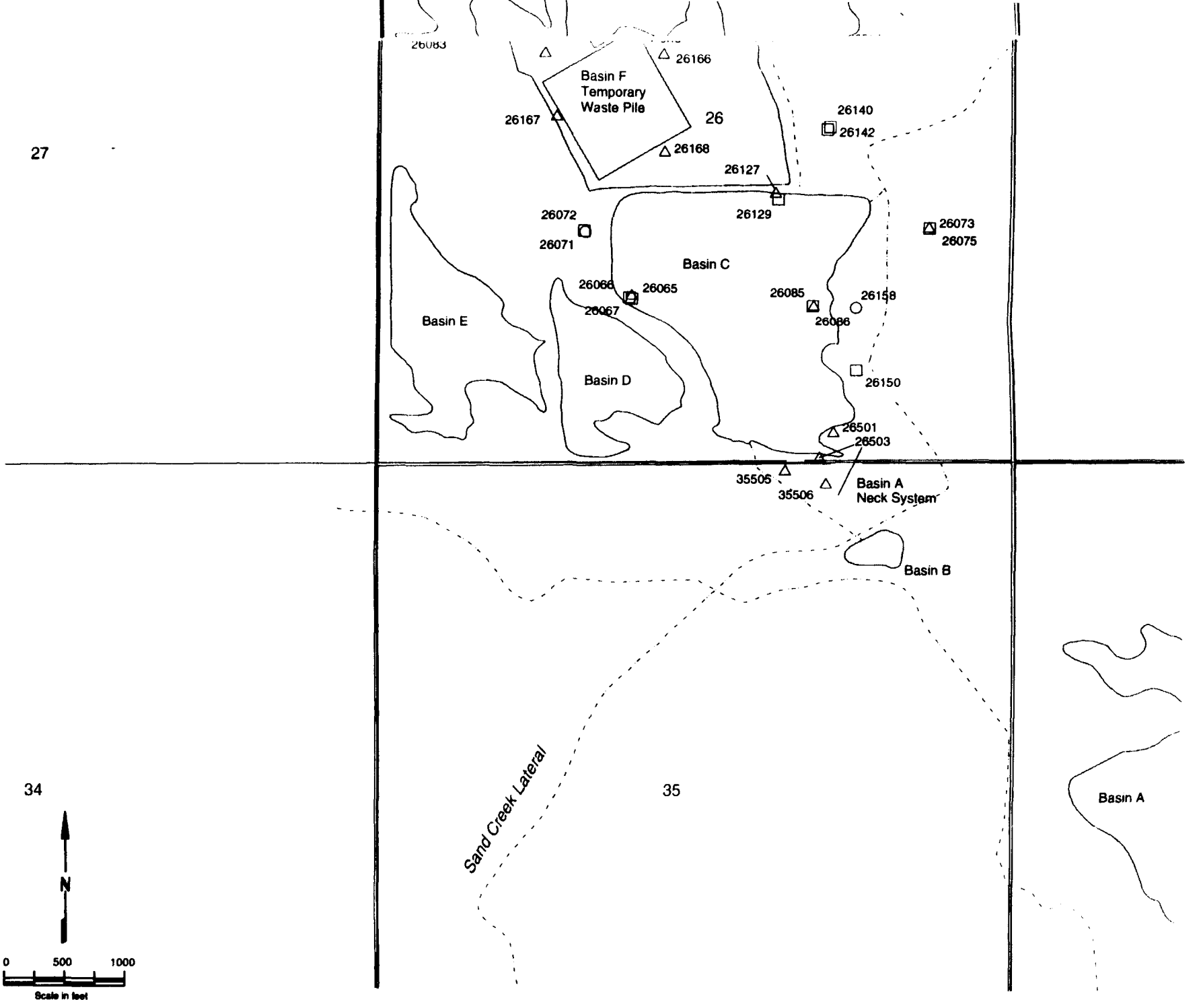
Figure 3.3

Winter 1990/1991 Sampling Network,
Denver Formation
Confined Flow System

GWAR FY91

9/27/92 mau/crisampr.JWJ


22
23
27
26
RMA Boundary
"C" Street
"D" Street
23188
23189
23190
23142
23095
23192
23191
23193
23180
23181
23179
23108
23222
23238
23530
23220
23221
23239
23241
Basin F
Temporary
Storage Ponds
26161
26162
26160
26153
23049
23237
26157
26170
26146
26145
26148
Basin F Liquid
Holding Tanks
26164
26015
26017
26041
26133
26163
26149
26171
27016
26019
Former Basin F
26020
26169
26173
Leachate
Collection
Pond
26084
26083
26165
26166
26156
26155
Basin F
Temporary
Waste Pile
26140
26142
26167
26168
26127
26129
26072
26071
26073
26075
Basin C
26066
26065
26085
26158
26067
26086
Basin E



EXPLANATION

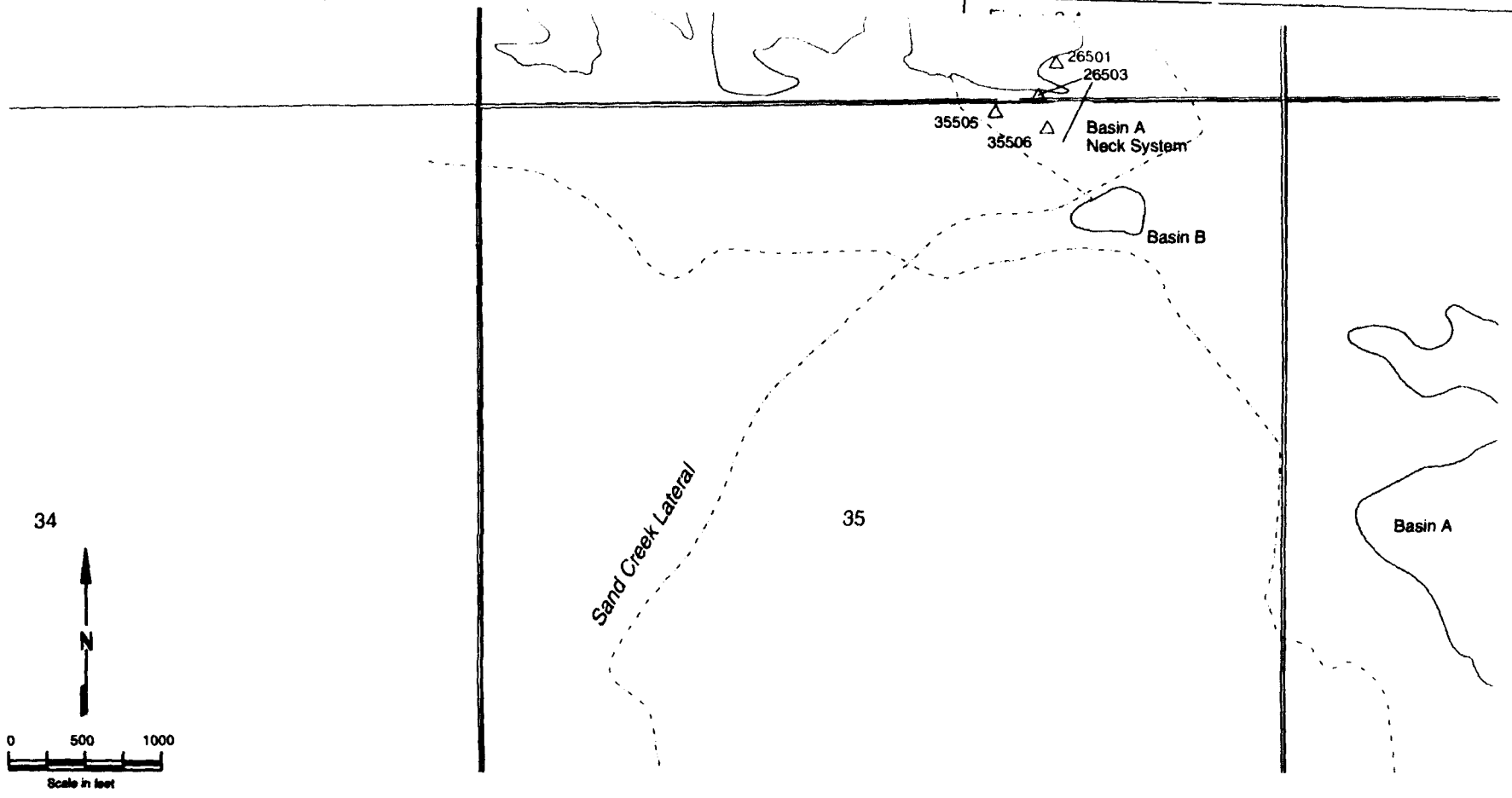
△ 26067 Alluvial well location and well identification number

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

identification number

Harding Lawson Associates



EXPLANATION

△ 26067	Alluvial well location and well identification number
○ 26072	Unconfined Denver Formation well location and well identification number
□ 35507	Confined flow system well location and well identification number

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Commerce City, Colorado

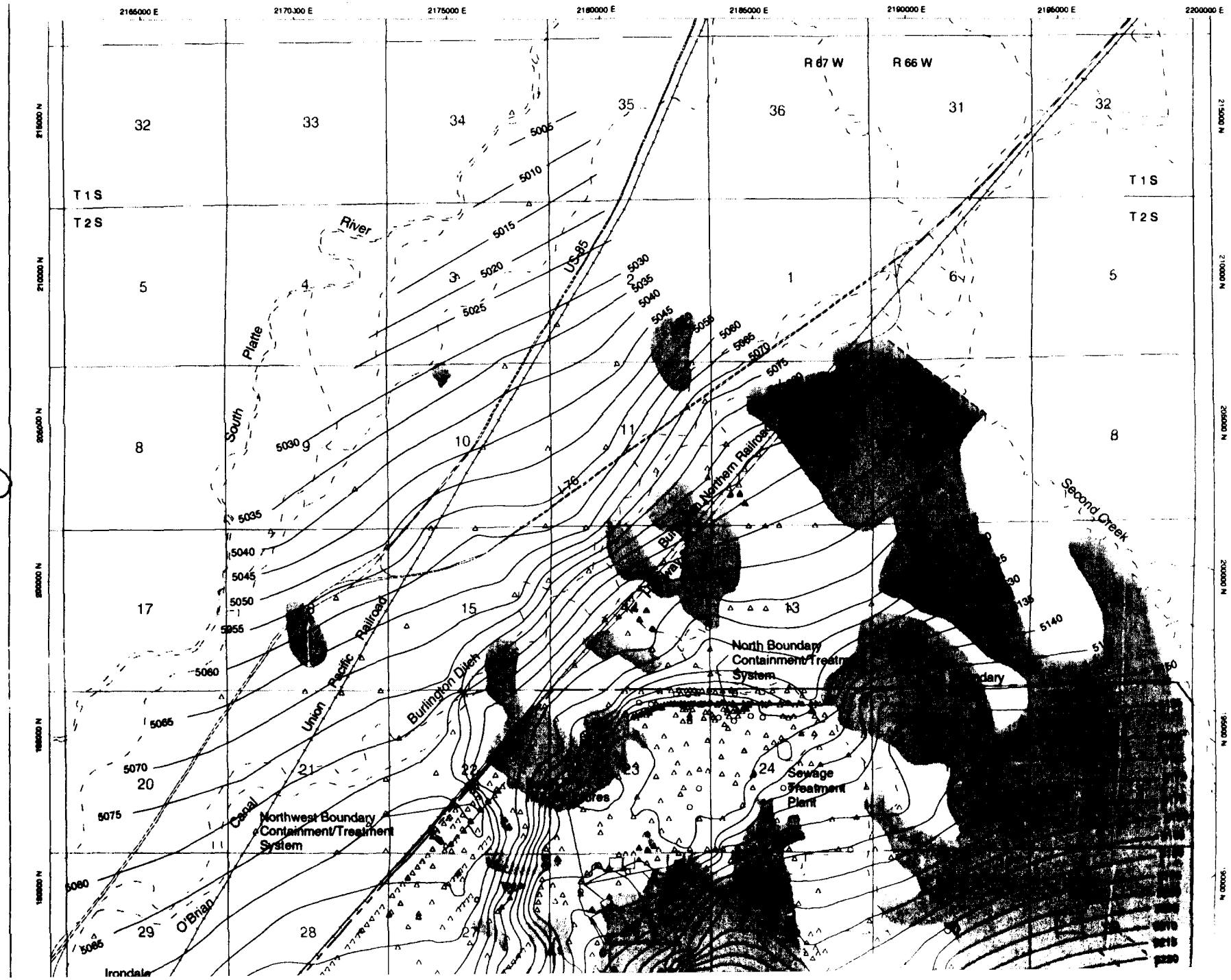
Prepared by:
Harding Lawson Associates

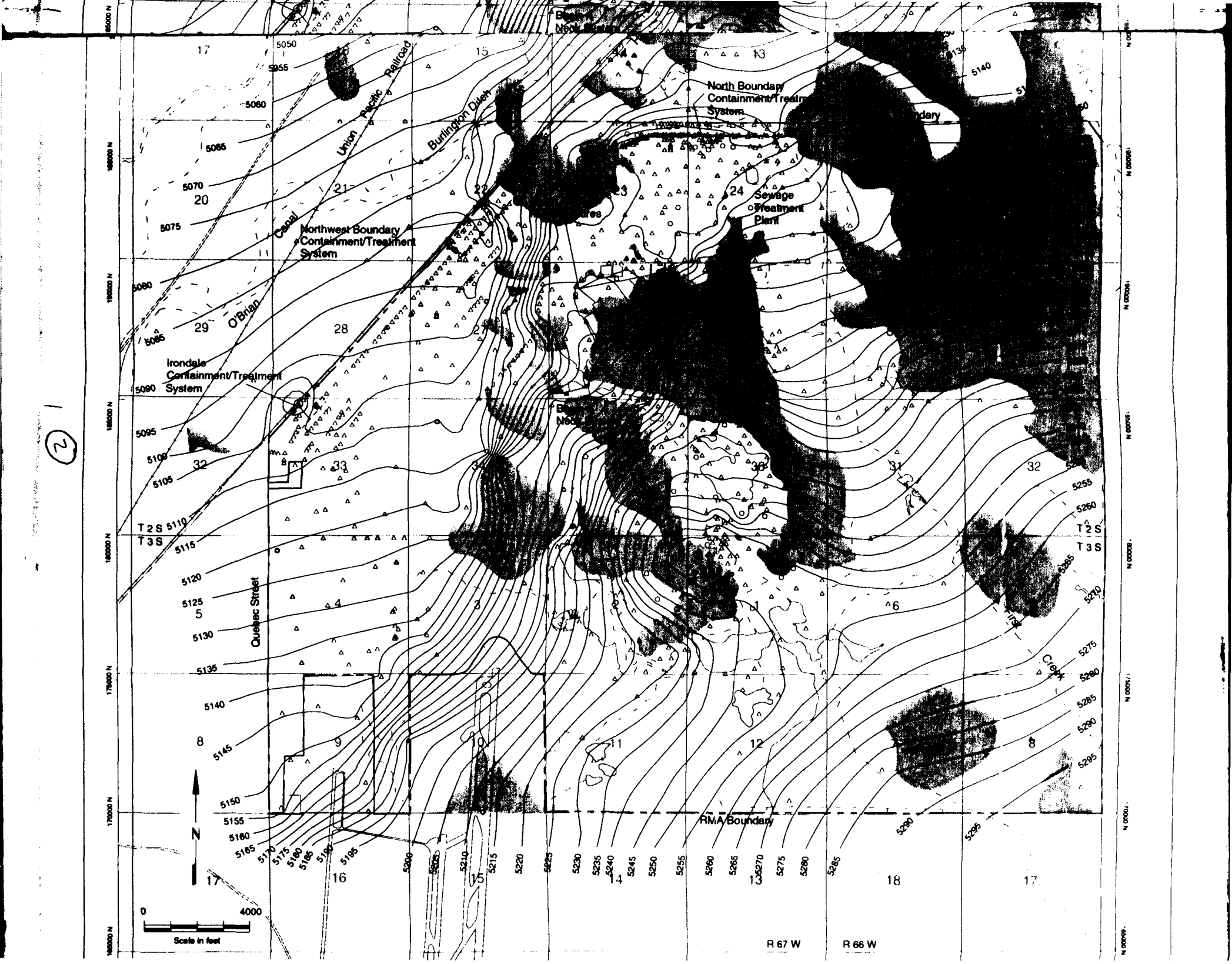
Figure 3.4

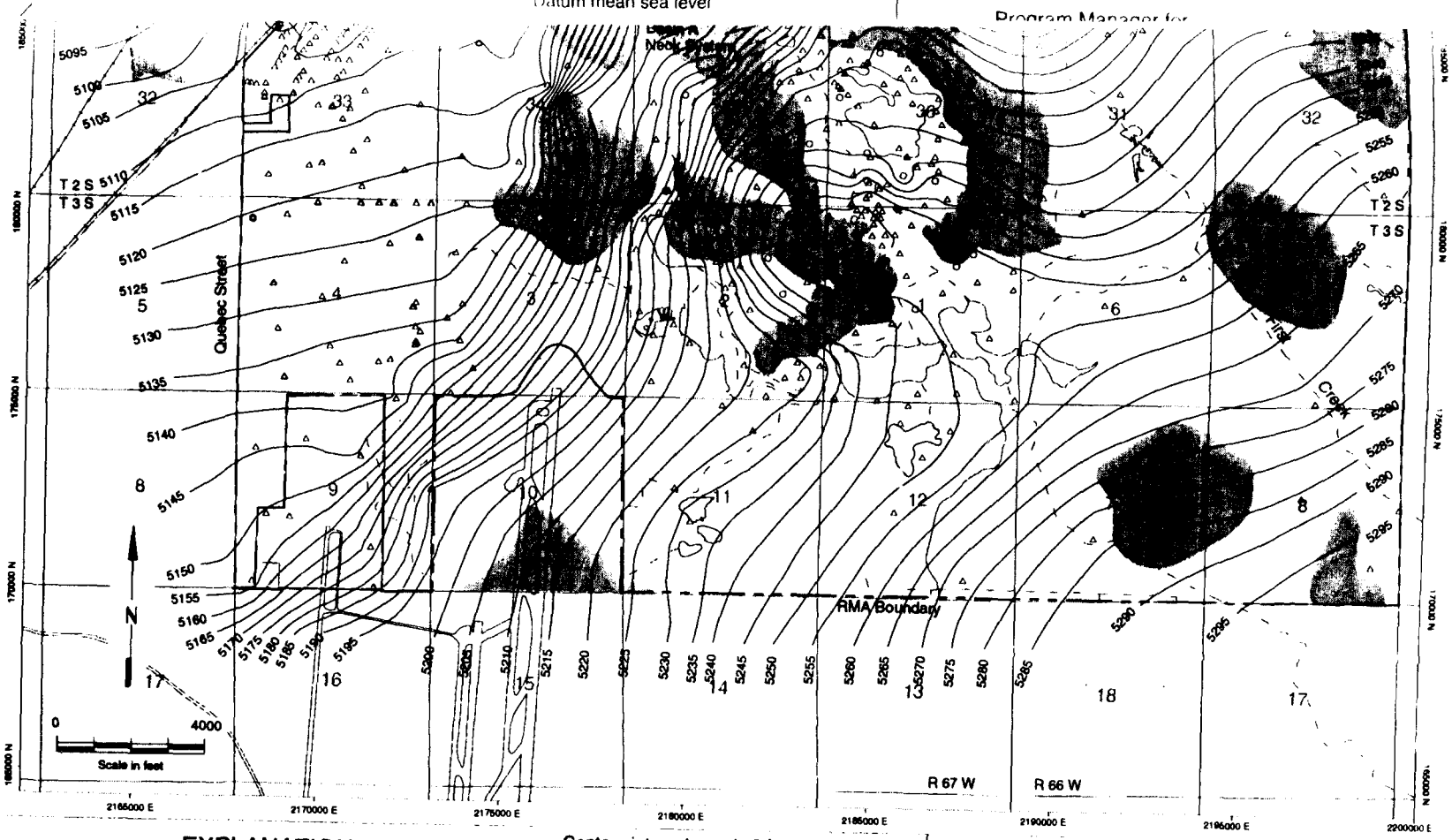
1991 Water Monitoring Year
Basin F Interim Response Action
Sampling Network

GWAR FY91

6/27/92 mw/basinf JWJ


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T1S
T2S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
8
17
15
13
20
21
22
23
24
29
28
South Platte River
US-85
I-76
Union Pacific Railroad
Burlington Ditch
Northern Railroad
Second Creek
North Boundary Containment/Treatment System
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
O'Brian Canal
Irondale
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5135
5140


North Boundary Containment/Treatment System
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Union Pacific Railroad
Burlington Ditch
Canal
O'Brian
Quebec Street
Creek
RMA Boundary
T 2 S
T 3 S
R 67 W
R 66 W
N
0
4000
Scale in feet



EXPLANATION

5105 — Water-level elevation contour (water levels measured from January 23, 1991, to February 4, 1991)

Approximate areas of unsaturated alluvium (dashed where inferred)

Well or piezometer location yielding water-level elevation

- Alluvial
- Unconfined Denver Formation

Contour interval equals 5 feet
Datum mean sea level

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

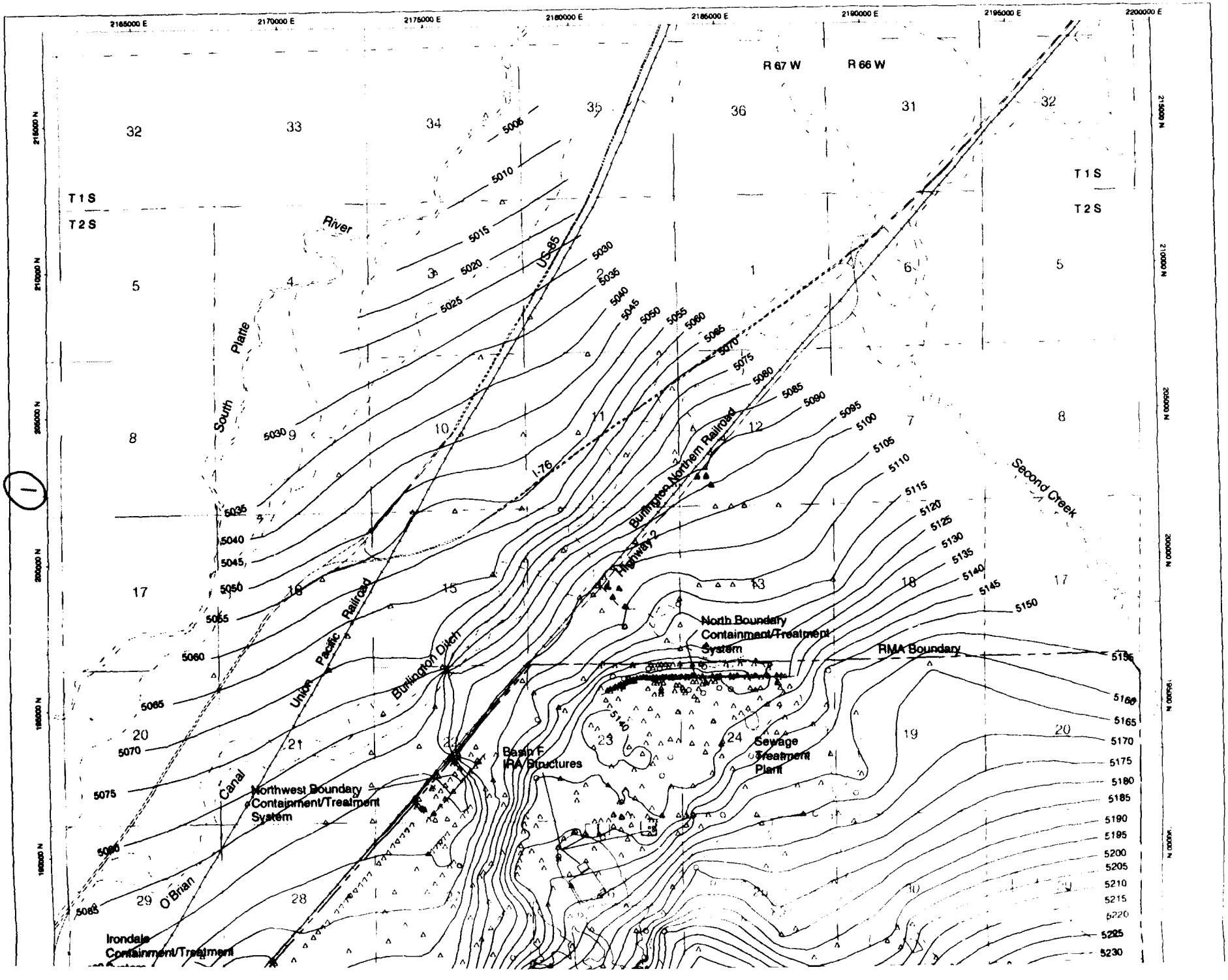
Prepared by:

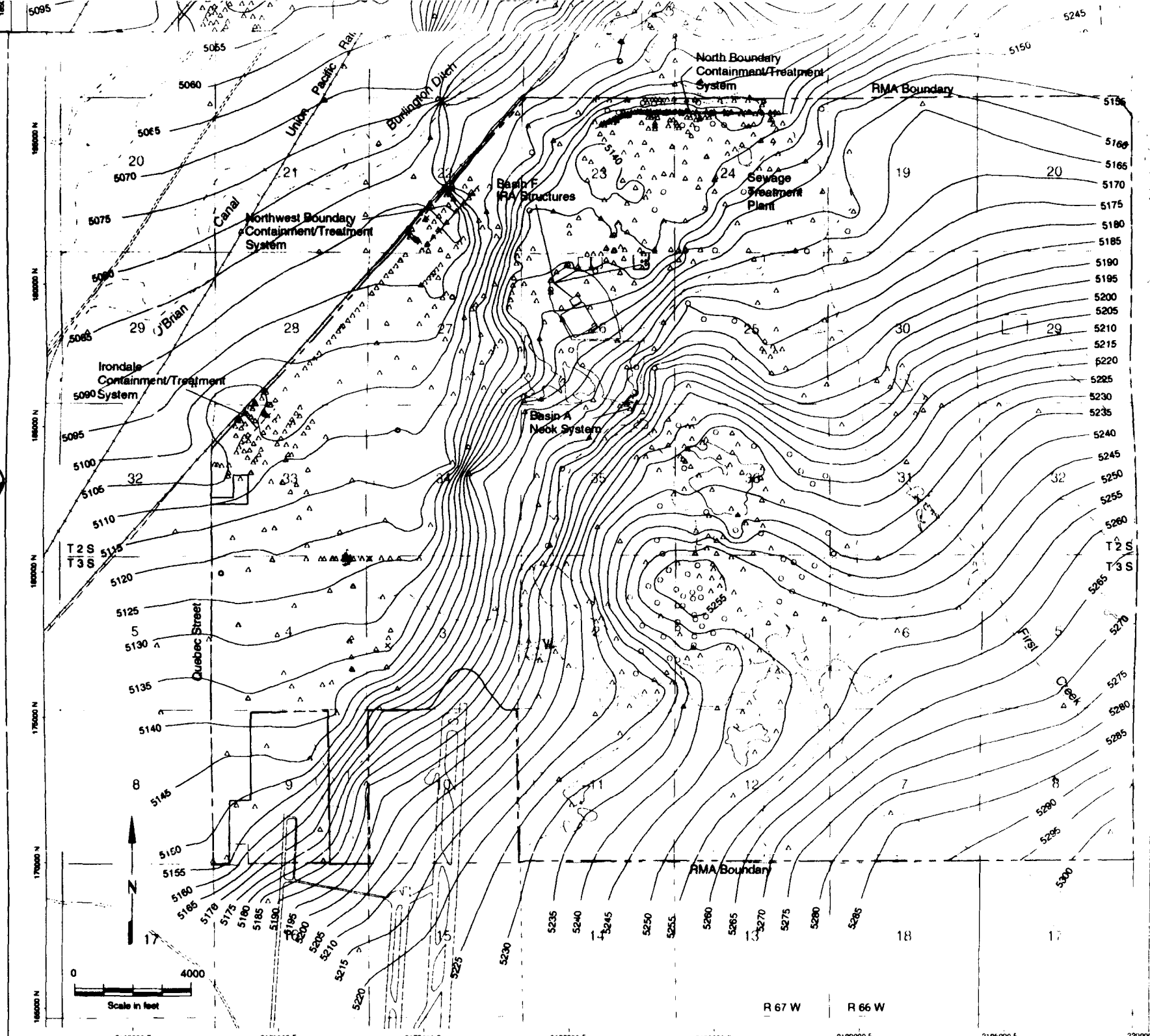
Harding Lawson Associates

Figure 4.1

Regional Water-Table Map of the Unconfined Flow System - Winter 1990/1991

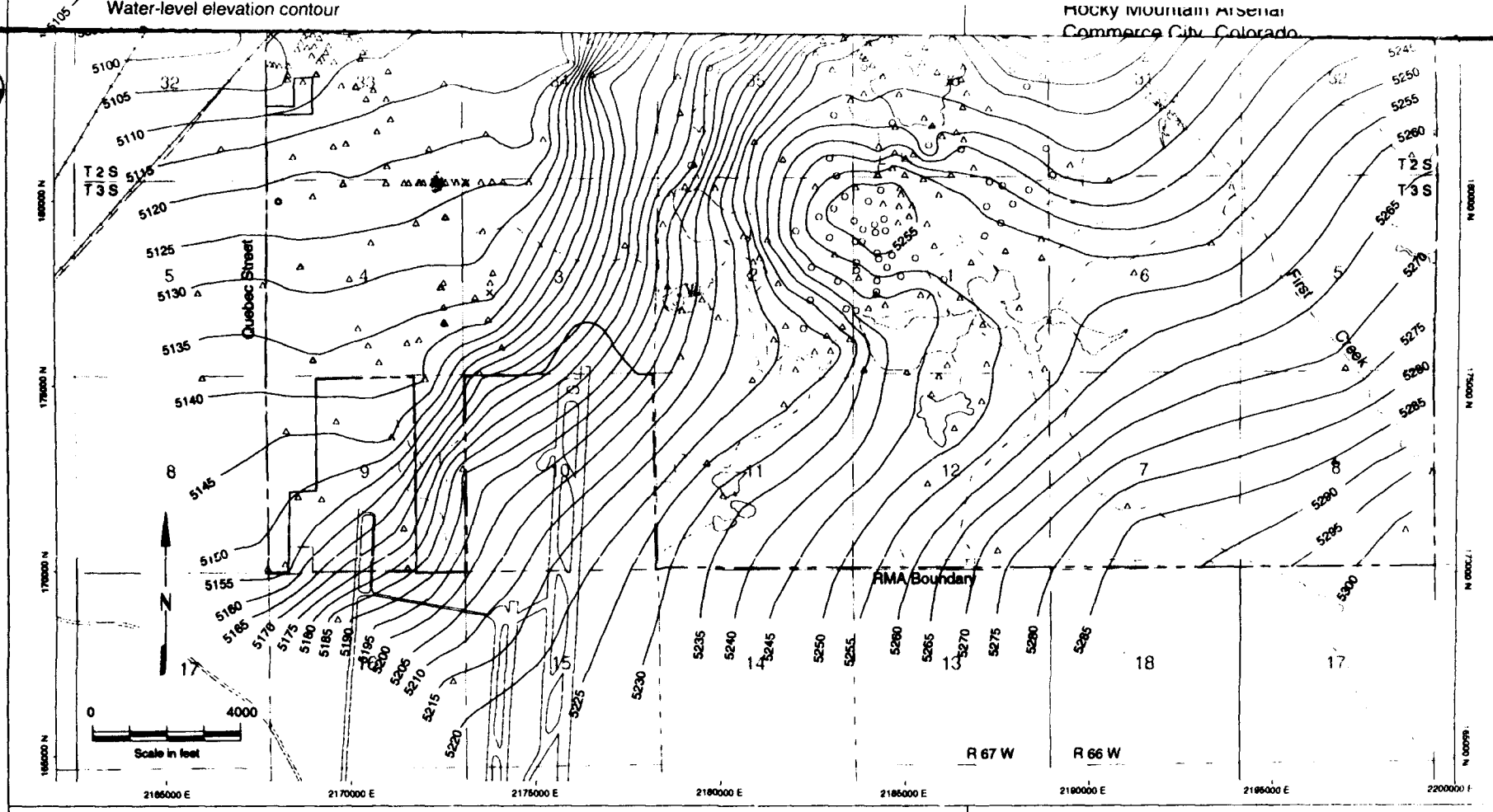
GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
T 1 S
T 2 S
215000 N
210000 N
205000 N
200000 N
195000 N
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
12
7
8
17
16
15
14
13
18
17
20
21
22
23
24
19
20
29
28
30
South Platte River
US-85
I-76
Burlington Northern Railroad
Second Creek
Union Pacific Railroad
Burlington Ditch
Highway 2
O'Brian Canal
North Boundary Containment/Treatment System
RMA Boundary
Basin F IRA Structures
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230



Contour interval equals 5 feet

Prepared for:



EXPLANATION

Contour interval equals 5 feet
Datum mean sea level

5105 Water-level elevation contour
(water levels measured from April 1,1991, to April 9, 1991)

Well or piezometer location yielding water-level elevation

- △ Alluvial
- ○ Unconfined Denver Formation

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

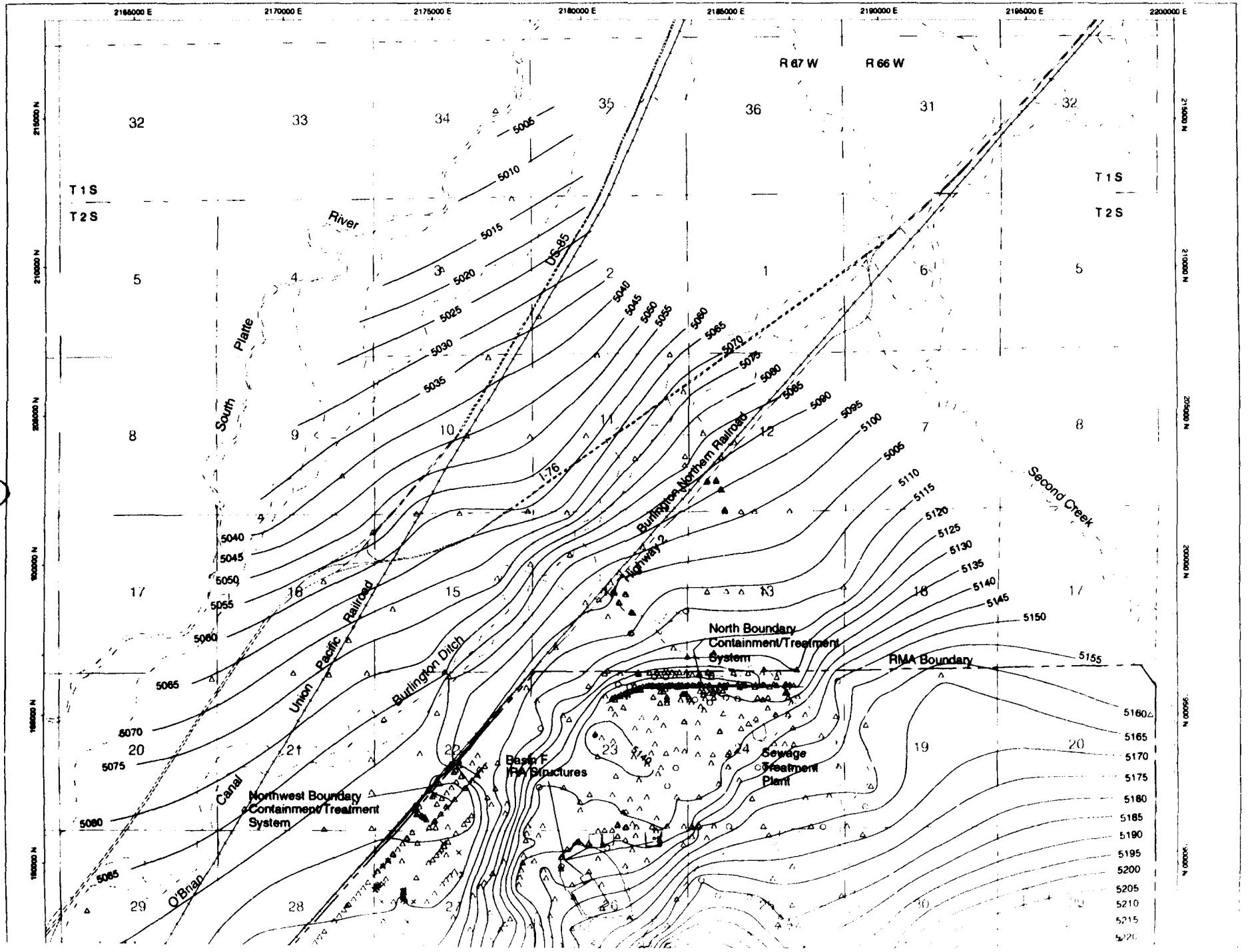
Prepared by:
Harding Lawson Associates

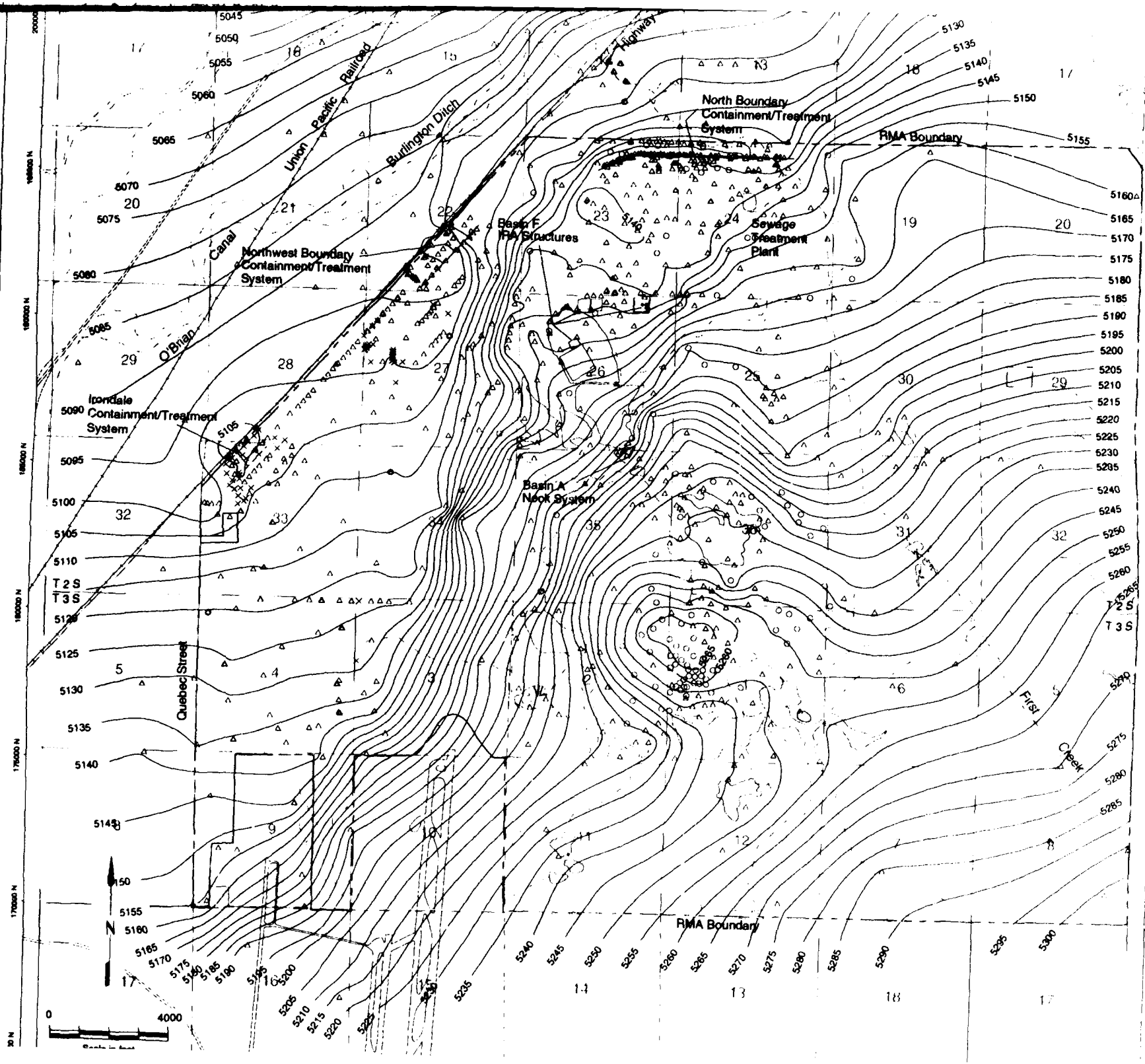
Figure 4.2

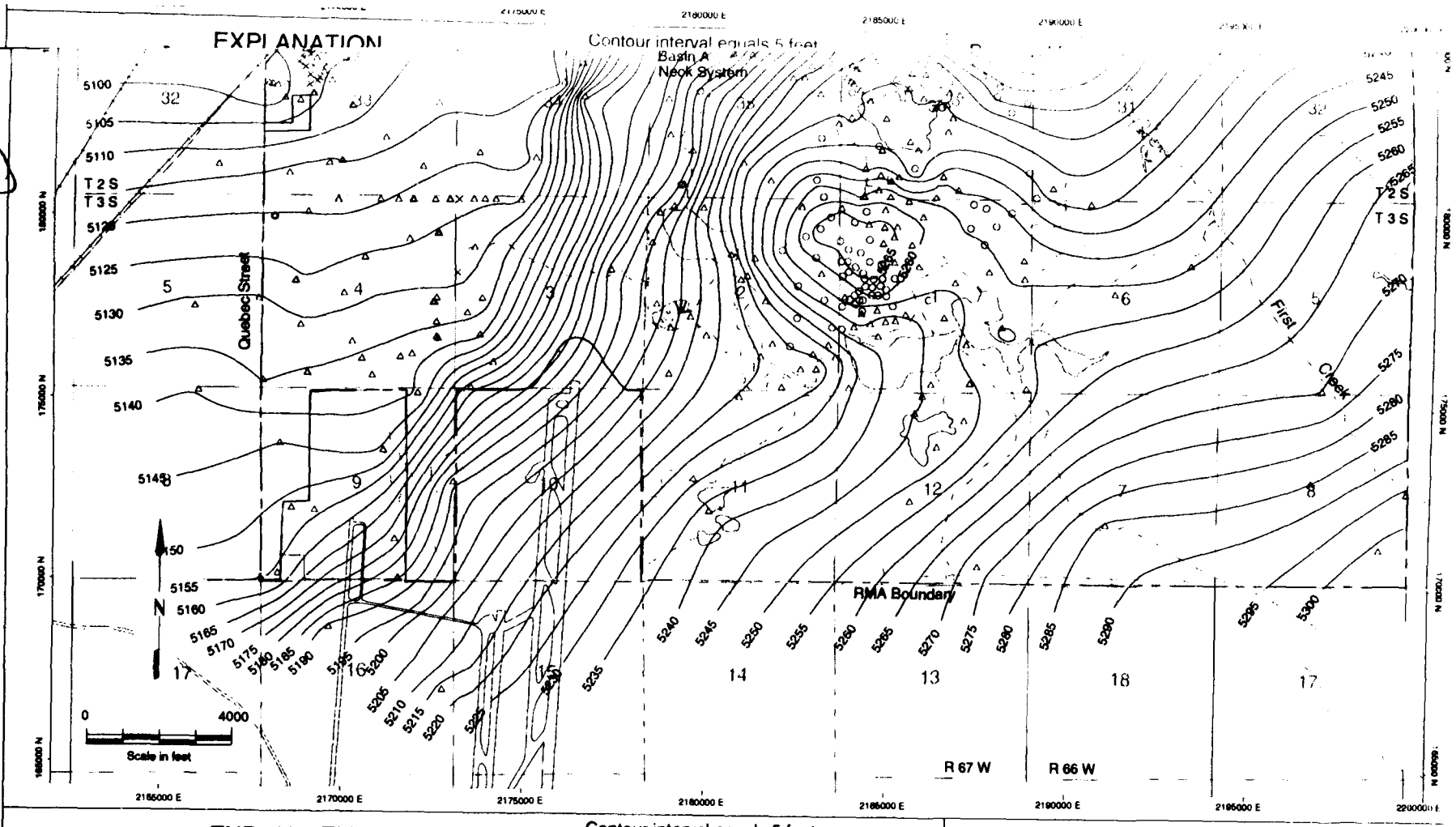
Regional Water-Table Map of the Unconfined Flow System - Spring 1991

GWAR FY91

7/8/91 RMA/2000800 DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
215000 N
210000 N
205000 N
200000 N
195000 N
190000 N
R 67 W
R 66 W
T1S
T2S
South Platte River
US-85
I-76
Burlington Northern Railroad
Highway 2
Second Creek
Union Pacific Railroad
Burlington Ditch
O'Brian Canal
North Boundary Containment/Treatment System
RMA Boundary
Basin F RMA Structures
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220


Union Pacific Railroad
Burlington Ditch
Canal
Highway 27
North Boundary Containment/Treatment System
RMA Boundary
Basin F RFA Structures
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
O'Brian
Quebec Street
Irondale Containment/Treatment System
Basin A Neck System
First Creek
T 2 S
T 3 S
RMA Boundary
N
0
4000



EXPLANATION

Contour interval equals 5 feet
Datum mean sea level

5190 Water-level elevation contour
(water levels measured from September 16,1991, to September 27, 1991)

Well or piezometer location yielding water-level elevation

- Alluvial
- Unconfined Denver Formation

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

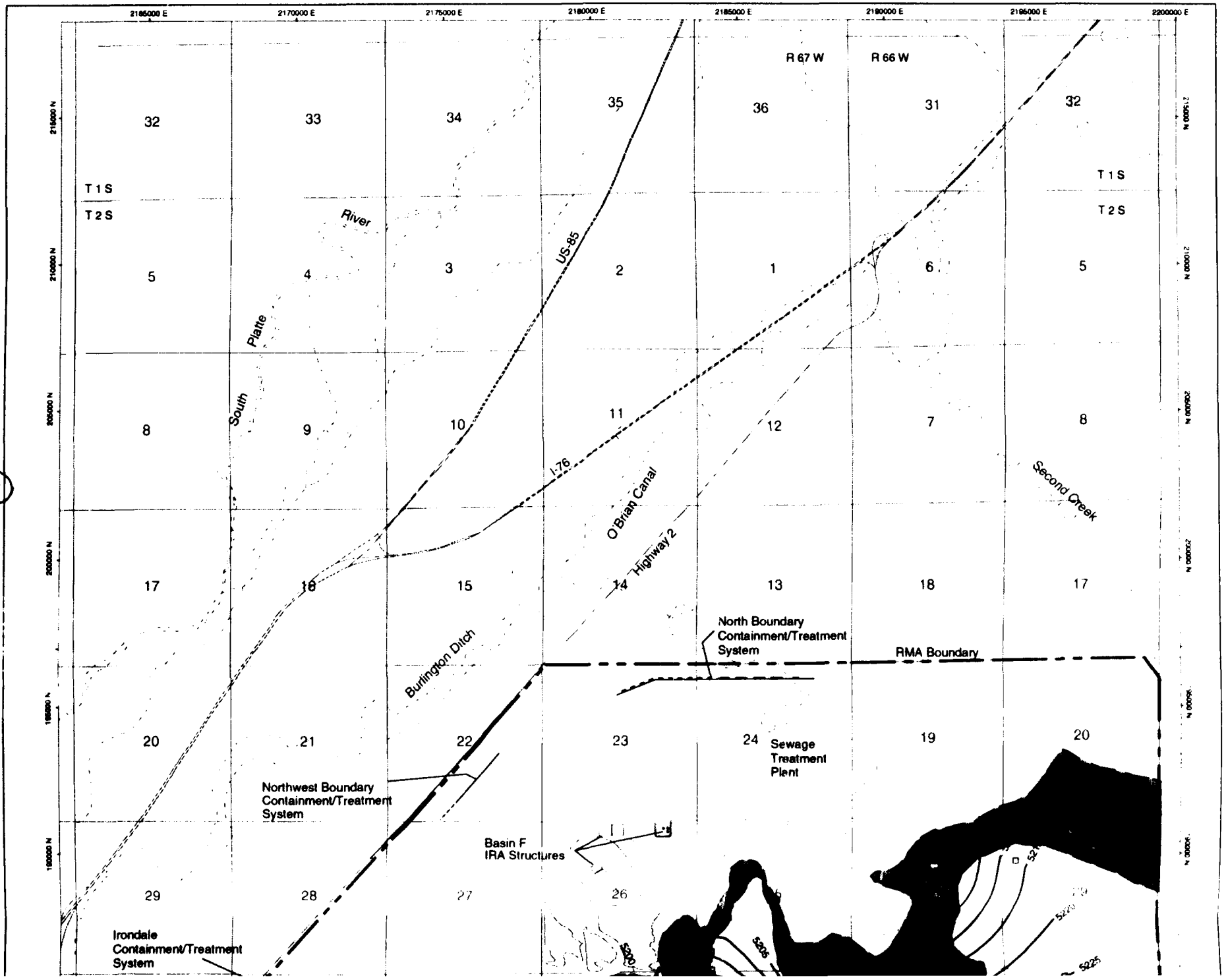
Prepared by:
Harding Lawson Associates

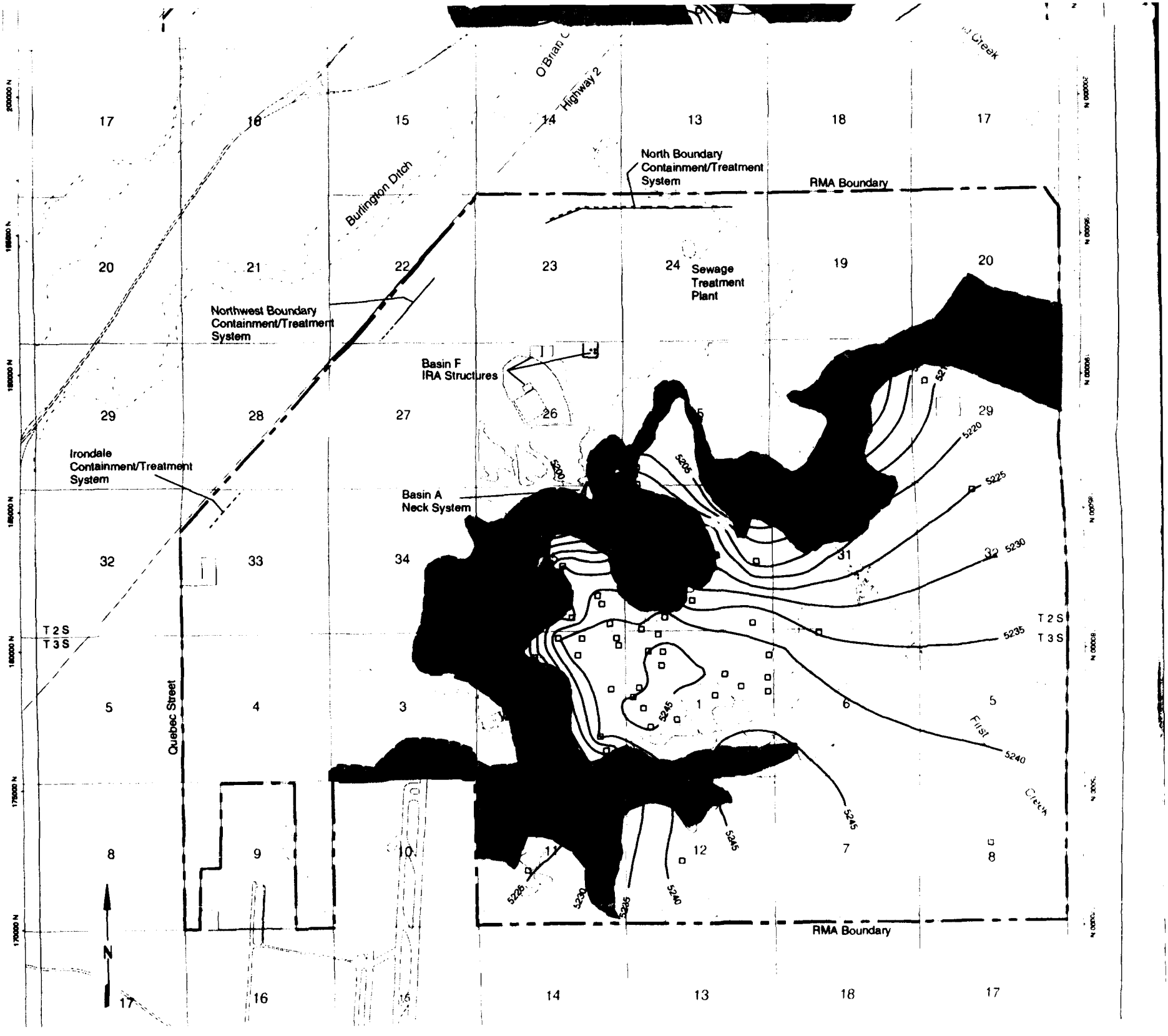
Figure 4.3

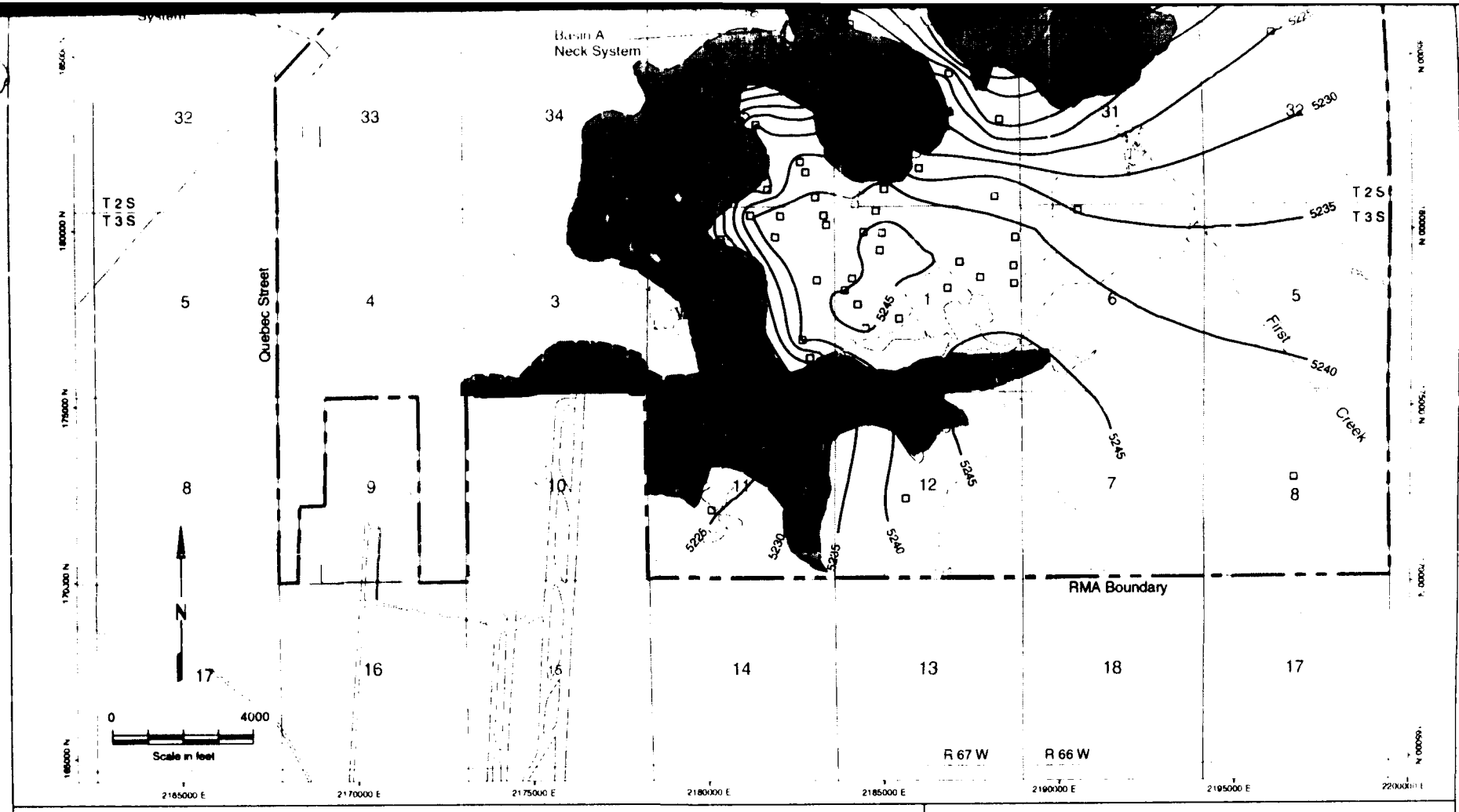
Regional Water-Table Map of the Unconfined Flow System - Fall 1991

GWAR FY91

7/1/92 RMA/20008907.DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
12
7
8
17
16
15
14
13
18
17
20
21
22
23
24
19
20
29
28
27
26
25
30
29
South Platte River
US-85
I-76
O'Brian Canal
Highway 2
Second Creek
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
5200
5205
5225
215000 N
210000 N
205000 N
200000 N
195000 N
190000 N


Highway 2
Burlington Ditch
North Boundary
Containment/Treatment
System
RMA Boundary
Sewage
Treatment
Plant
Northwest Boundary
Containment/Treatment
System
Basin F
IRA Structures
Irondale
Containment/Treatment
System
Basin A
Neck System
Quebec Street
T2S
T3S
5200
5205
5220
5225
5230
5235
5240
5245
RMA Boundary
N



EXPLANATION

Well location yielding water-level elevation

5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991

Approximate areal extent of subcrop, Denver Zone A (Ebasco, 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system

Physical barrier

Hydraulic barrier

Recharge trenches

Barrier wall

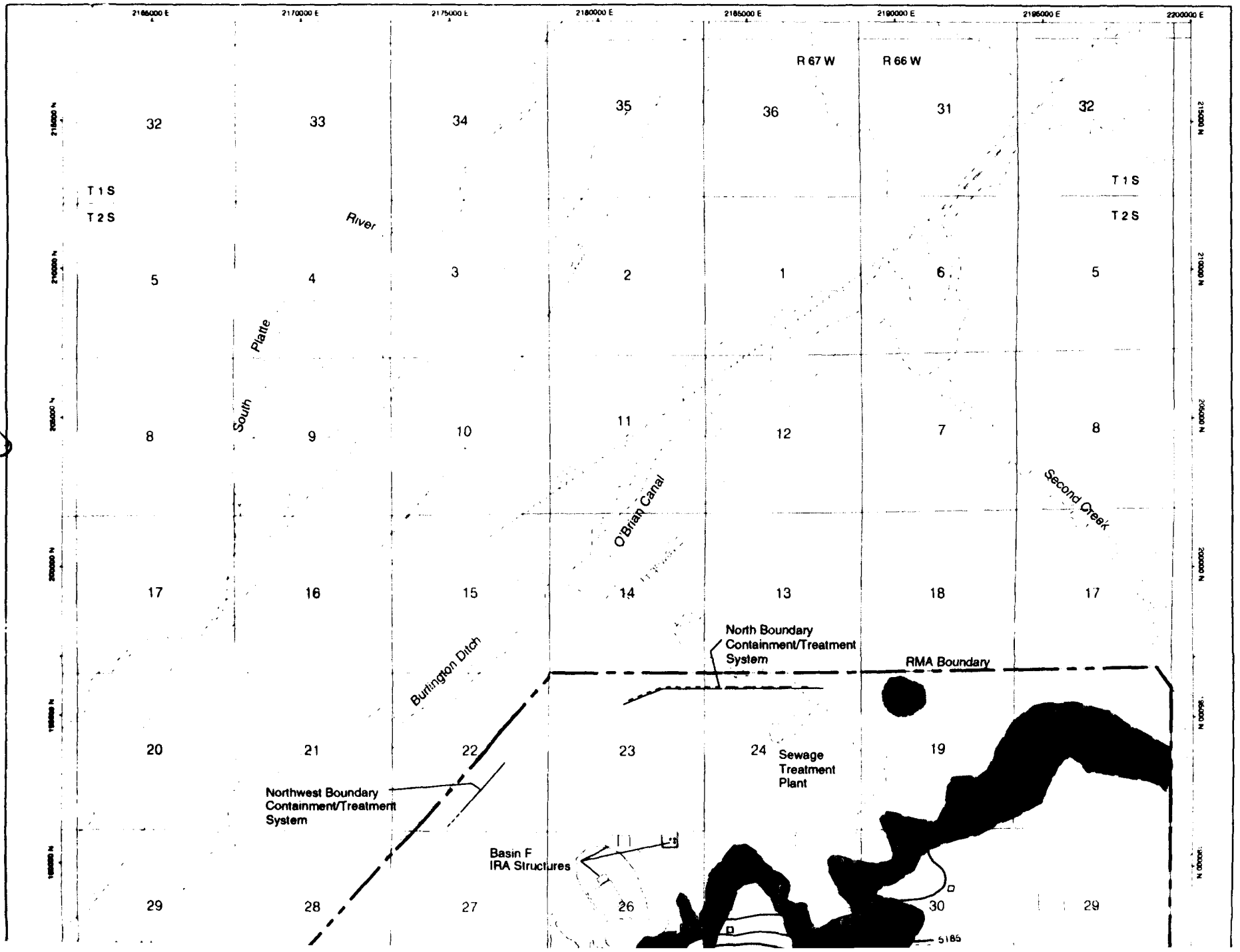
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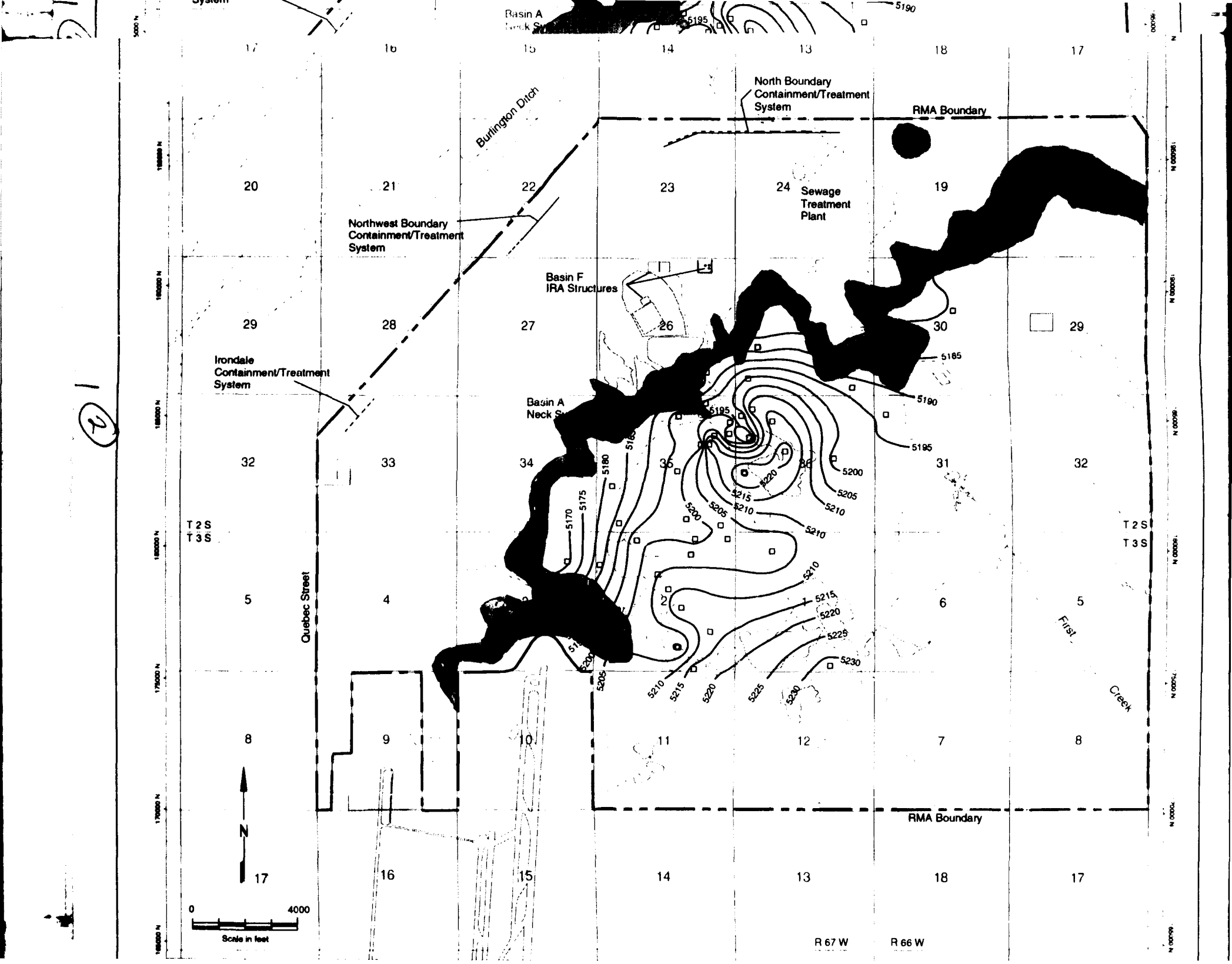
Prepared by:
Harding Lawson Associates

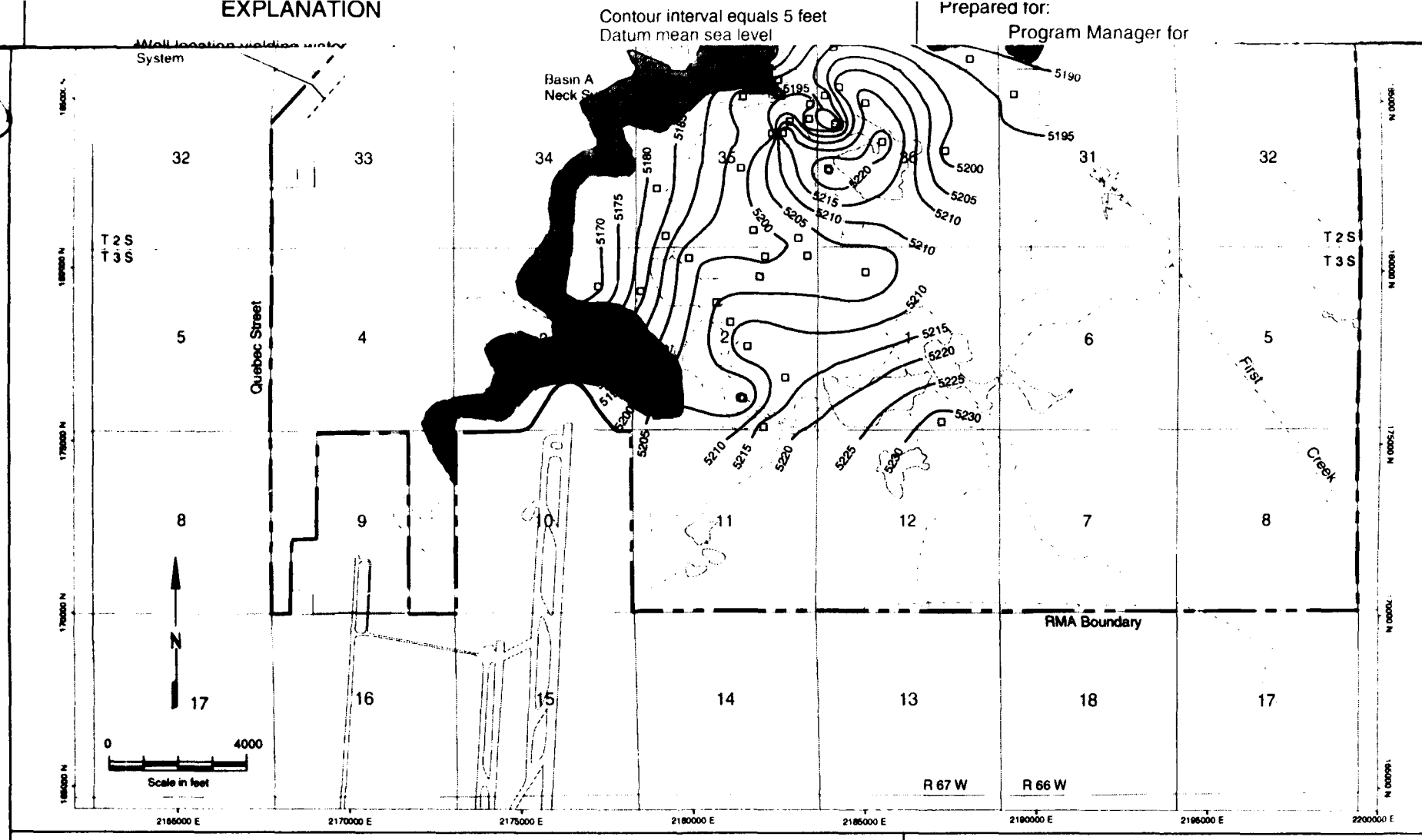
Figure 4.4

Potentiometric Surface of the Denver Formation, Zone A, Winter 1990/1991

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
T 1 S
T 2 S
South Platte River
O'Brian Canal
Second Creek
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
5185


North Boundary
Containment/Treatment
System
RMA Boundary
Burlington Ditch
Sewage
Treatment
Plant
Northwest Boundary
Containment/Treatment
System
Basin F
IRA Structures
Irondale
Containment/Treatment
System
Basin A
Neck
Quebec Street
First
Creek
T 2 S
T 3 S
RMA Boundary
N
0
4000
Scale in feet
R 67 W
R 66 W
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230



EXPLANATION

Well location yielding water-level elevation

5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991)

Approximate areal extent of subcrop, Denver Zone 1U (Ebasco, 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

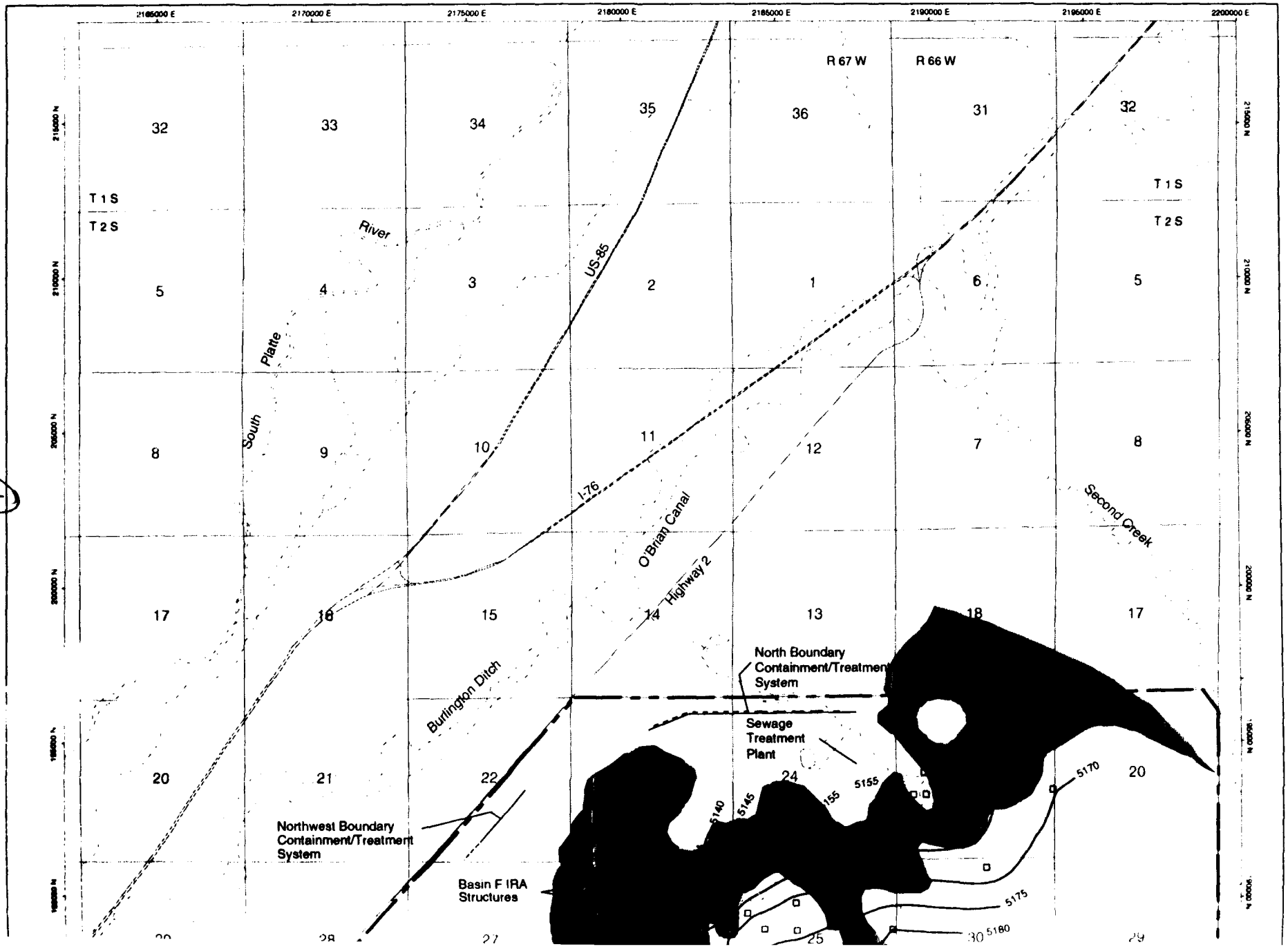
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Program Manager for
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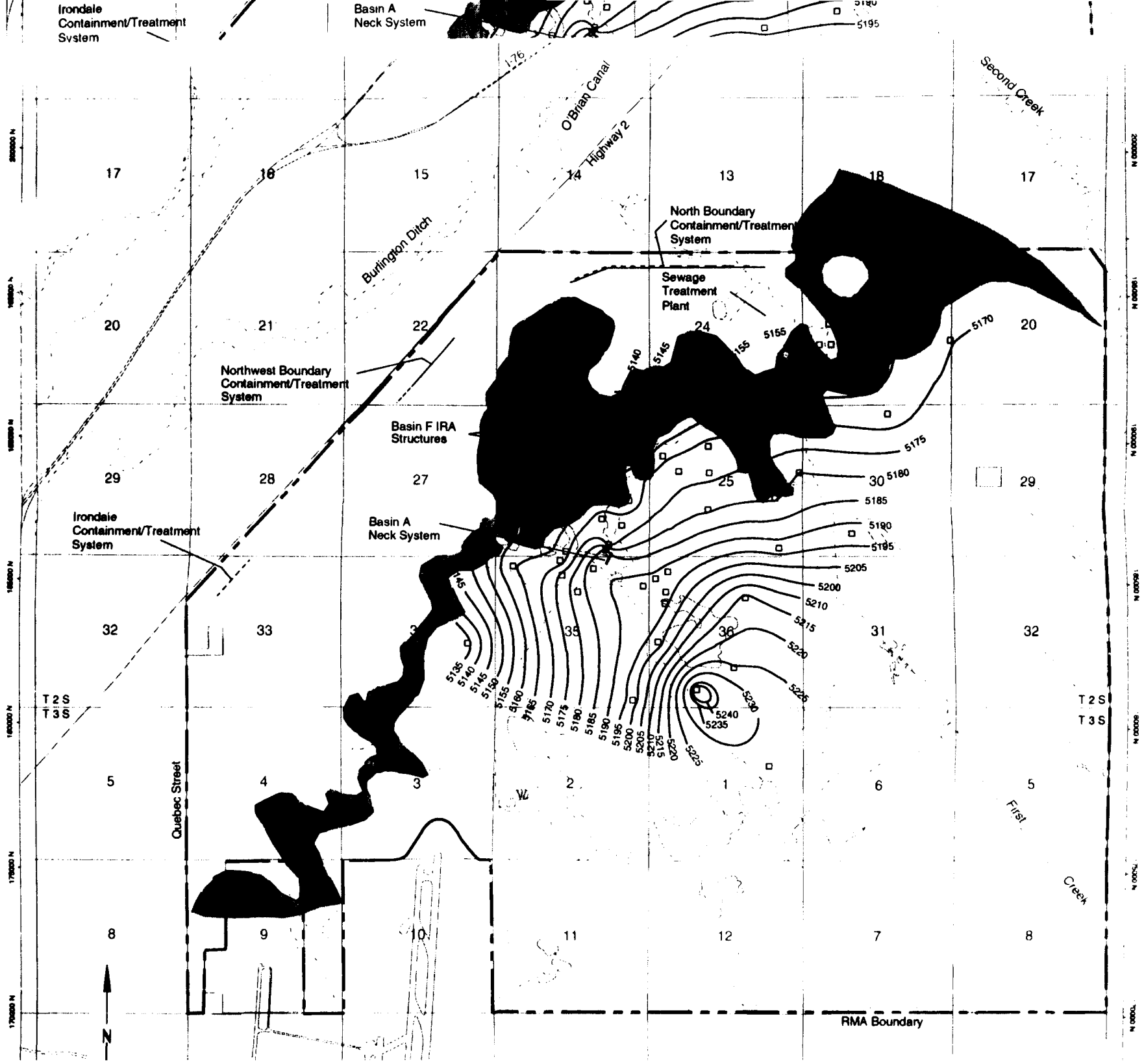
Prepared by:
Harding Lawson Associates

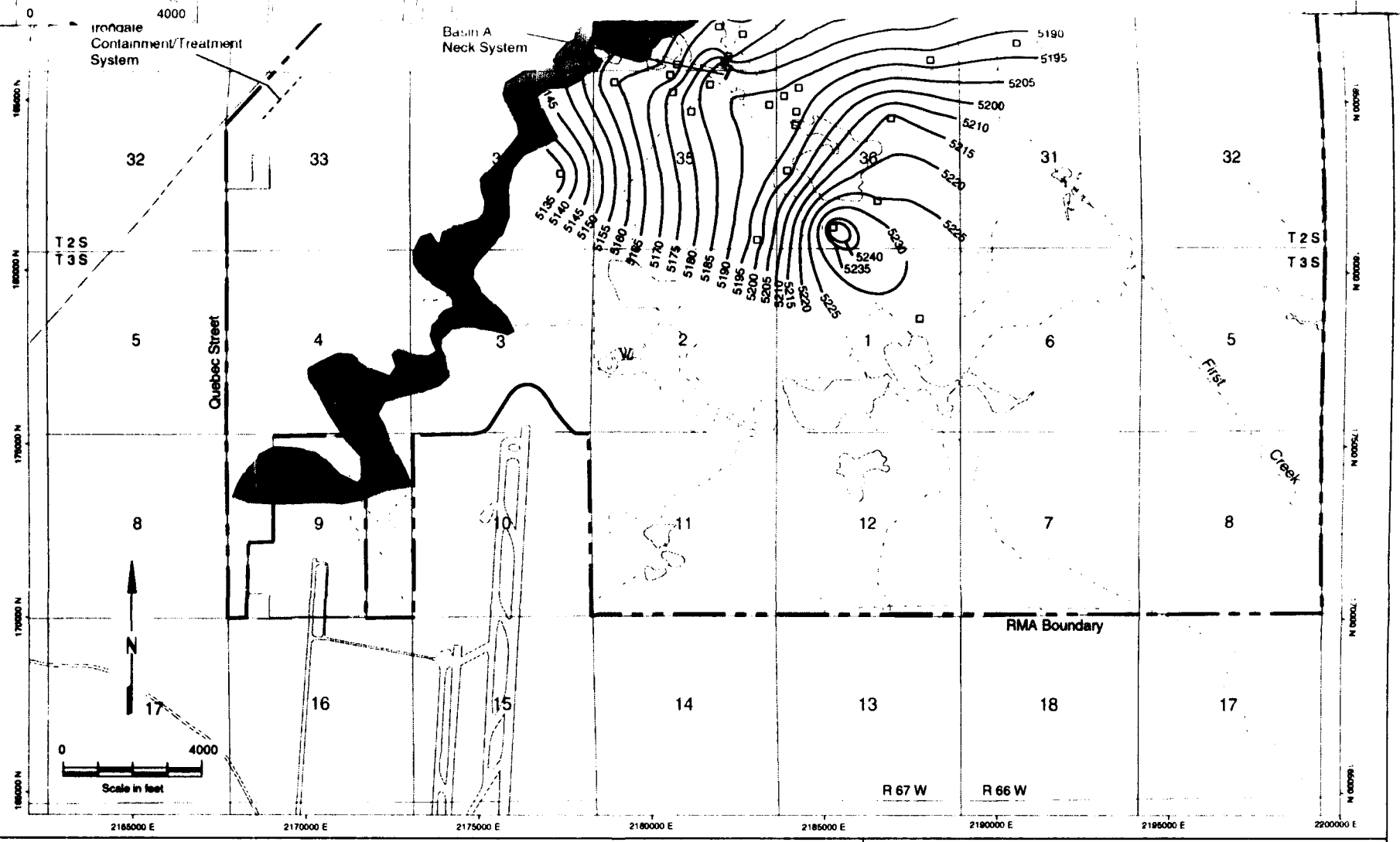
Figure 4.5

Potentiometric Surface of the Denver Formation, Zone 1U, Winter 1990/1991

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
River
South Platte
US-85
I-76
O'Brian Canal
Highway 2
Second Creek
Burlington Ditch
North Boundary Containment/Treatment System
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
5140
5145
5150
5155
5160
5170
5175


Irondale
Containment/Treatment
System
Basin A
Neck System
5180
5195
I-76
O'Brian Canal
Highway 2
Second Creek
17
16
15
14
13
18
17
North Boundary
Containment/Treatment
System
Burlington Ditch
Sewage
Treatment
Plant
20
21
22
24
5155
5140
5145
155
5170
20
Northwest Boundary
Containment/Treatment
System
Basin F IRA
Structures
5175
29
28
27
25
30
5180
29
5185
Irondale
Containment/Treatment
System
Basin A
Neck System
5190
5195
5205
5200
5210
5215
32
33
35
36
31
32
5220
5225
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5230
5240
5235
T2S
T3S
T2S
T3S
5
4
3
2
1
6
5
Quebec Street
First
Creek
8
9
10
11
12
7
8
N
RMA Boundary



EXPLANATION

Well location yielding water-level elevation

5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991)

Approximate areal extent of subcrop, Denver Zone 1 (Ebasco, 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system

Physical barrier

Hydraulic barrier

Recharge trenches

Barrier wall

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

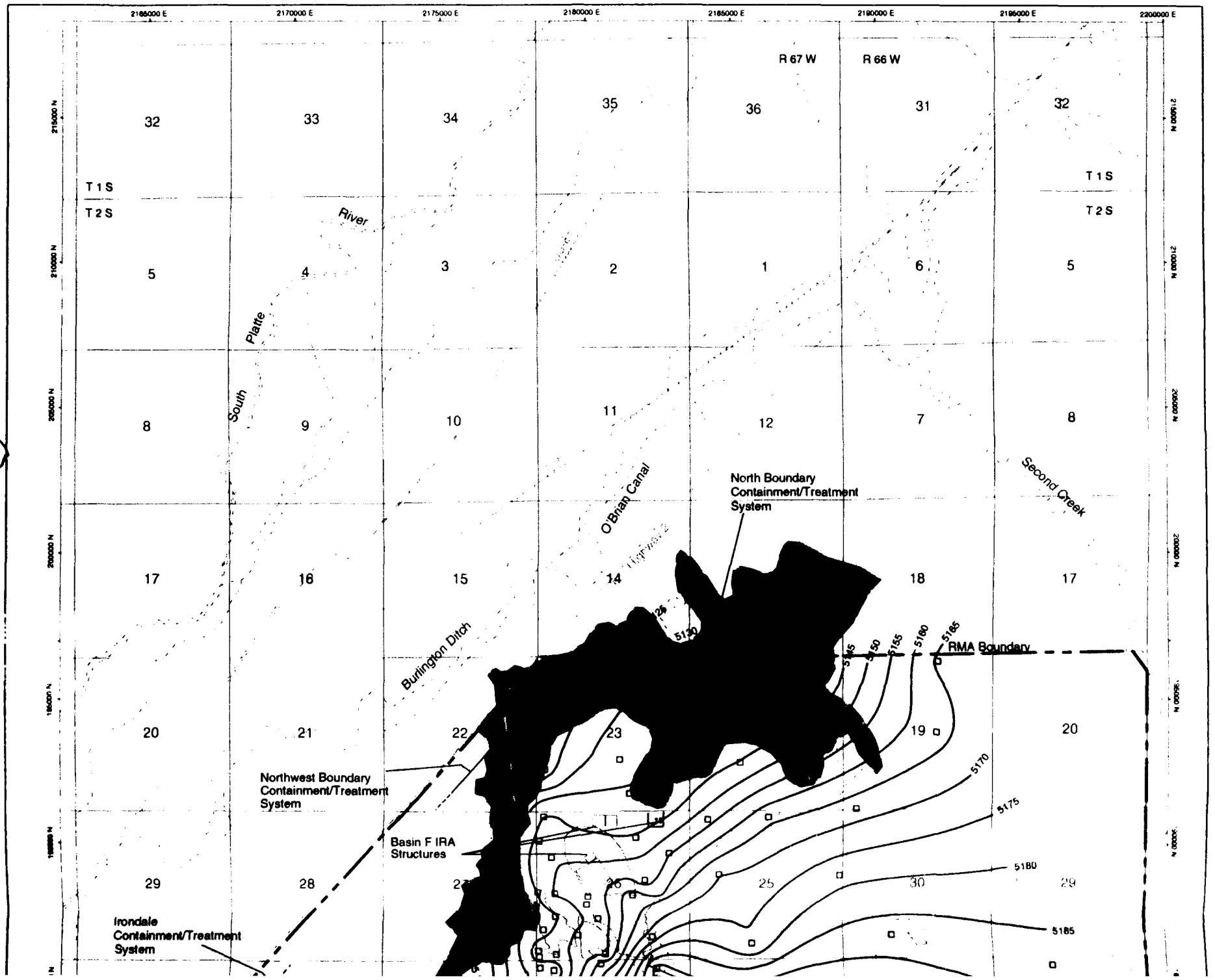
Prepared by:
Harding Lawson Associates

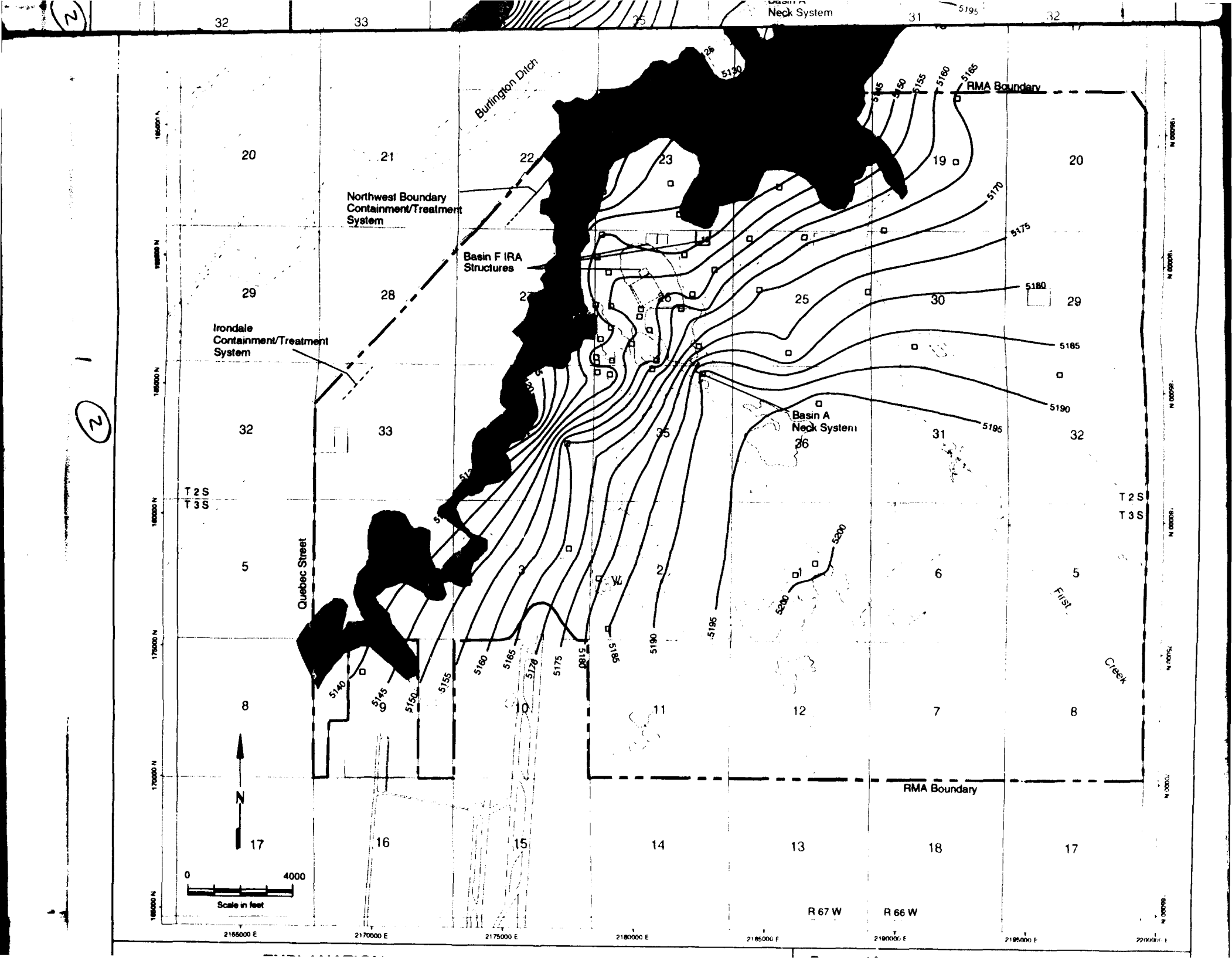
Figure 4.6

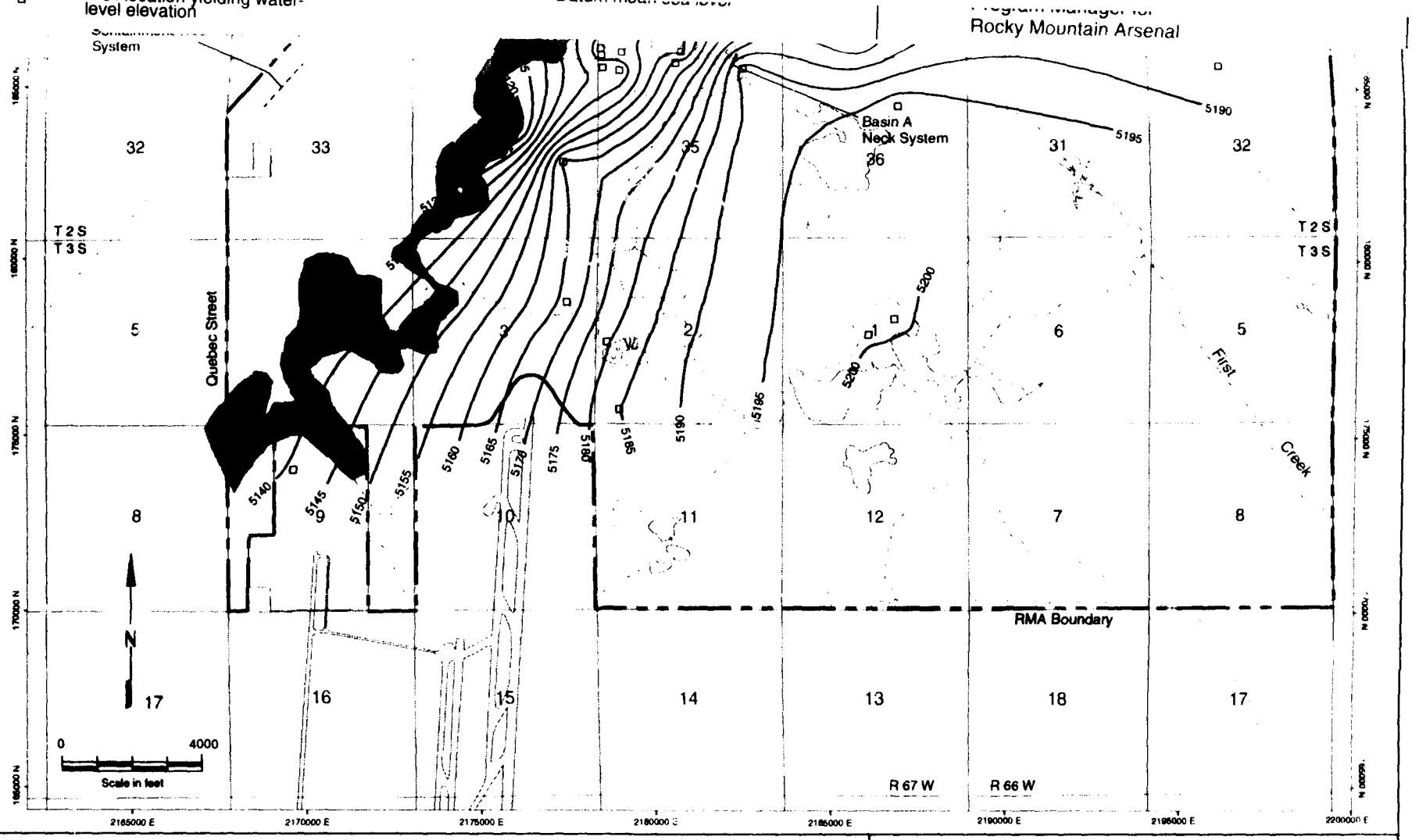
Potentiometric Surface of the Denver Formation, Zone 1, Winter 1990/1991

GWAR FY91

7/8/92 mw/wt91_z_1.DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
River
Platte
South
O'Brian Canal
Second Creek
Burlington Ditch
North Boundary
Containment/Treatment
System
RMA Boundary
Northwest Boundary
Containment/Treatment
System
Basin F IRA
Structures
Irondale
Containment/Treatment
System
5120
5145
5150
5155
5160
5165
5170
5175
5180
5185


Basin A
Neck System
Burlington Ditch
RMA Boundary
Northwest Boundary
Containment/Treatment
System
Basin F IRA
Structures
Irondale
Containment/Treatment
System
Basin A
Neck System
Quebec Street
First Creek
RMA Boundary
T 2 S
T 3 S
R 67 W
R 66 W
N
0
4000
Scale in feet
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E



EXPLANATION

- Well location yielding water-level elevation
- 5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991)
- Approximate areal extent of subcrop, Denver Zone 2 (Ebasco, 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system
- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

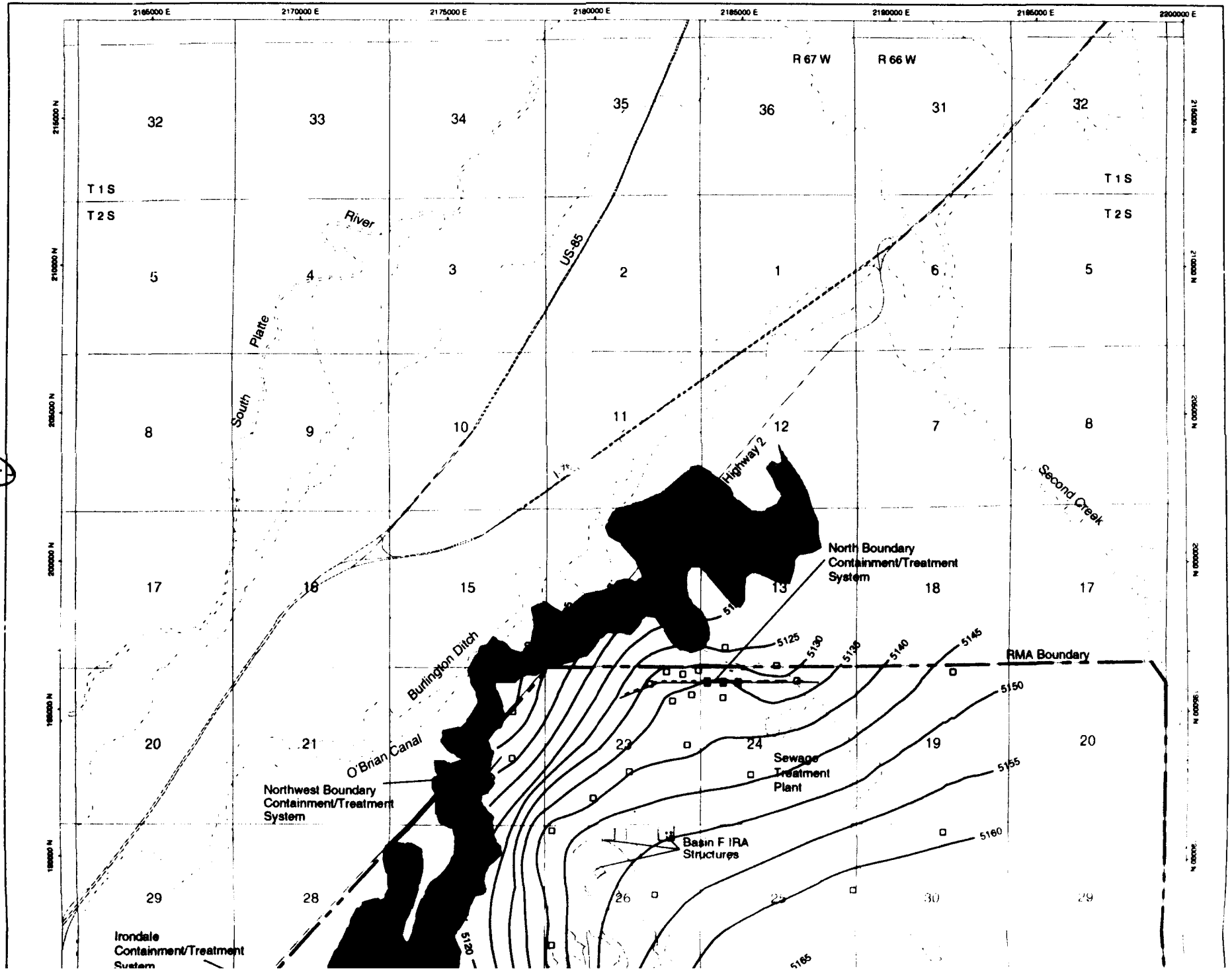
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

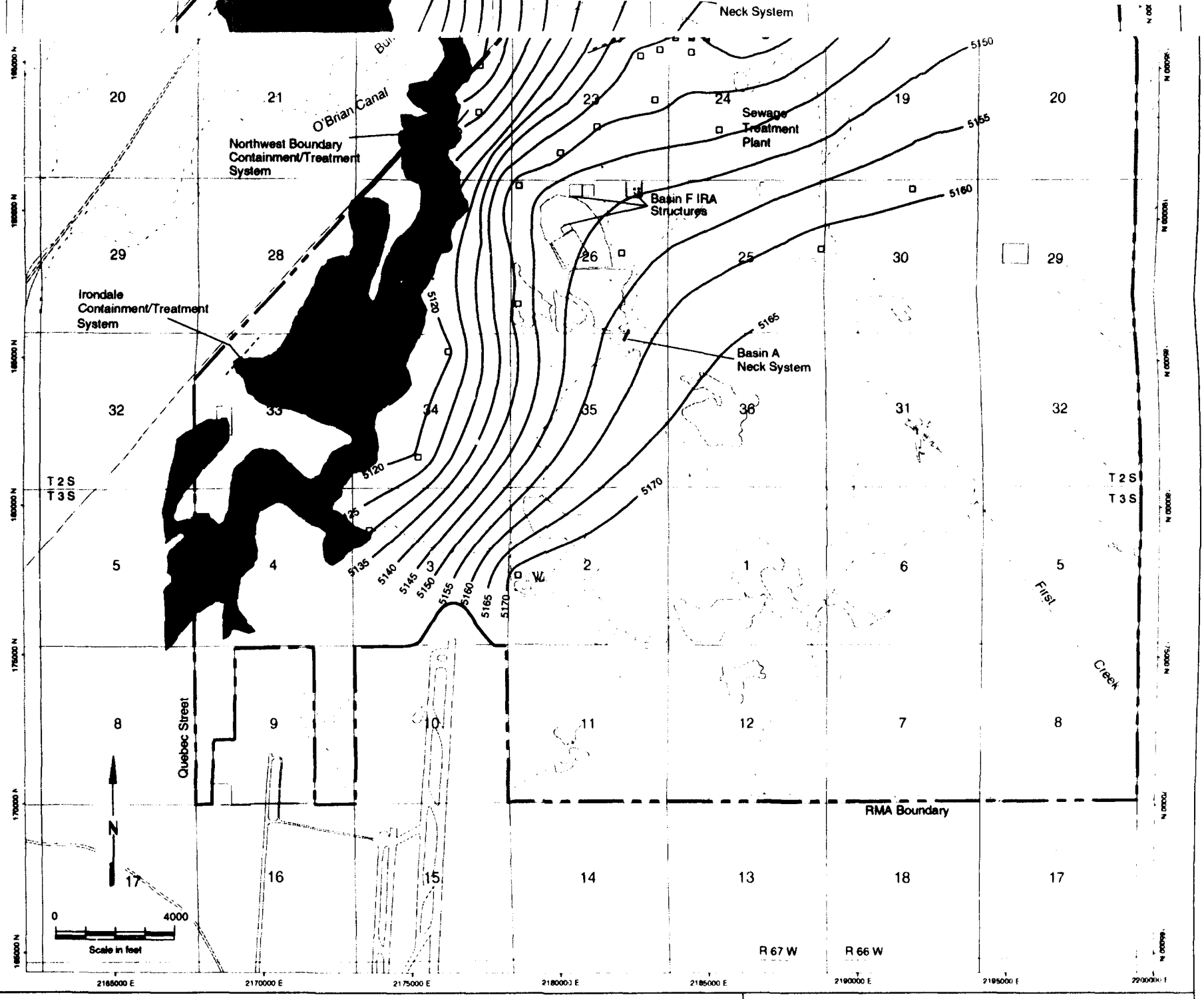
Figure 4.7

Potentiometric Surface of the Denver Formation, Zone 2, Winter 1990/1991

GWAR FY91

7/8/92 mw/w91_2_2.DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
12
7
8
17
16
15
13
18
17
20
21
23
24
19
20
29
28
26
30
29
South Platte River
US-85
Highway 2
Second Creek
Burlington Ditch
O'Brian Canal
North Boundary Containment/Treatment System
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Sewage Treatment Plant
Basin F IRA Structures
RMA Boundary
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
216000 N
210000 N
205000 N
200000 N
195000 N
190000 N



EXPLANATION

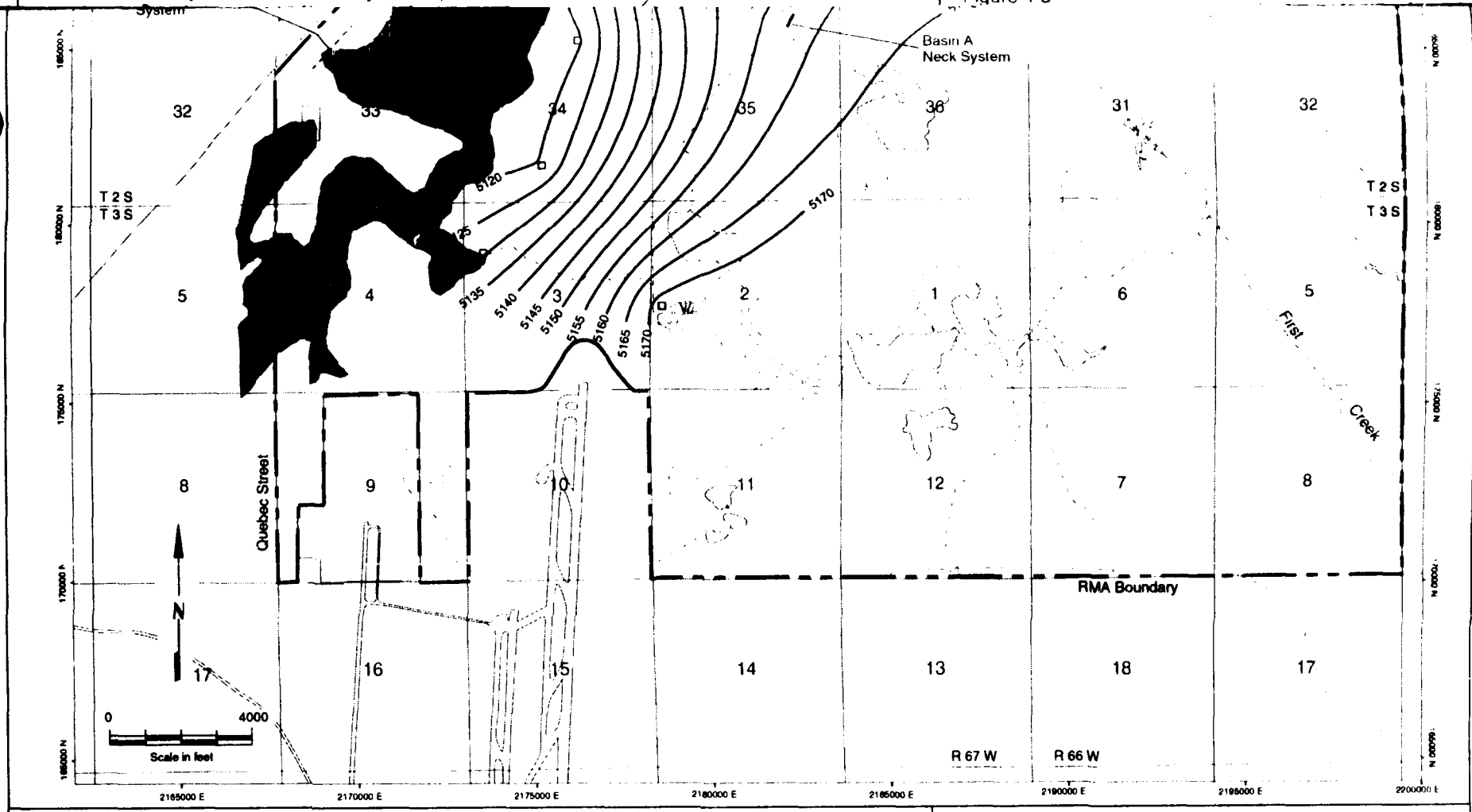
- Well location yielding water-level elevation

Contour interval equals 5 feet
Datum mean sea level

Prepared for:

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Commerce City, Colorado

Figure 4 8



EXPLANATION

- Well location yielding water-level elevation
- 5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991)
- Approximate areal extent of subcrop, Denver Zone 3 (Ebasco 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system
- Physical barrier
- *Hydraulic barrier*
- Recharge trenches
- Barrier wall

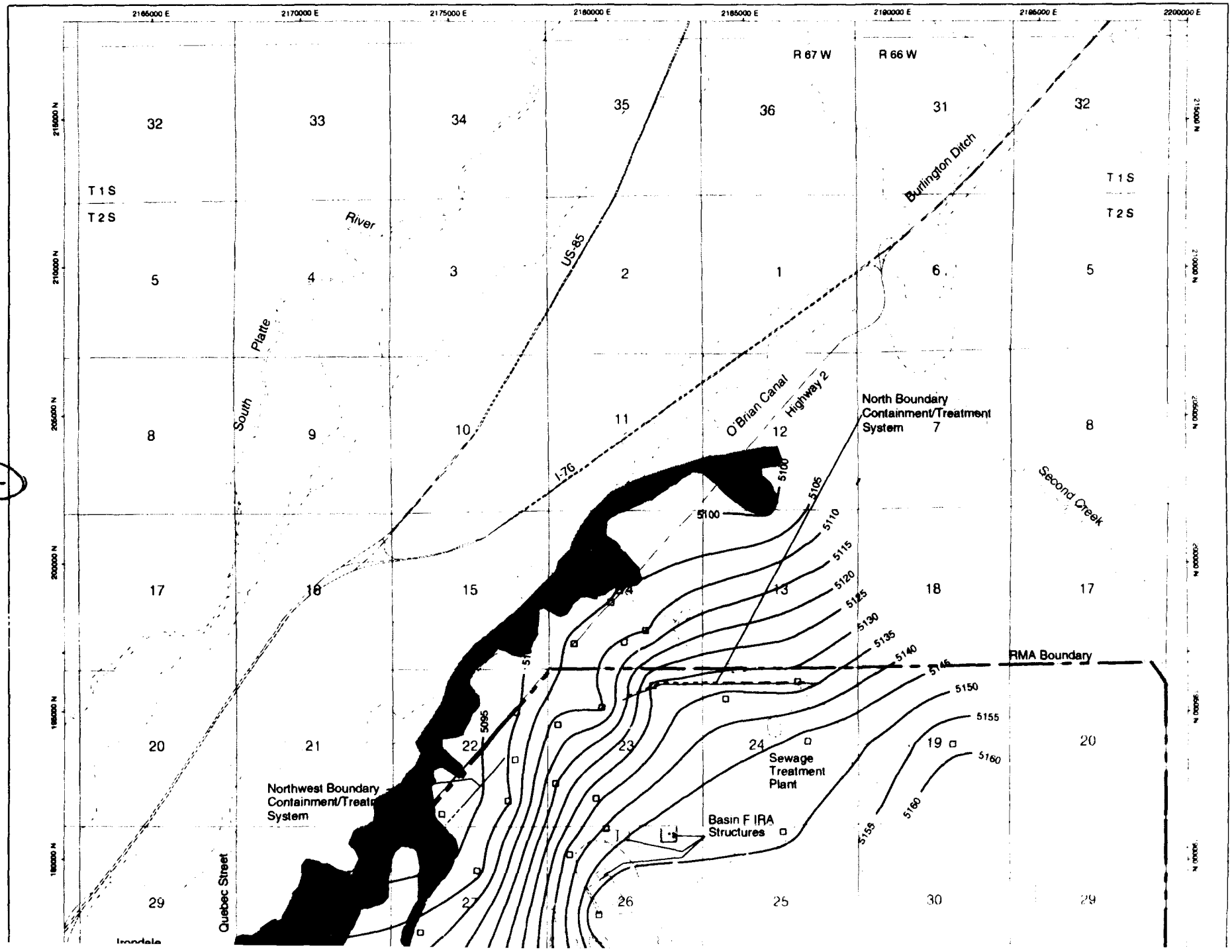
Prepared for:
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Rocky Mountain Arsenal
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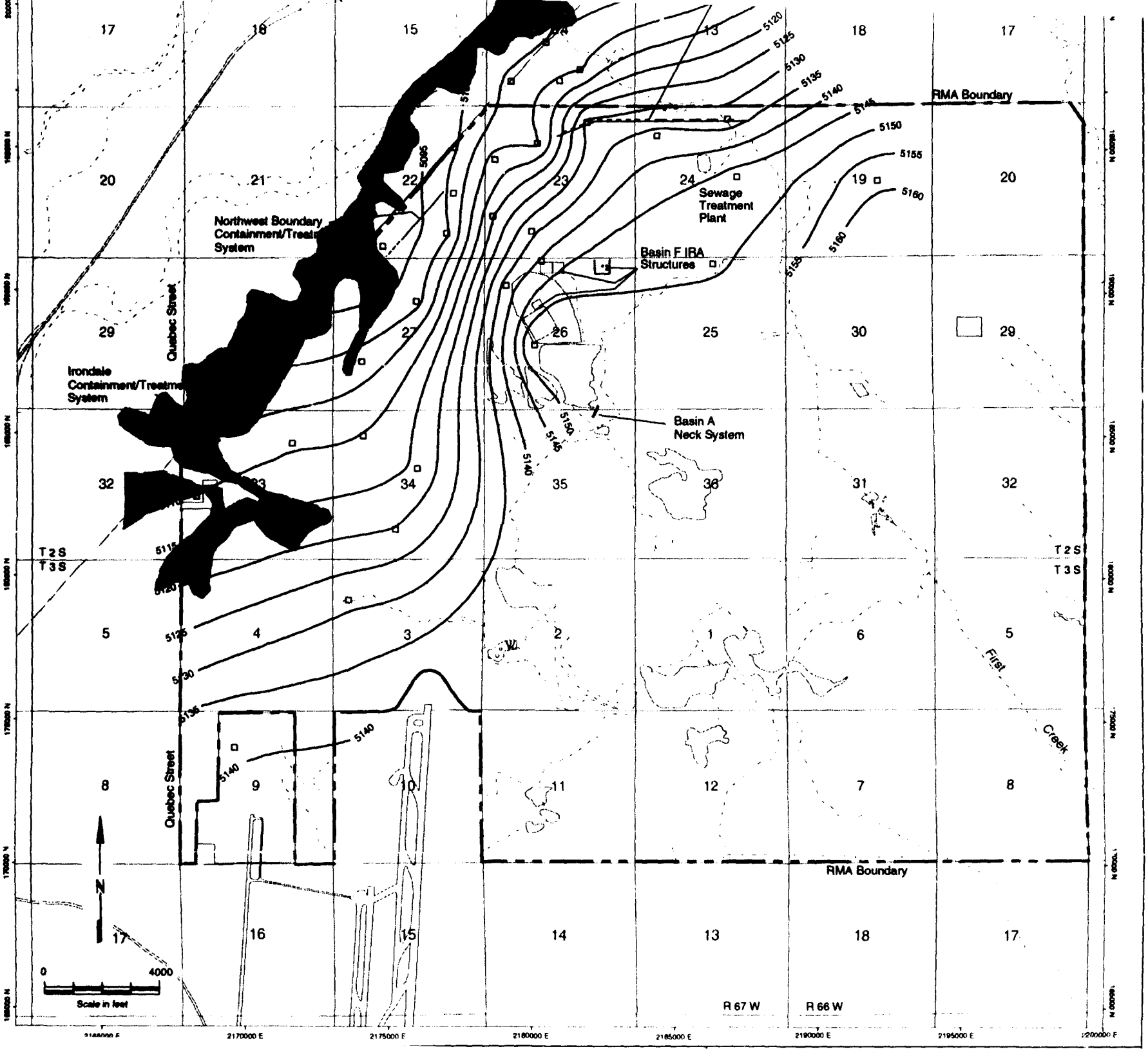
Prepared by:
Harding Lawson Associates

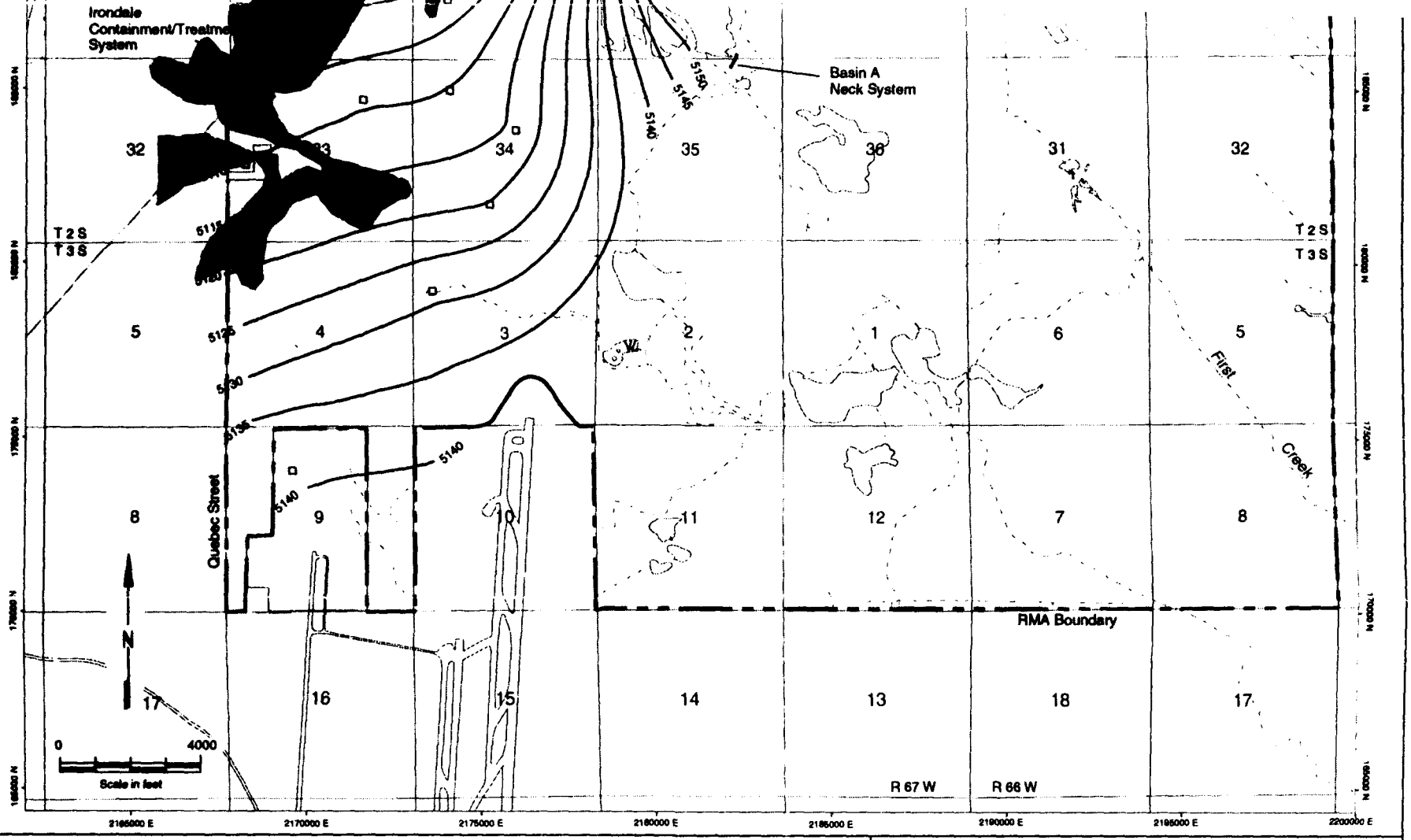
Figure 4.8

Potentiometric Surface of the Denver Formation, Zone 3, Winter 1990/1991

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
Burlington Ditch
South Platte River
US-85
O'Brian Canal
Highway 2
I-76
Second Creek
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Basin F IRA Structures
Northwest Boundary Containment/Treatment System
Quebec Street
Irondale
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160


RMA Boundary
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Sewage Treatment Plant
Quebec Street
Quebec Street
First Creek
T2S
T3S
T2S
T3S
RMA Boundary
R 67 W
R 66 W
0
4000
Scale in feet
N
5085
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E



EXPLANATION

Well location yielding water-level elevation

5230 — Elevation of the potentiometric surface (water level measured January 23, 1991, to February 4, 1991)

Approximate areal extent of subcrop, Denver Zone 4 (Ebasco, 1989)

Contour interval equals 5 feet
Datum mean sea level

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

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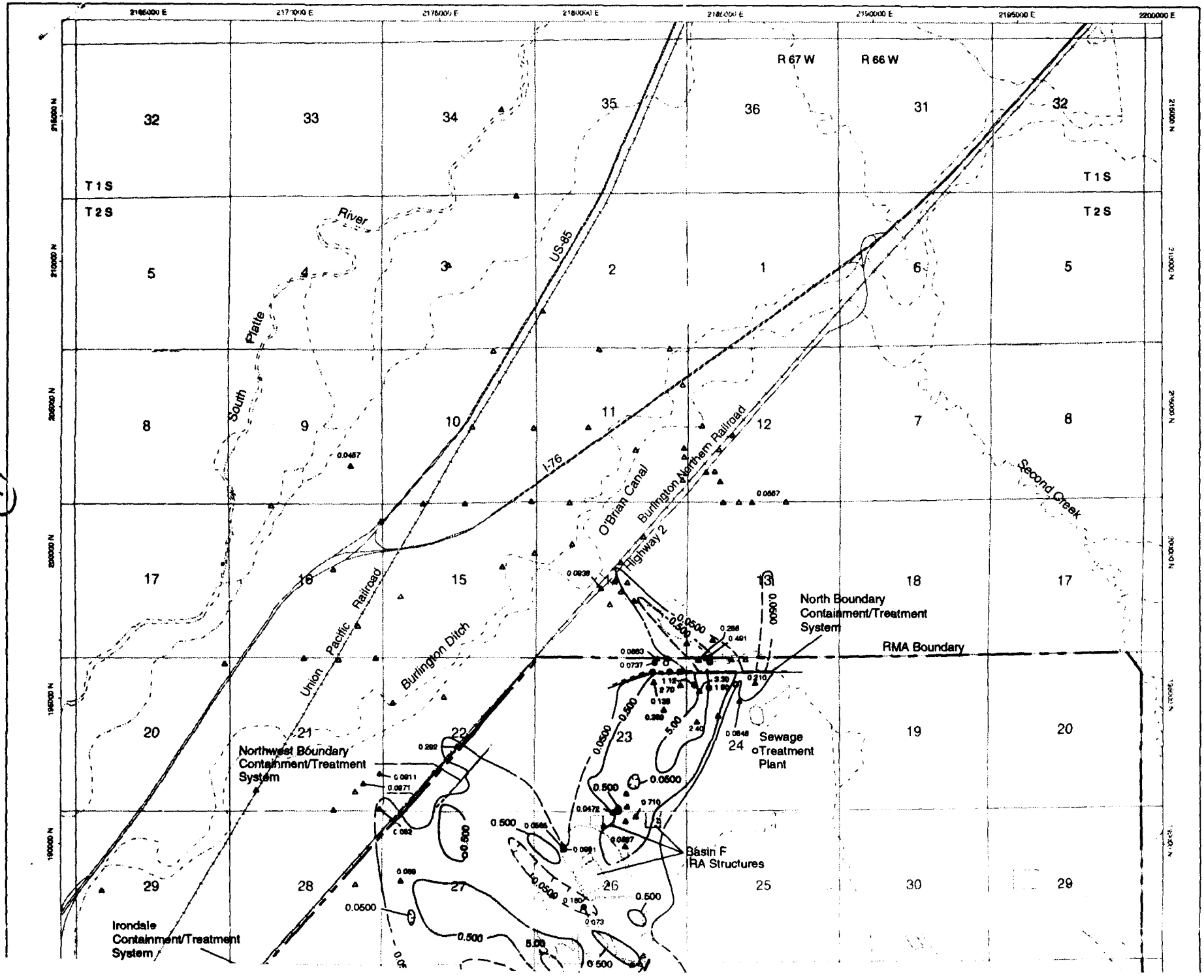
Prepared by:
Harding Lawson Associates

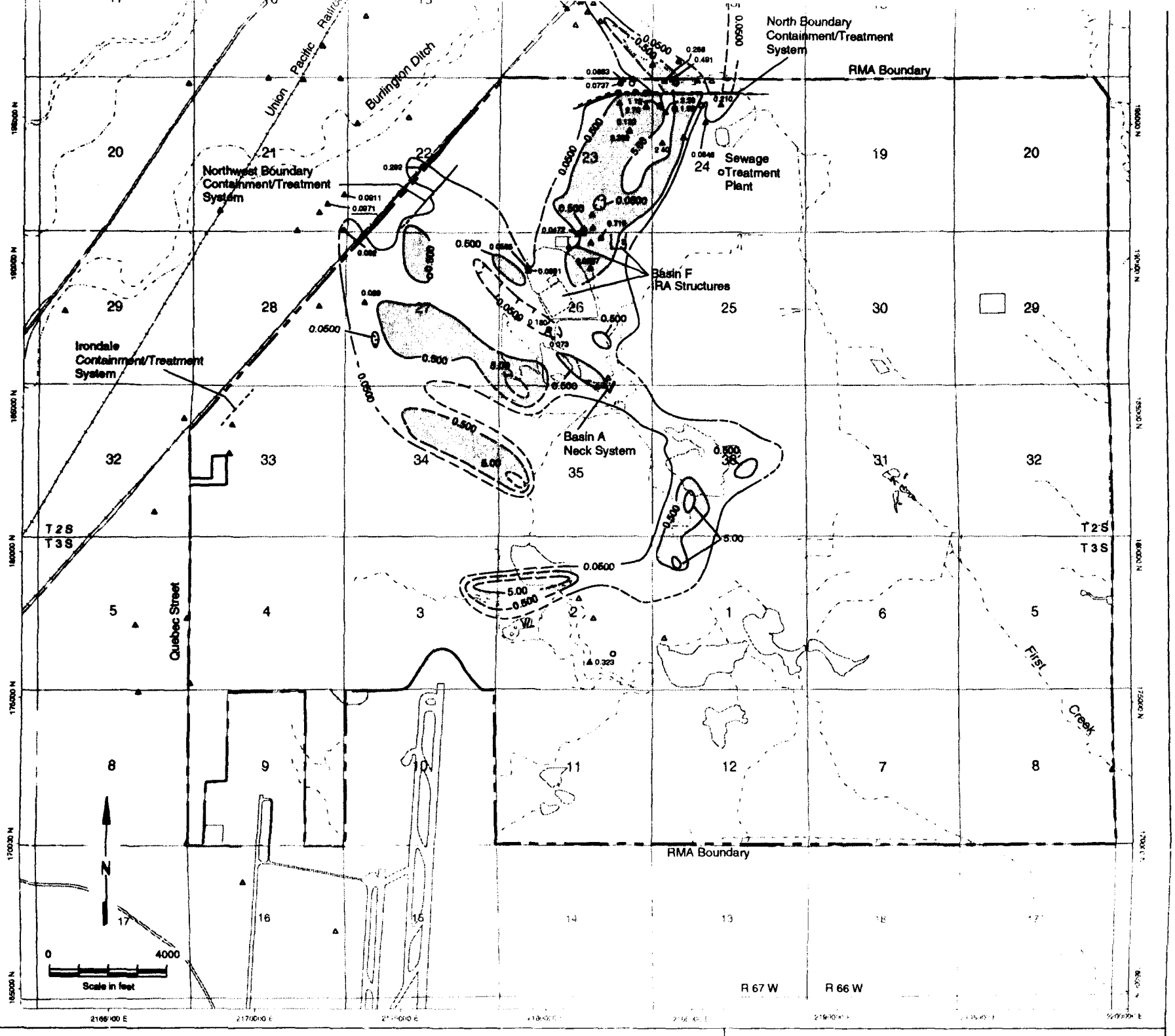
Figure 4.9

Potentiometric Surface of the Denver Formation, Zone 4, Winter 1990/1991

GWAR FY91

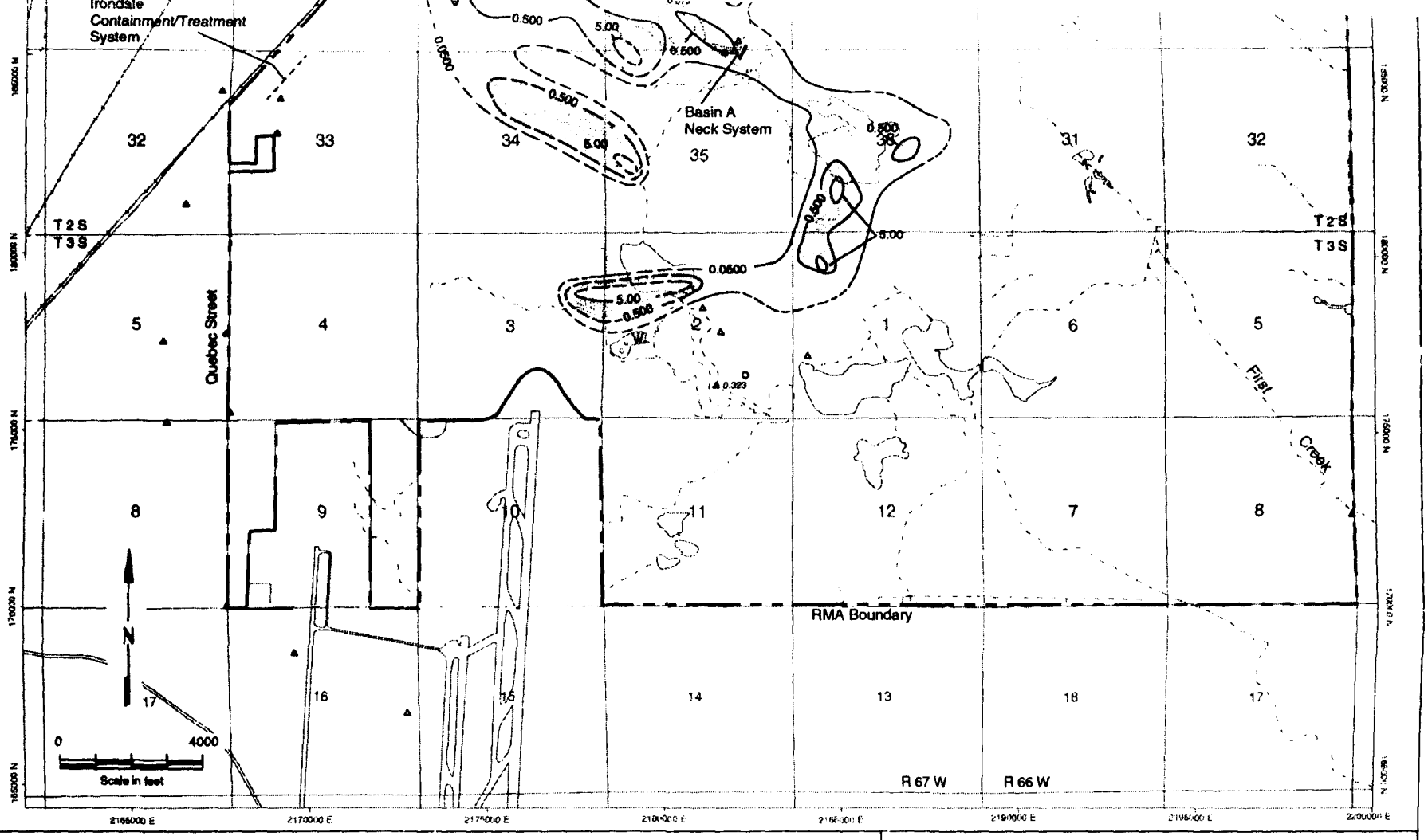
711088 mdw01_z_4.DRG


R 67 W
R 66 W
T1S
T2S
South Platte River
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F RA Structures
Irondale Containment/Treatment System



EXPLANATION

Prepared for:
Program Manager for



EXPLANATION

0.0500 — Fall 1989 plume isoconcentration line with value, dashed where inferred

Hachures where a depression exists

Concentration ranges (ug/l)
Fall 1989:

- 0.0500 - 0.499
- 0.500 - 4.99
- 5.00 and above

Unconfined flow system

Winter 1990/1991 samples collected from February 5, 1991, to March 11, 1991

0.710 ▲ Alluvial
1.90 ● Denver
] Concentrations (ug/l)

0.0971 ▲ Alluvial (well sampled in Winter 1990/1991, not sampled Fall 1989)

▲ Alluvial
○ Denver
] Below Certified Reporting Limit (CRL)

Highest CRL = 0.0539 ug/l
Lowest CRL = 0.050 ug/l

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

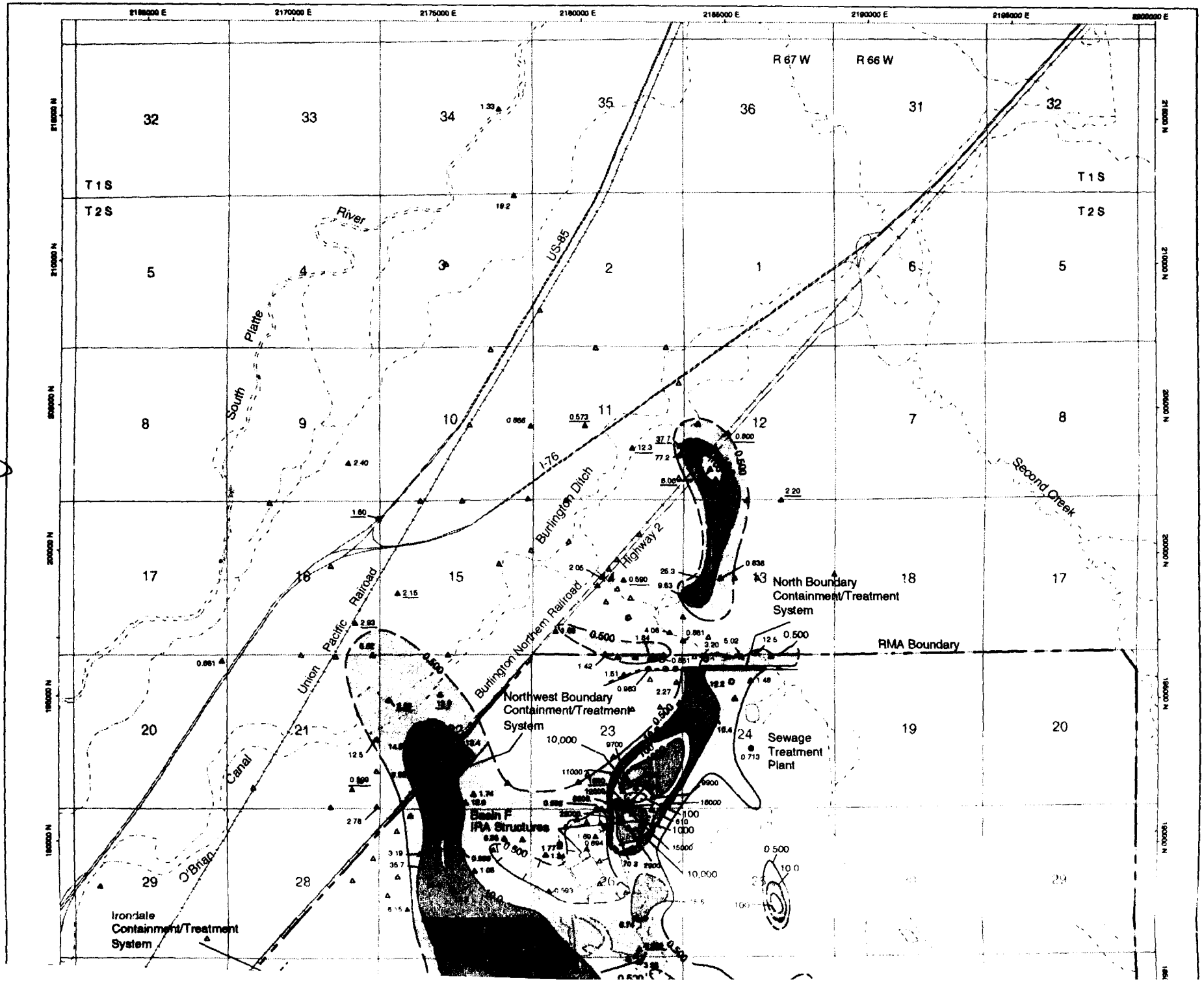
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:
Harding Lawson Associates

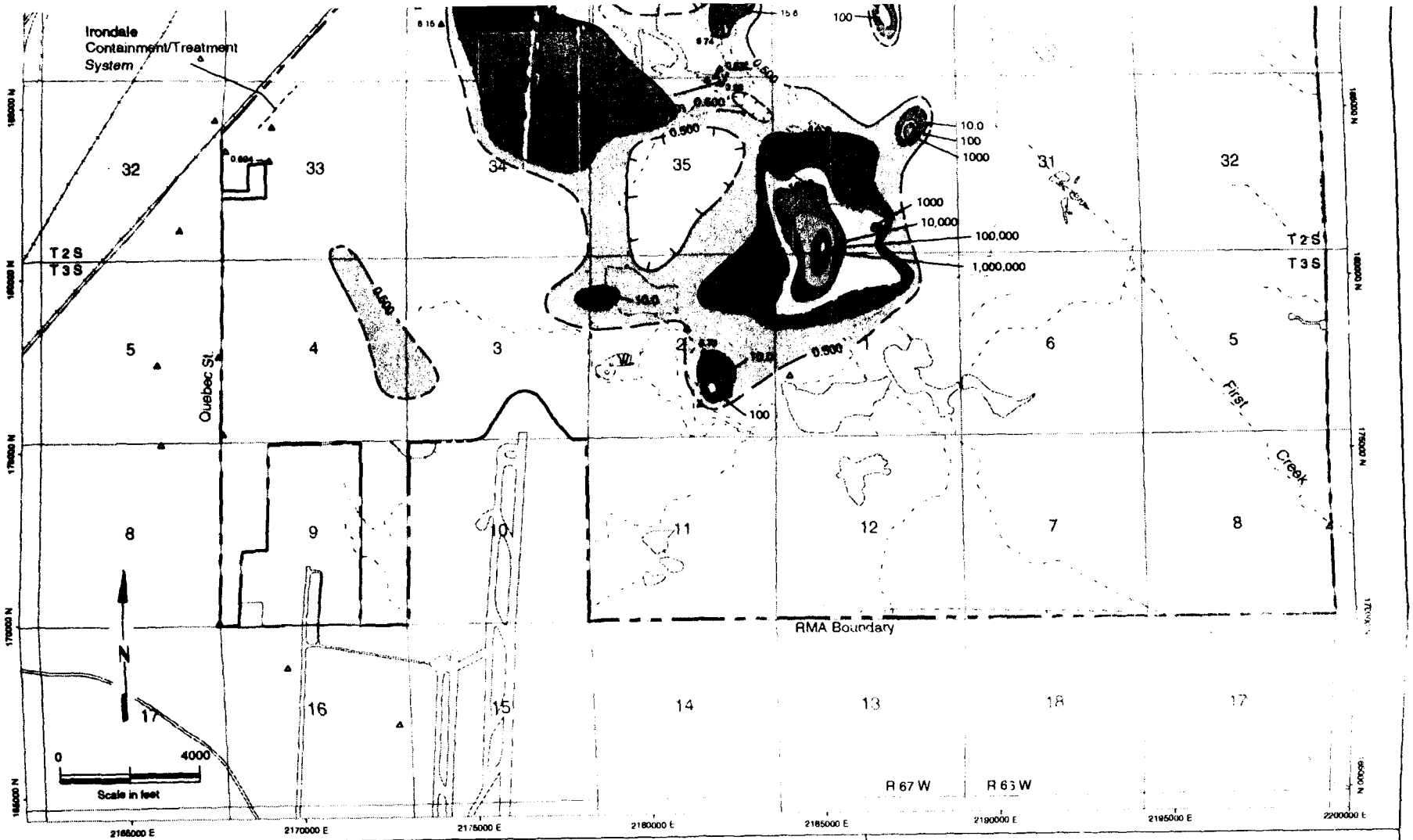
Figure 4.10

Unconfined Groundwater Flow System
Fall 1989 Dieldrin Plumes with
Winter 1990/1991 Analytical Results Posted

GWAR FY91


R 67 W
R 66 W
T 1 S
T 2 S
South Platte River
US-85
I-76
Burlington Ditch
Highway 2
Second Creek
Union Pacific Railroad
Burlington Northern Railroad
O'Brian Canal
RMA Boundary
North Boundary Containment/Treatment System
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Sewage Treatment Plant
Irondale Containment/Treatment System


North Boundary Containment/Treatment System
RMA Boundary
Northwest Boundary Containment/Treatment System
Sewage Treatment Plant
Irondale Containment/Treatment System
Union Pacific Railroad
Burlington Northern Railroad
Canal
O'Brien
Quebec St.
First Creek
T2S
T3S
RMA Boundary
N
0
4000
Scale in feet
2165000 E
2170000 E
EXPLANATION



EXPLANATION

0.500 — Fall 1989 plume isoconcentration line with value, dashed where inferred

Concentration ranges (ug/l) Fall 1989

- 0.500 - 9.99
- 10.0 - 99.9
- 100 - 999
- 1000 - 9,999
- 10,000 - 99,999
- 100,000 - 999,999
- 1,000,000 - and above

Unconfined flow system

Winter 1990/1991 samples collected from February 5, 1991, to March 11, 1991

1.74 ▲ Alluvial
0.713 ● Denver
] Concentrations (ug/l)

0.673 ▲ Alluvial (well sampled in Winter 1990/1991, not sampled Fall 1989)

▲ Alluvial
○ Denver
] Below Certified Reporting Limit (CRL)

Highest CRL = 0.195 ug/l
Lowest CRL = 0.130 ug/l

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

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Rocky Mountain Arsenal
Commerce City, Colorado

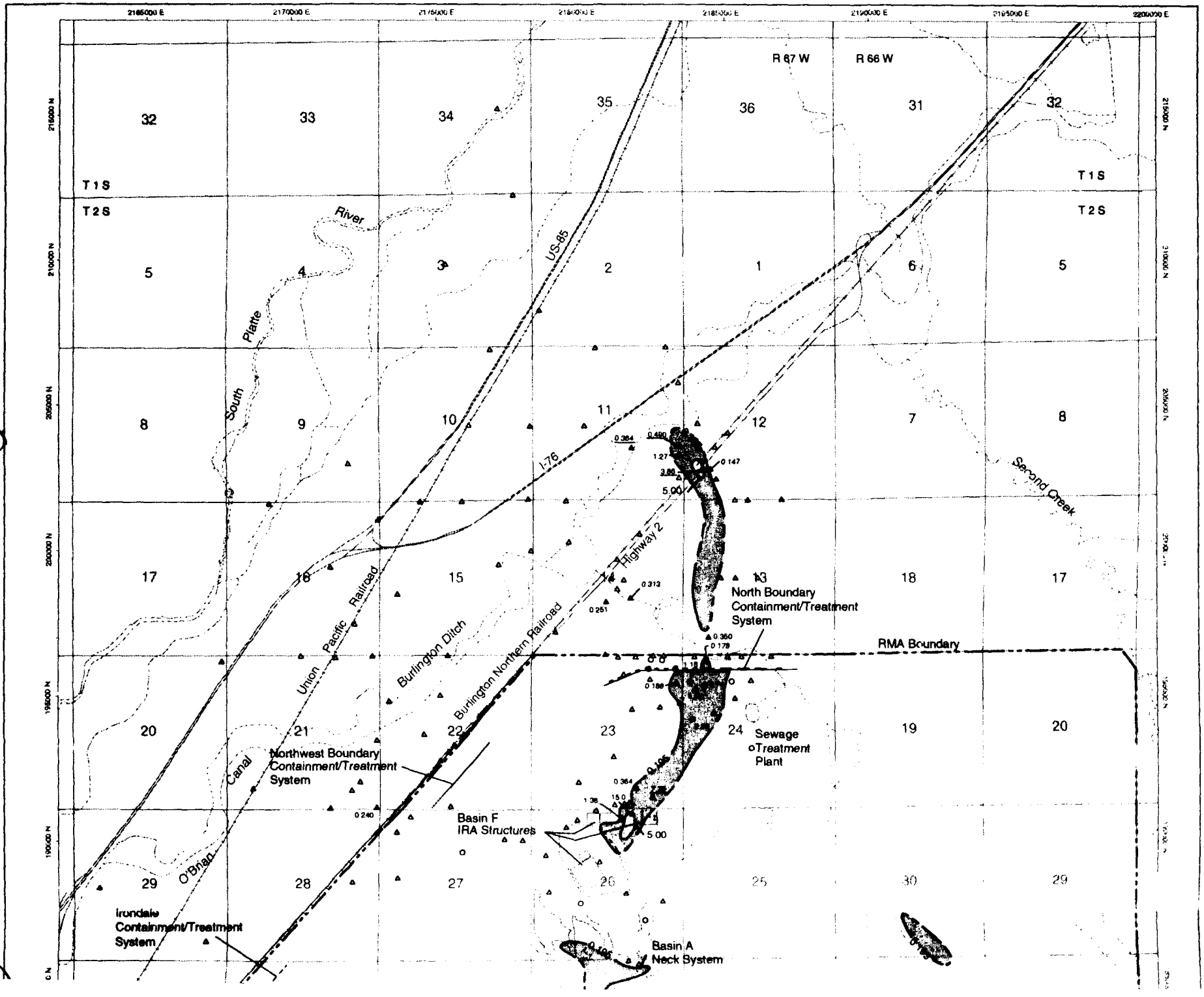
Prepared by:
Harding Lawson Associates

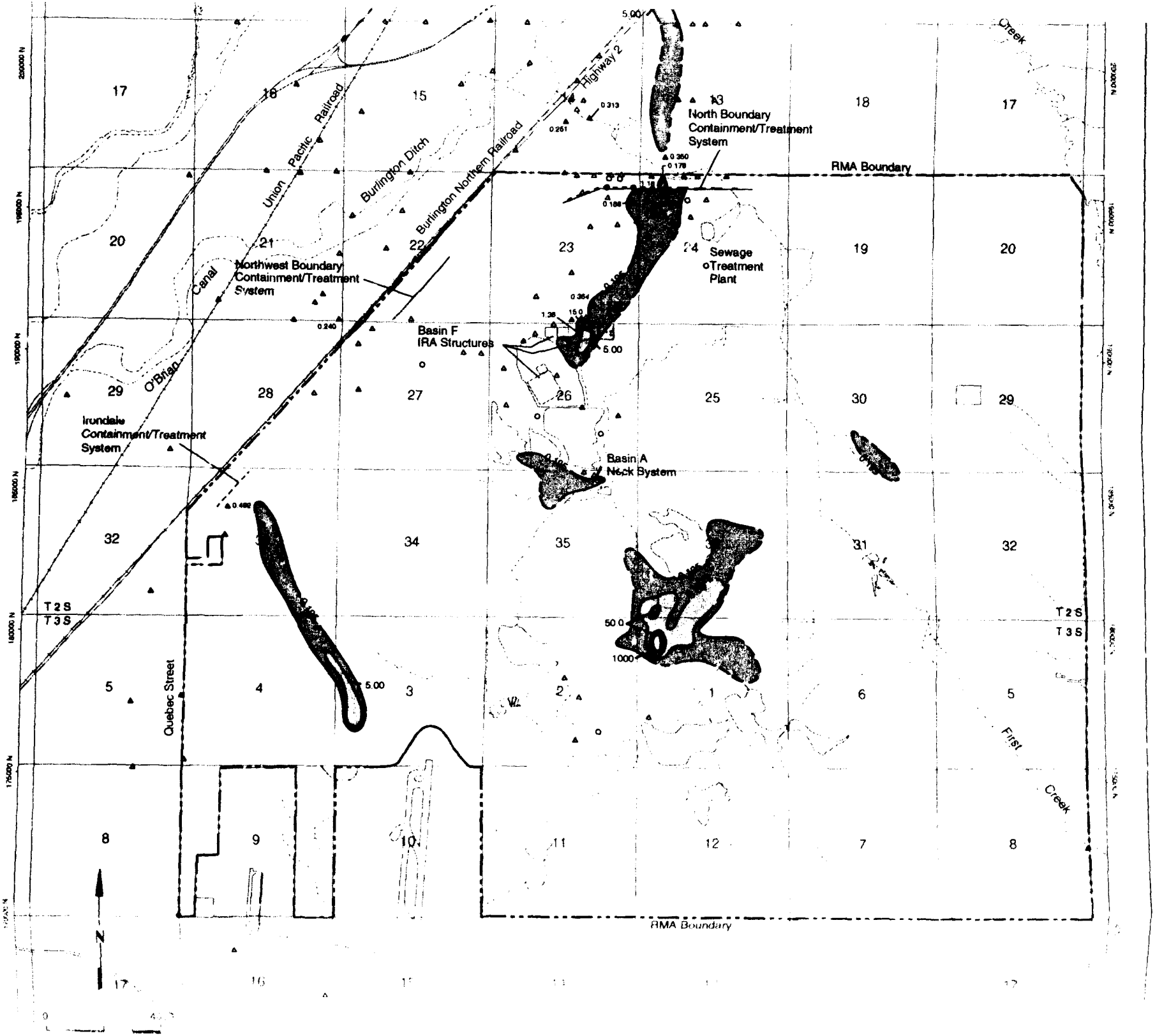
Figure 4.11

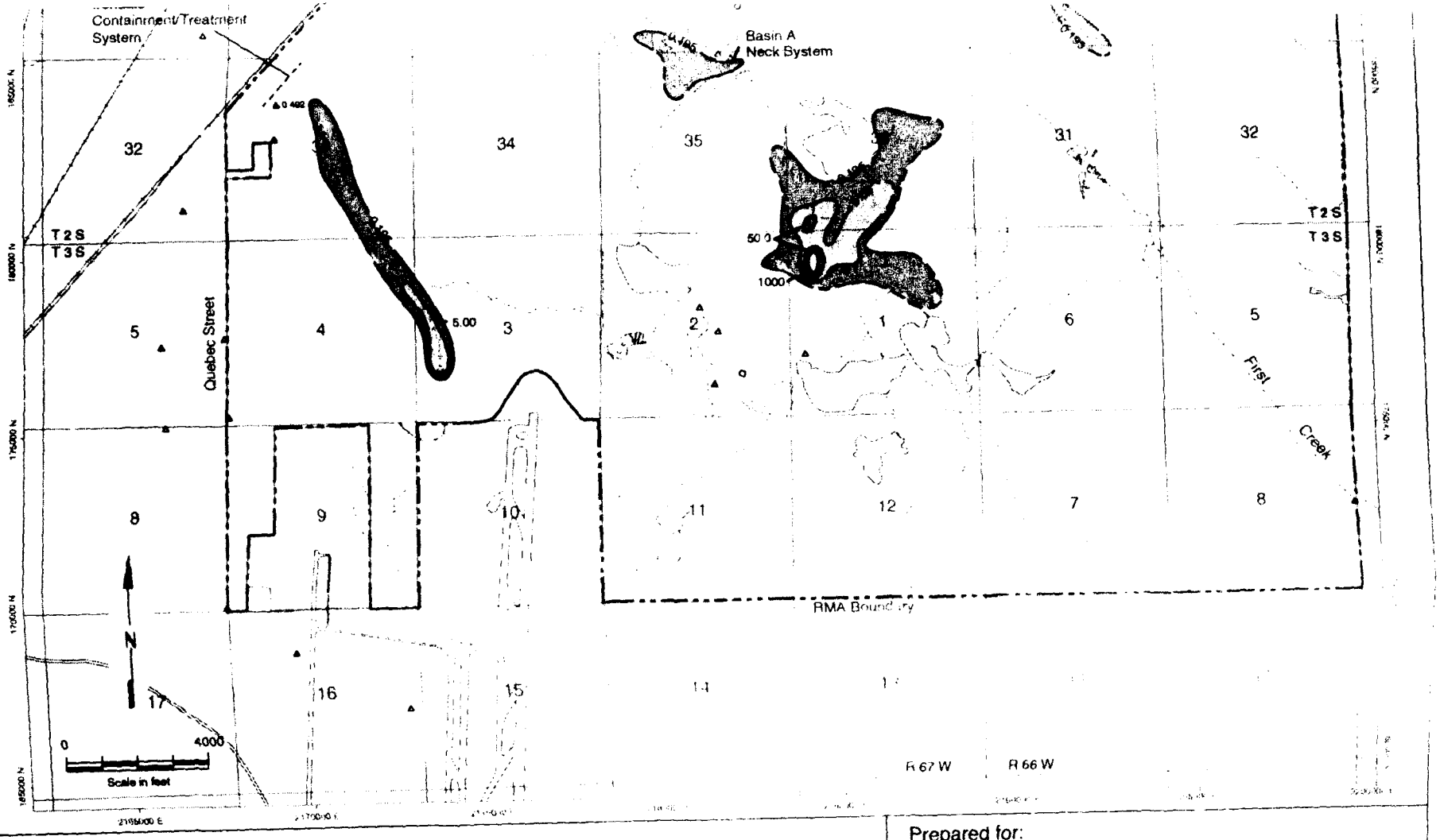
Unconfined Groundwater Flow System
Fall 1989 Chloroform Plumes with
Winter 1990/1991 Analytical Results Posted

GWAR FY91

771488 mslohfer DRG


R 67 W
R 66 W
T 1 S
T 2 S
River
South Platte
US-85
I-76
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
Burlington Northern Railroad
Canal
O'Brian
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Irondale Containment/Treatment System


Union Pacific Railroad
Burlington Ditch
Burlington Northern Railroad
Highway 2
Canal
O'Brien
Creek
Quebec Street
First Creek
RMA Boundary
North Boundary Containment/Treatment System
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Sewage Treatment Plant
T2S
T3S
N



EXPLANATION

Unconfined flow system

Winter 1990/1991 samples collected from February 5, 1991, to March 11, 1991

- Alluvial — Concentrations (ug/l)
- Denver — Concentrations (ug/l)
- Alluvial (well sampled in Winter 1990/1991, not sampled Fall 1989)
- Alluvial — Below Certified Reporting Limit (CRL)
- Denver — Below Certified Reporting Limit (CRL)

Highest CRL = 0.195 ug/l
Lowest CRL = 0.130 ug/l

0.195 — Fall 1989 plume isoconcentration line with value, dashed where inferred

Concentration ranges (ug/l)
Fall 1989:

- 0.195 - 4.99
- 5.00 - 49.9
- 50.0 - 999
- 1000 - and above

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

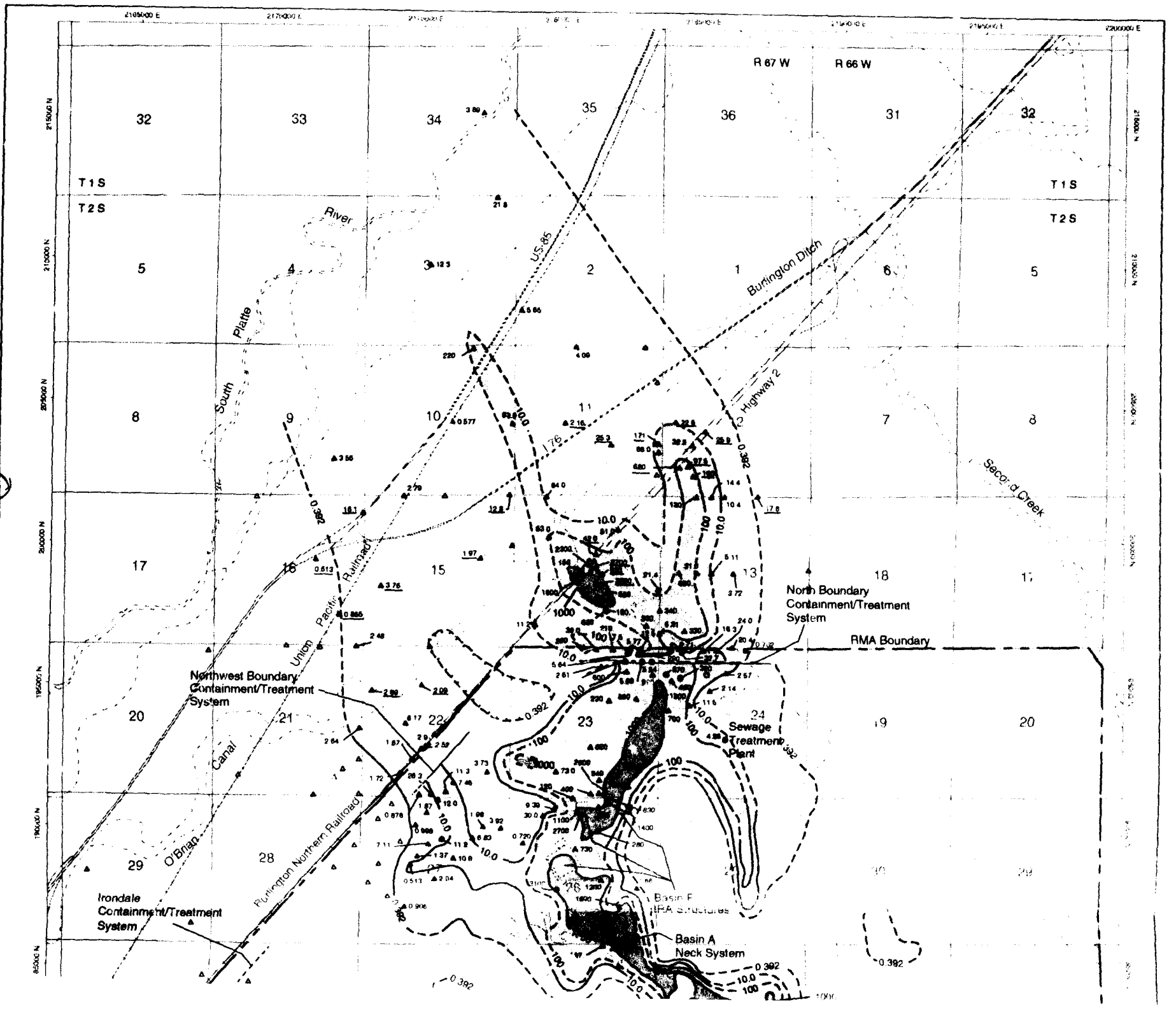
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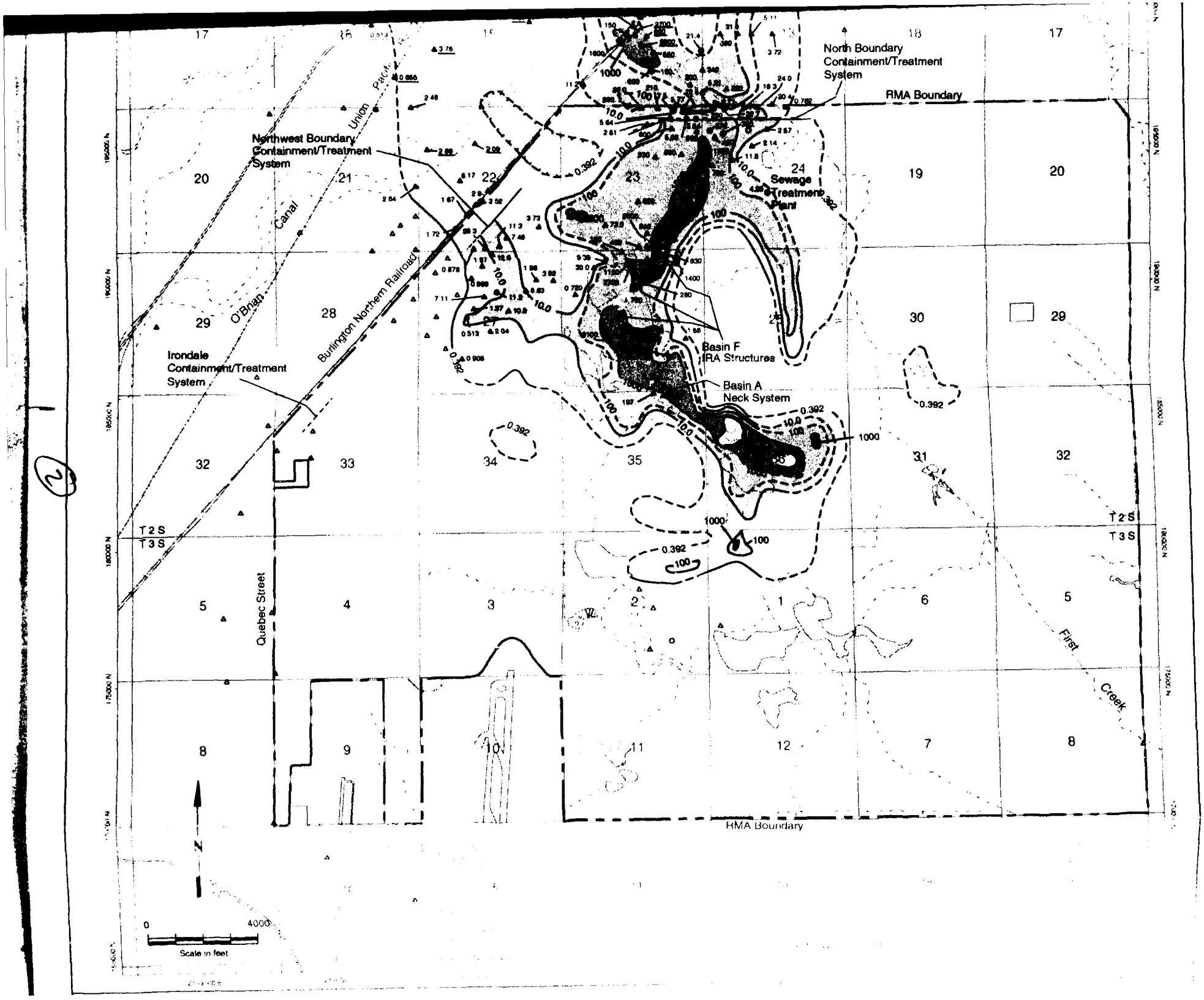
Prepared by:
Harding Lawson Associates

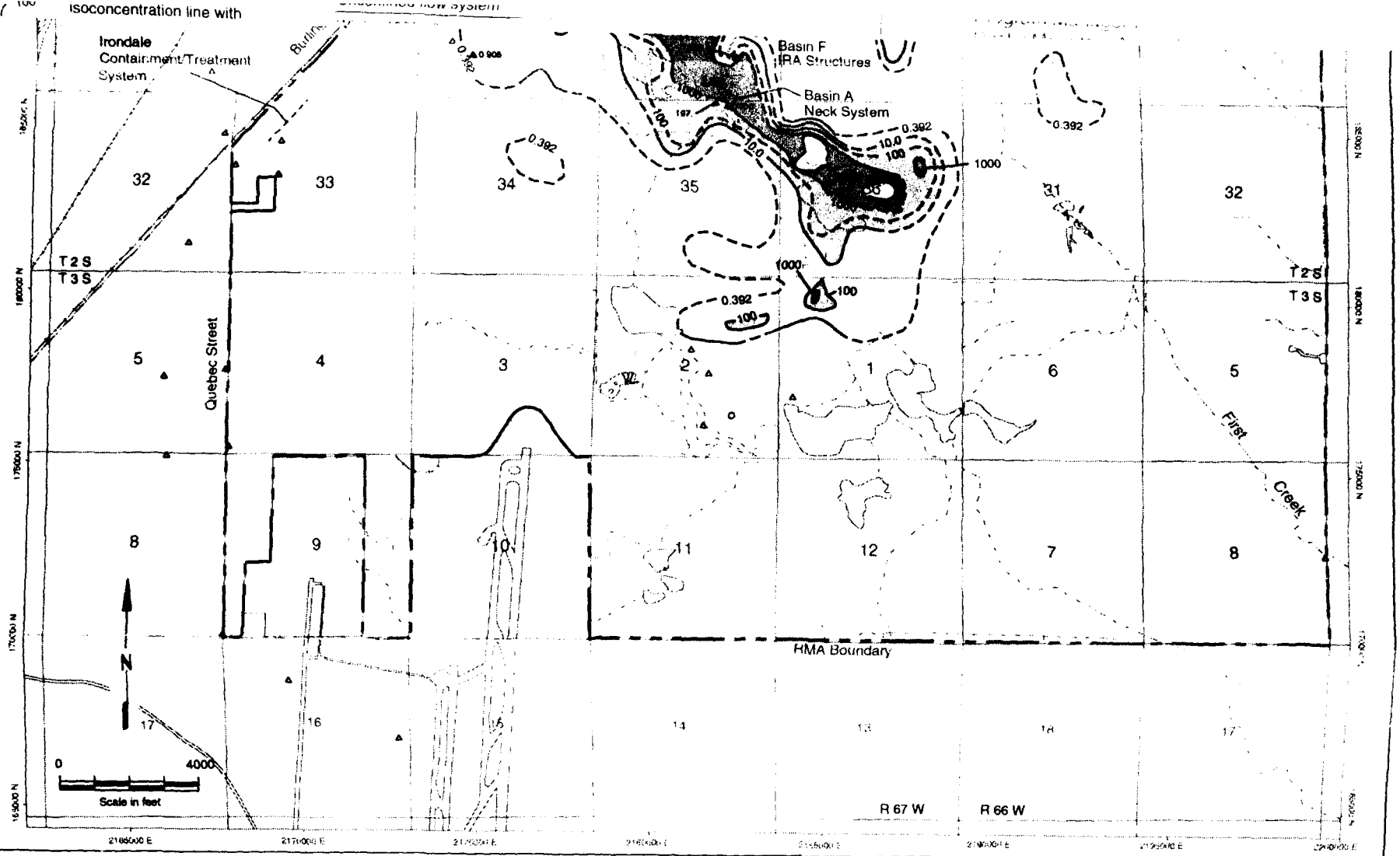
Figure 4.12
Unconfined Groundwater Flow System
Fall 1989 Dibromochloropropane (DBCP)
Plumes with Winter 1990/1991
Analytical Results Posted

GWAR FY91

7/1/92 ms/dlw DPG


R 67 W
R 66 W
T 1 S
T 2 S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
7
8
17
16
15
13
18
17
20
21
22
23
24
19
20
29
28
30
29
South Platte River
U.S. 85
Burlington Ditch
Highway 2
Second Creek
Union Pacific Railroad
Burlington Northern Railroad
O'Brien Canal
North Boundary Containment/Treatment System
RMA Boundary
Northwest Boundary Containment/Treatment System
Sewage Treatment Plant
Irondale Containment/Treatment System
Basin A Neck System
Basin F IRA Structures
0.392
100
10.0
1000


North Boundary
Containment/Treatment
System
RMA Boundary
Northwest Boundary
Containment/Treatment
System
Union Pacific
Canal
O'Brian
Burlington Northern Railroad
Sewage
Treatment
Plant
Basin F
IRA Structures
Basin A
Neck System
Irondale
Containment/Treatment
System
Quebec Street
First
Creek
T2S
T3S
RMA Boundary
0
4000
Scale in feet
N



EXPLANATION

100 — Fall 1989 plume isoconcentration line with value, dashed where inferred

Hachures where a depression exists

Concentration ranges (ug/l)
Fall 1989:

- 0.392 - 9.99
- 10.0 - 99.9
- 100 - 999
- 1000 - 9,999
- 10,000 and above

Unconfined flow system

Winter 1990/1991 samples
collected from February 5, 1991, to March 11, 1991

- 660 ▲ Alluvial
- 320 ● Denver

Concentrations (ug/l)

- 171 ▲ *Alluvial (well sampled in Winter 1990/1991, not sampled Fall 1989)*
- ▲ Alluvial
- ○ *Denver*

Below Certified Reporting Limit (CRL)

Highest CRL = 10.1 ug/l
Lowest CRL = 0.392 ug/l

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

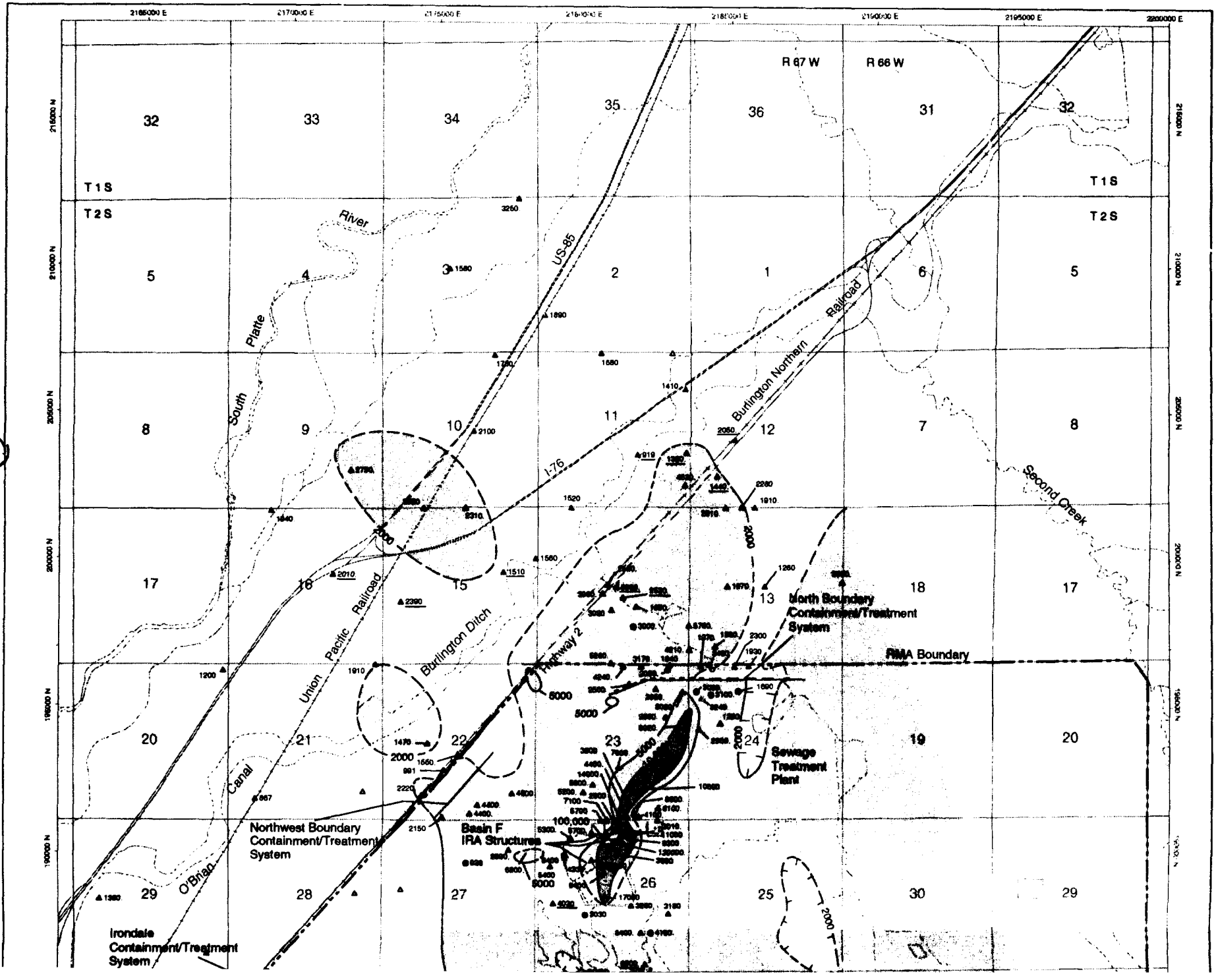
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Prepared by:
Harding Lawson Associates

Figure 4.13

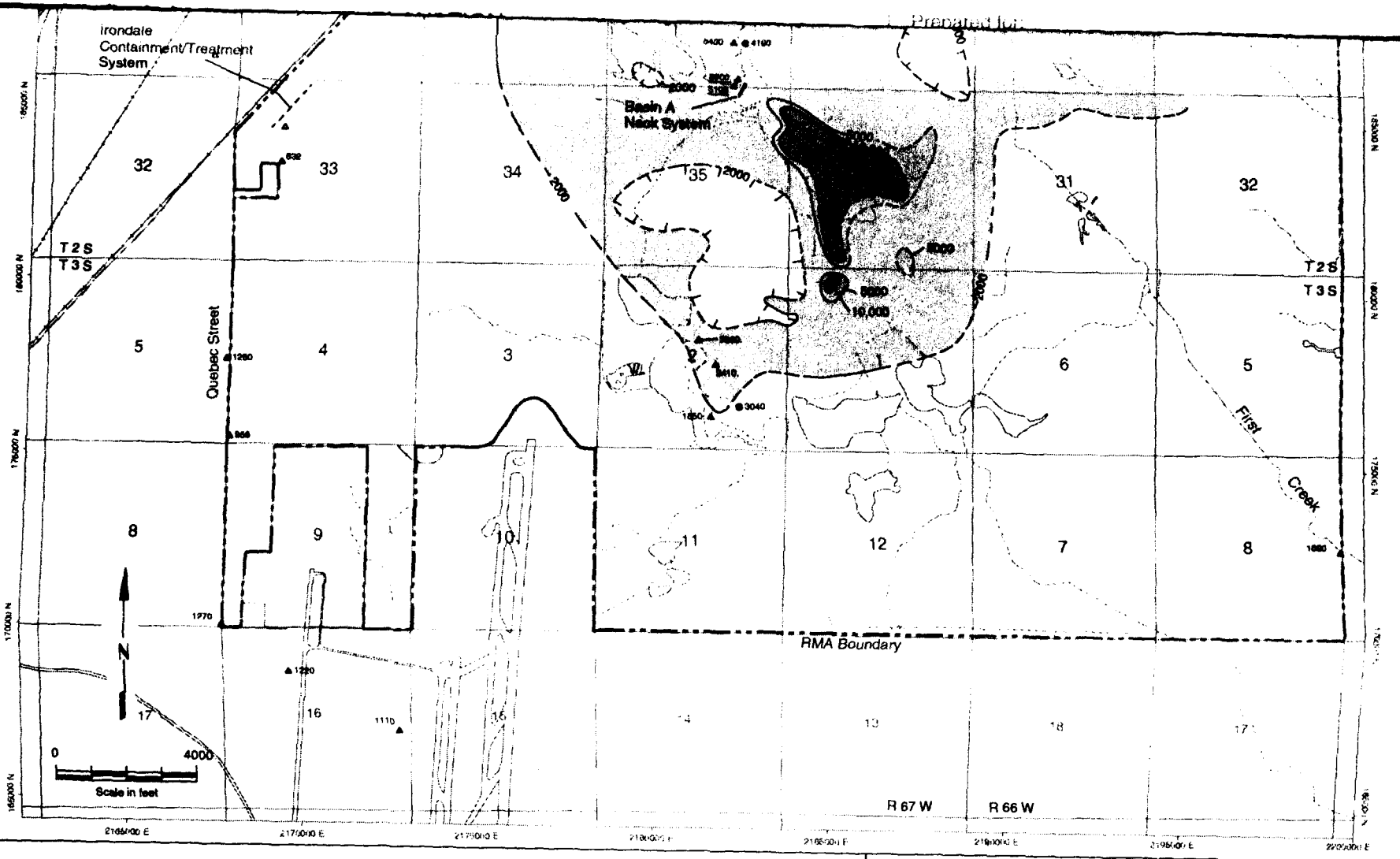
Unconfined Groundwater Flow System
Fall 1989 Diisopropylmethylphosphonate (DIMP)
Plumes with Winter 1990/1991
Analytical Results Posted

GWAR FY91

7/11/88 mw/dmpp/ DPG


R 67 W
R 66 W
T1S
T2S
River
South Platte
US-85
Railroad
Burlington Northern
I-76
Second Creek
Union Pacific Railroad
Burlington Ditch
Highway 2
O'Brian Canal
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Basin F IRA Structures
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System

RMA Boundary
North Boundary Containment/Treatment System
Basin A Neck System
Basin F IRA Structure
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Buckingham Ditch
Union Pacific Railroad
O'Brian Canal
First Creek
Quebec Street
T2S
T3S
N
0
4000



EXPLANATION

0.0500 — Fall 1989 plume isoconcentration line with value, dashed where inferred

Hachures where a depression exists

Concentration ranges (ug/l) Fall 1989:

- 2000 - 4999
- 5000 - 9999
- 10,000 - 99,999
- 100,000 and above

Unconfined flow system

Winter 1990/1991 samples collected from February 5, 1991, to March 11, 1991

- 5400 ▲ Alluvial
- 4190 ● Denver

] Concentrations (ug/l)

- 5600 ▲ Alluvial (well sampled in Winter 1990/1991, not sampled Fall 1989)
- ▲ Alluvial
- ○ Denver

] Below Certified Reporting Limit (CRL)

Highest CRL = 1000 ug/l
Lowest CRL = 153 ug/l

Containment system

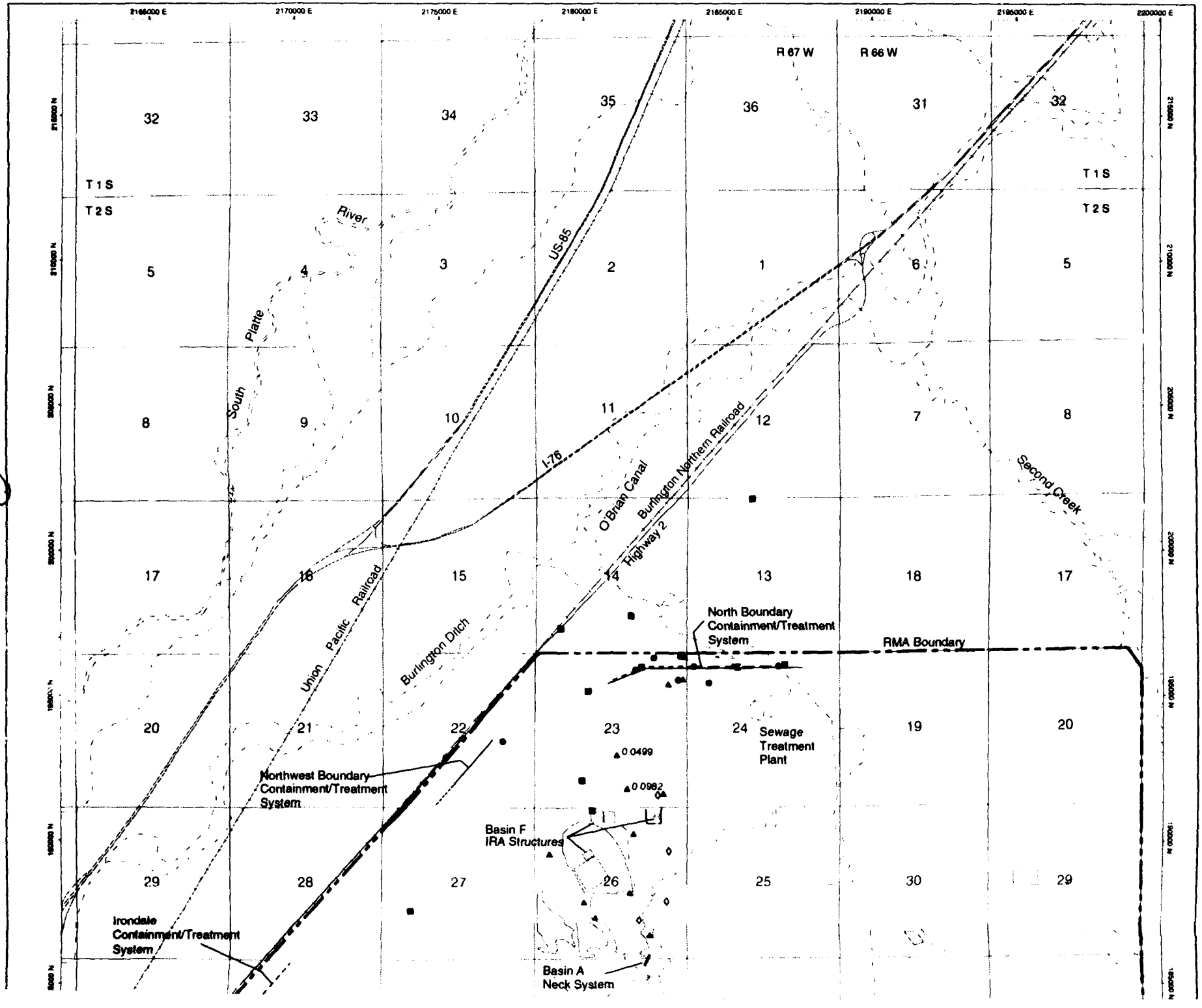
- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

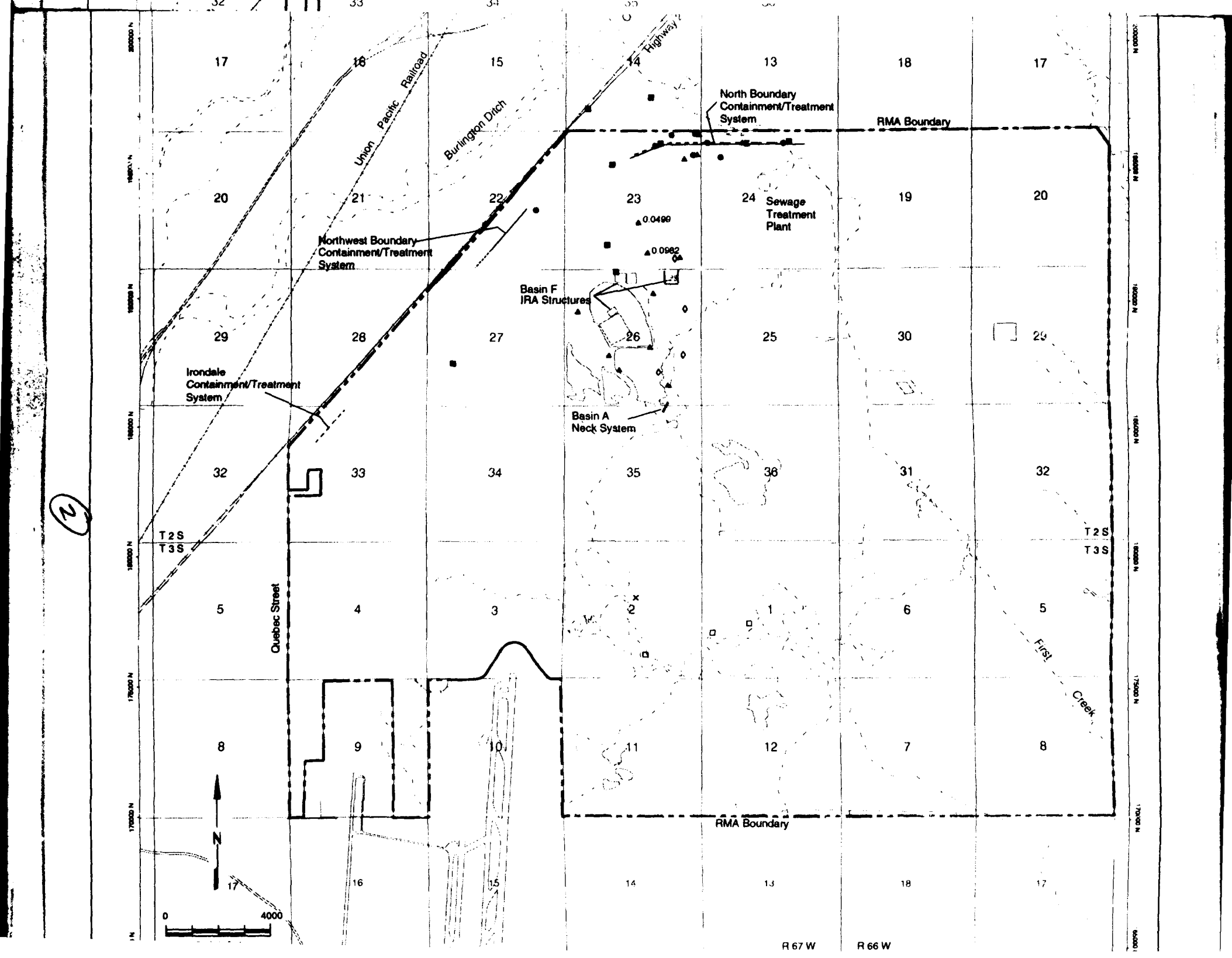
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

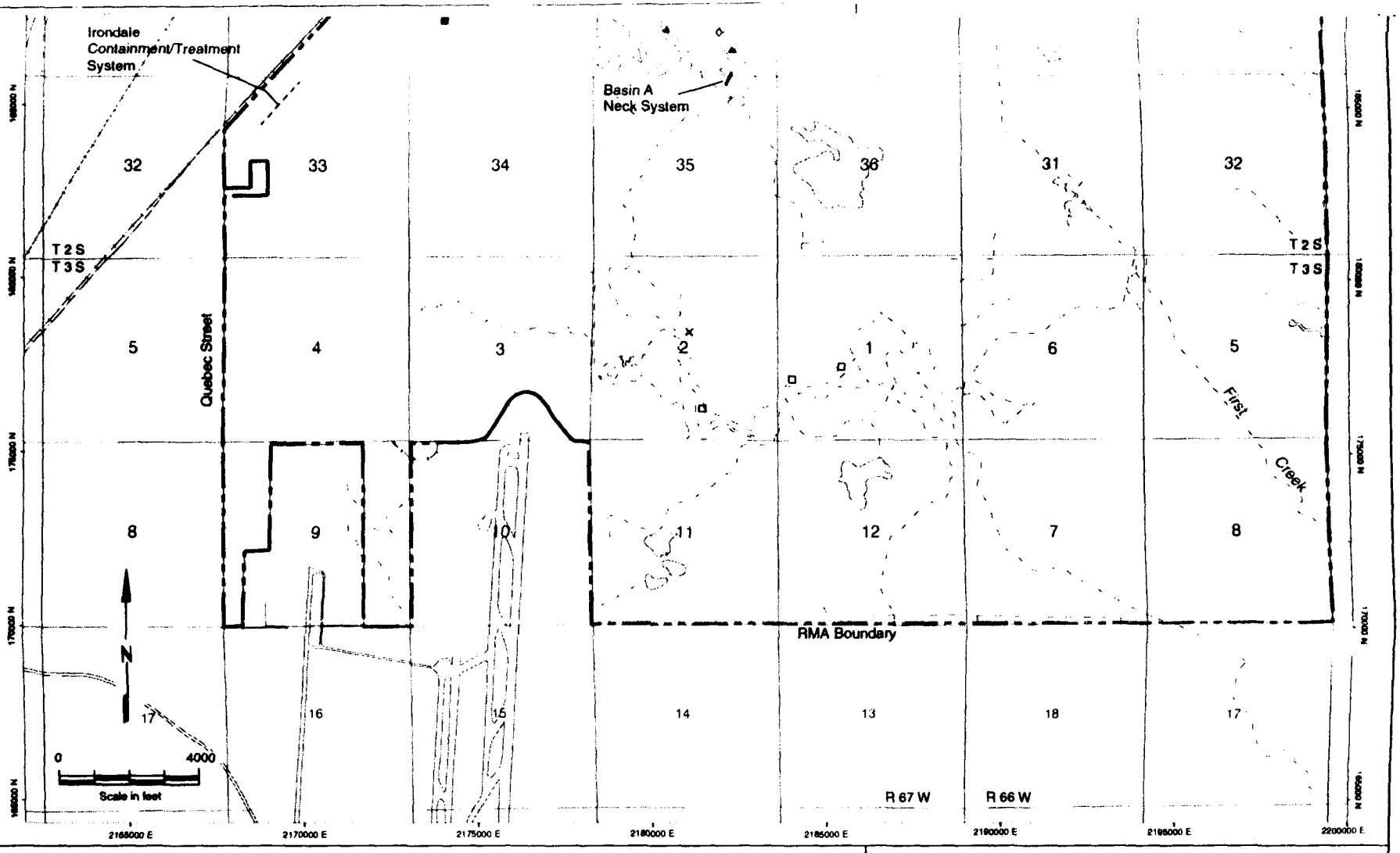
Figure 4.14

Unconfined Groundwater Flow System
Fall 1989 Fluoride Plumes with
Winter 1990/1991 Analytical Results Posted

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
32
33
34
35
36
31
32
5
4
3
2
1
6
5
8
9
10
11
12
7
8
17
16
15
14
13
18
17
20
21
22
23
24
19
20
29
28
27
26
25
30
29
South Platte River
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Highway 2
Second Creek
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
0 0499
0 0982
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
Basin A Neck System


Union Pacific Railroad
Burlington Ditch
Highway 2
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Irondale Containment/Treatment System
Quebec Street
First Creek
RMA Boundary
T2S
T3S
R67W
R66W
0
4000
N



EXPLANATION

- Denver Zone A
- Denver Zone 1U
- Denver Zone 1
- Denver Zone 2
- Denver Zone 3
- Denver Zone 4
- Denver Zone 5
- Denver Zone 6

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Analyte concentrations in ug/l

Note: Symbols without values indicate nondetections

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Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

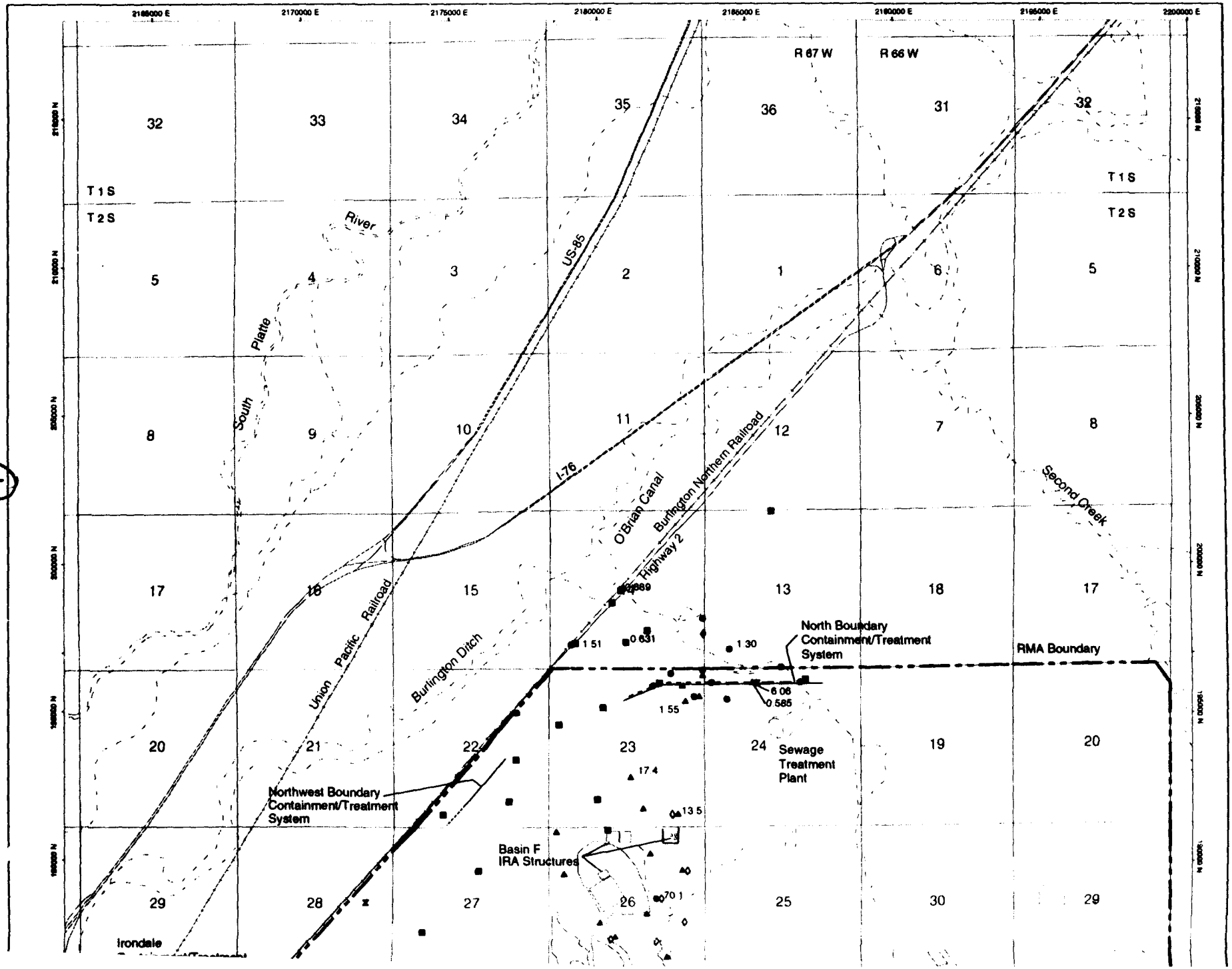
Prepared by:
Harding Lawson Associates

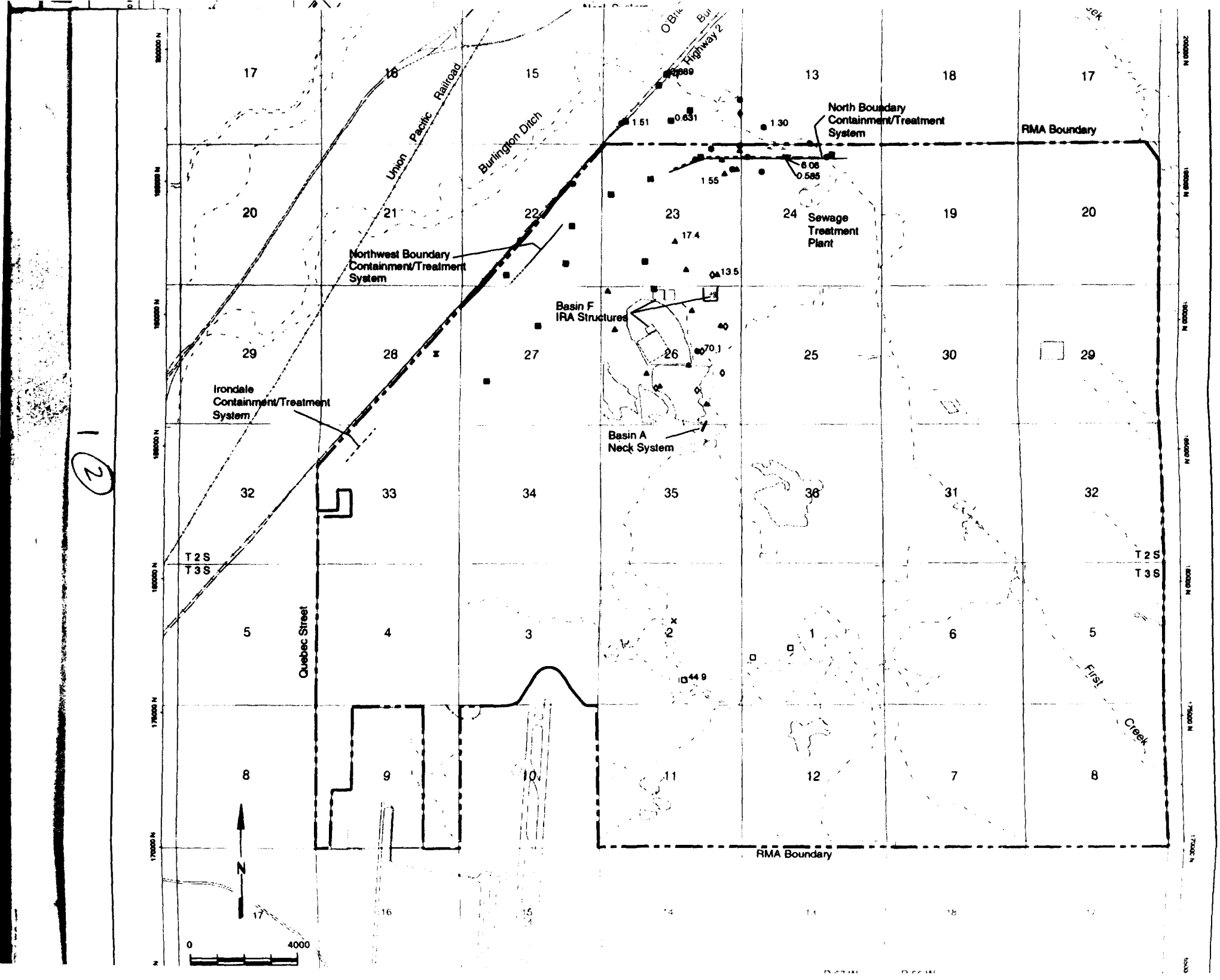
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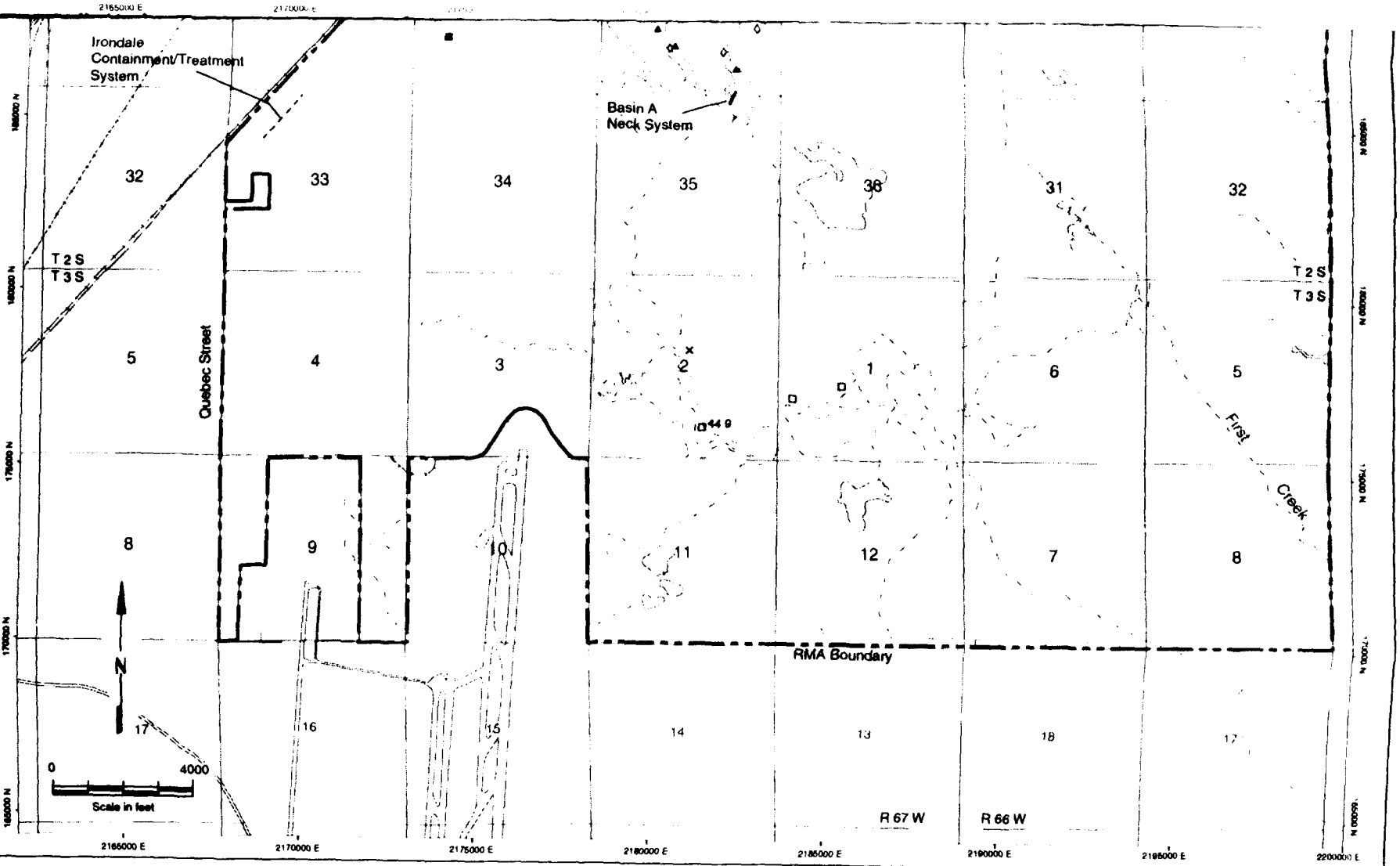
Dieldrin Detections, Confined Groundwater Flow System, Winter 1990/1991

GWAR FY91

7/10/92 mxlc: ddm DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
River
South Platte
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale
1 51
0 631
1 30
6 06
0 585
1 55
17 4
13 5
70 1


Union Pacific Railroad
Burlington Ditch
Highway 2
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Irondale Containment/Treatment System
Quebec Street
First Creek
T2S
T3S
RMA Boundary
N
0
4000
1.51
0.631
1.30
6.06
0.585
1.55
17.4
13.5
70.1
44.9



EXPLANATION

- Denver Zone A
- Denver Zone 1U
- Denver Zone 1
- Denver Zone 2
- Denver Zone 3
- Denver Zone 4
- Denver Zone 5
- Denver Zone 6

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Analyte concentrations in ug/l

Note: Symbols without values indicate nondetections

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

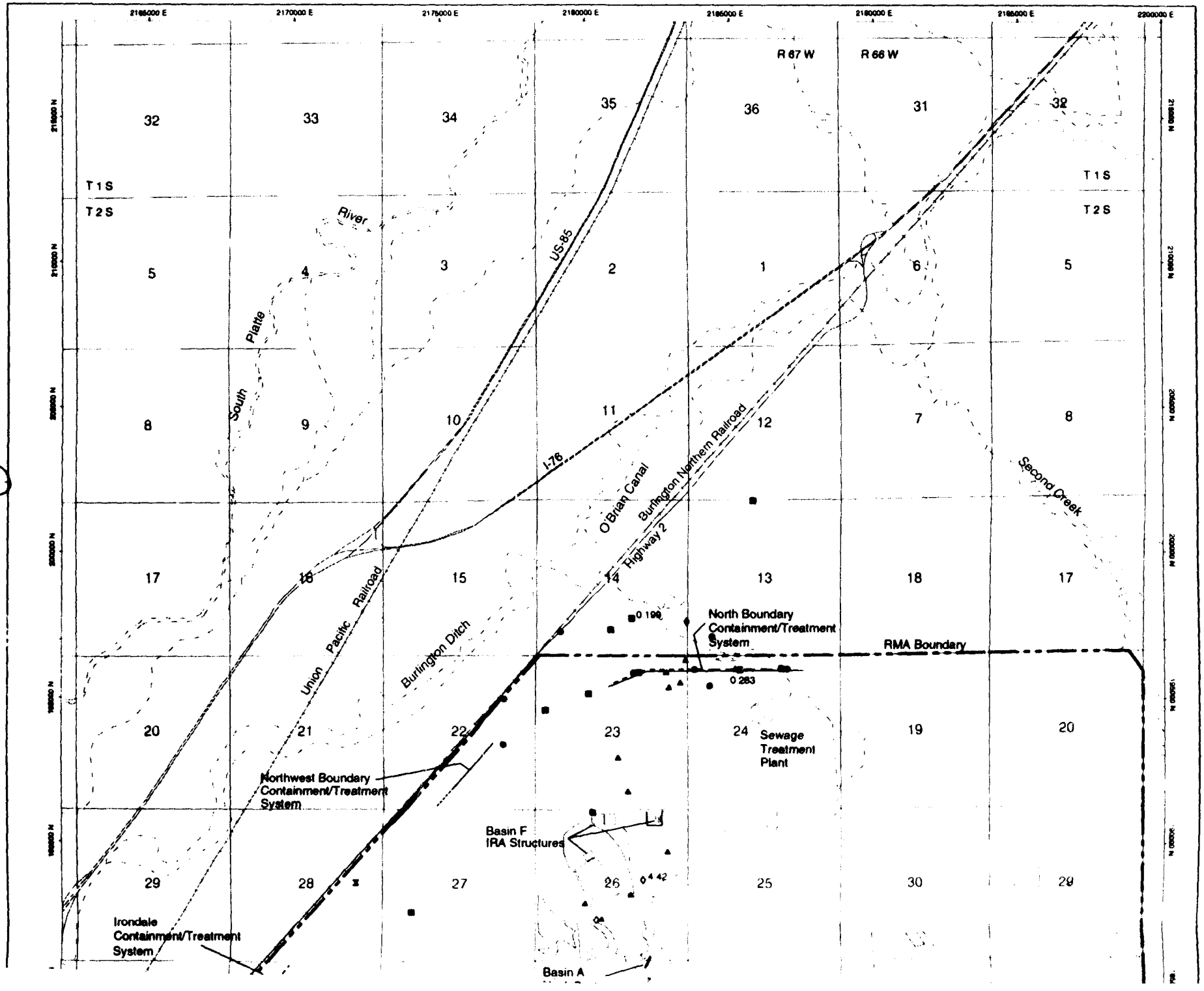
Harding Lawson Associates

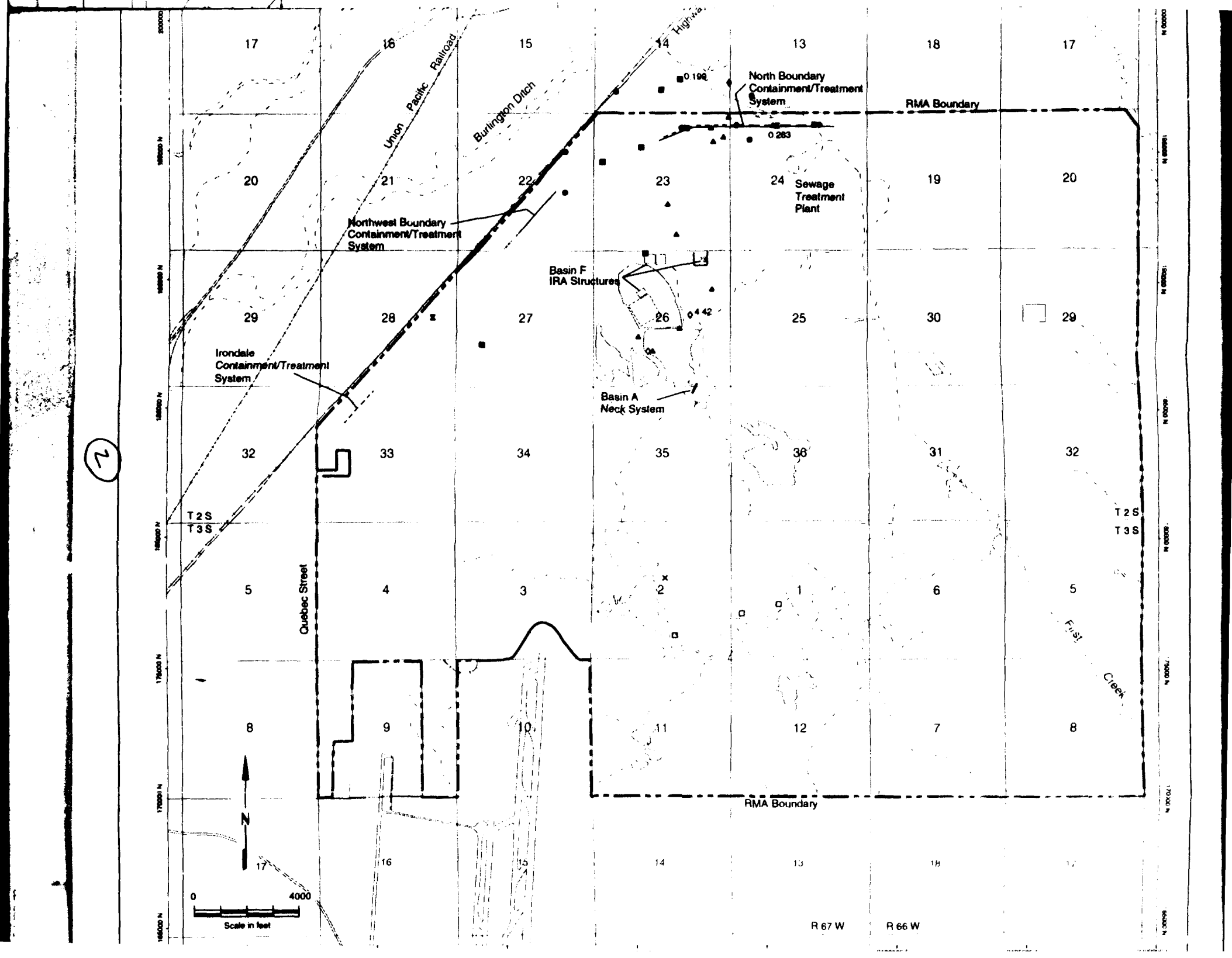
Figure 4.16

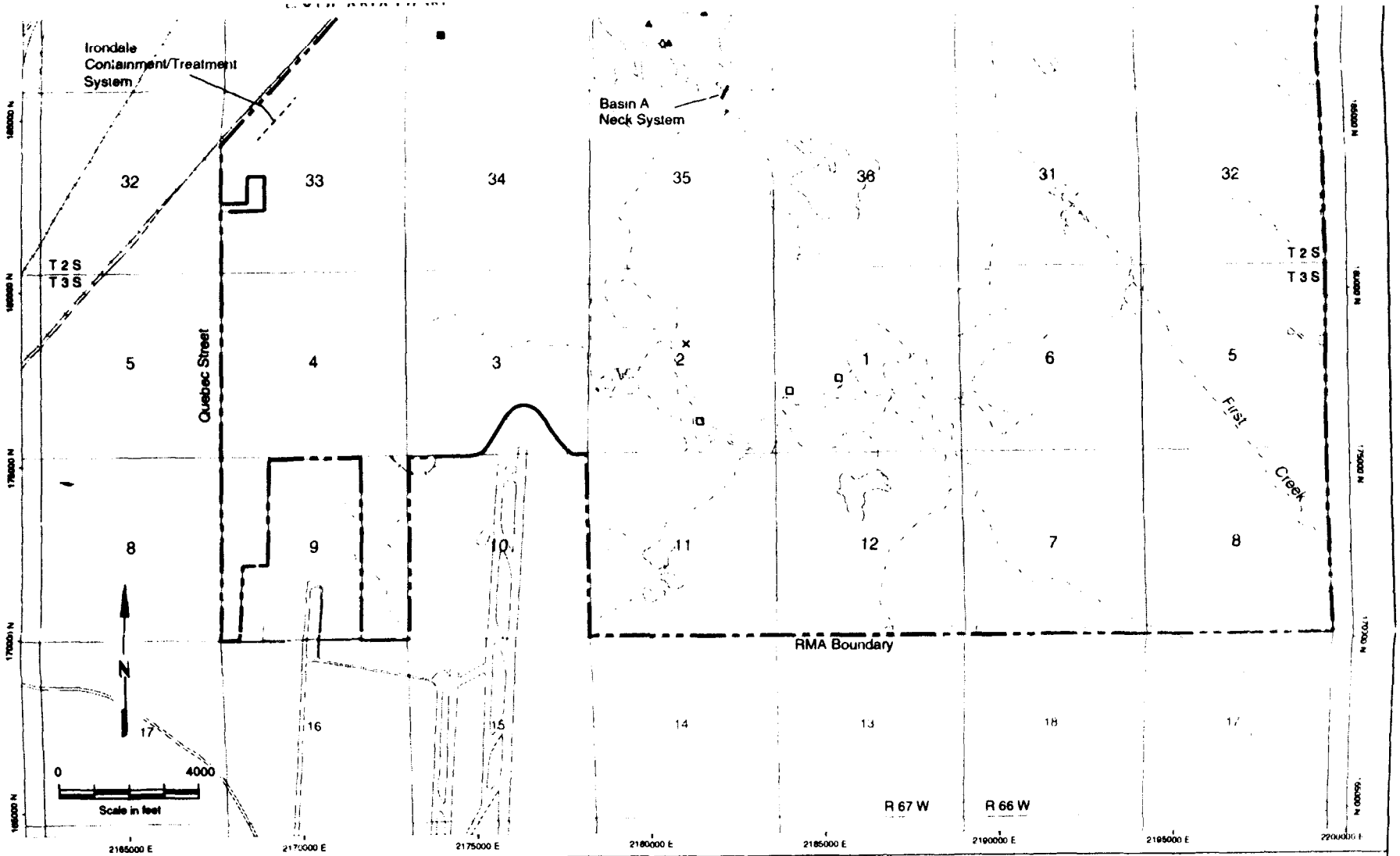
Chloroform Detections, Confined Groundwater Flow System, Winter 1990/1991

GWAR FY91

7/NOR2 mavc dh28 DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
River
South Platte
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
Basin A


Union Pacific Railroad
Burlington Ditch
Highway
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Basin A Neck System
Irondale Containment/Treatment System
Quebec Street
First Creek
T 2 S
T 3 S
R 67 W
R 66 W
0
4000
Scale in feet
N
0.199
0.283
0.442



EXPLANATION

- Denver Zone A
- Denver Zone 1U
- Denver Zone 1
- Denver Zone 2
- Denver Zone 3
- Denver Zone 4
- Denver Zone 5
- Denver Zone 6

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Analyte concentrations in ug/l

Note: Symbols without values indicate nondetections

Prepared for:
Program Manager for
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Commerce City, Colorado

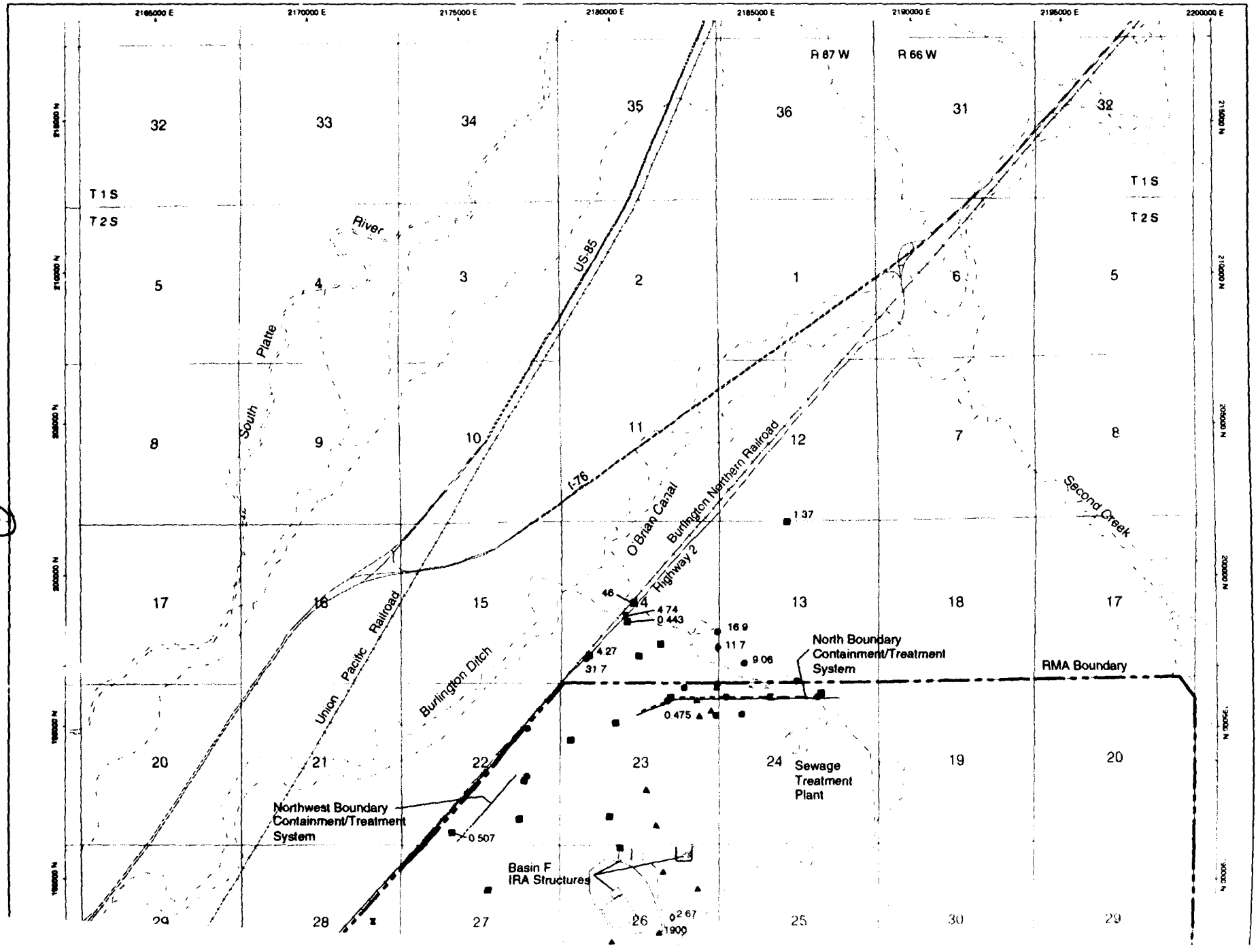
Prepared by:
Harding Lawson Associates

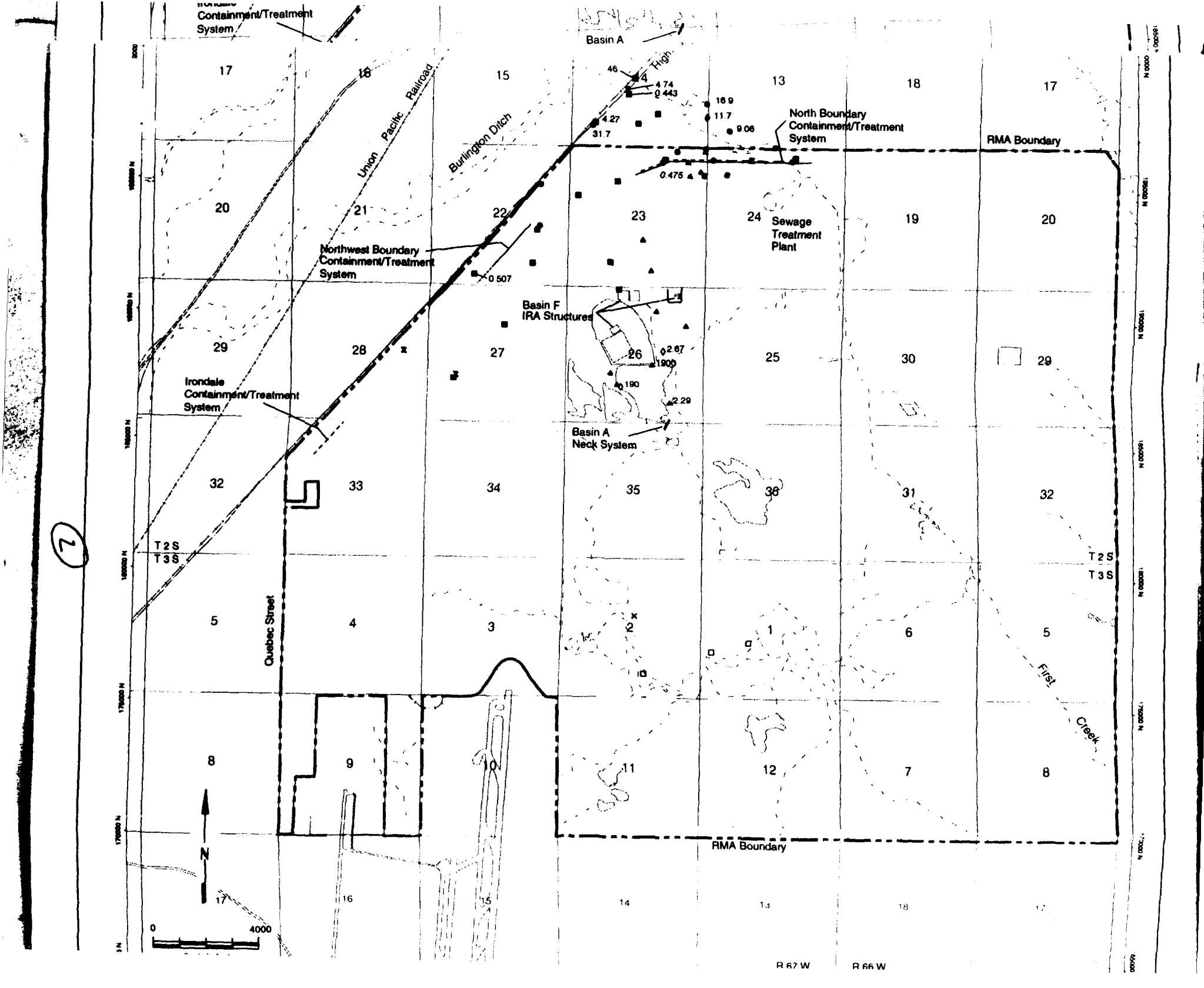
Figure 4.17

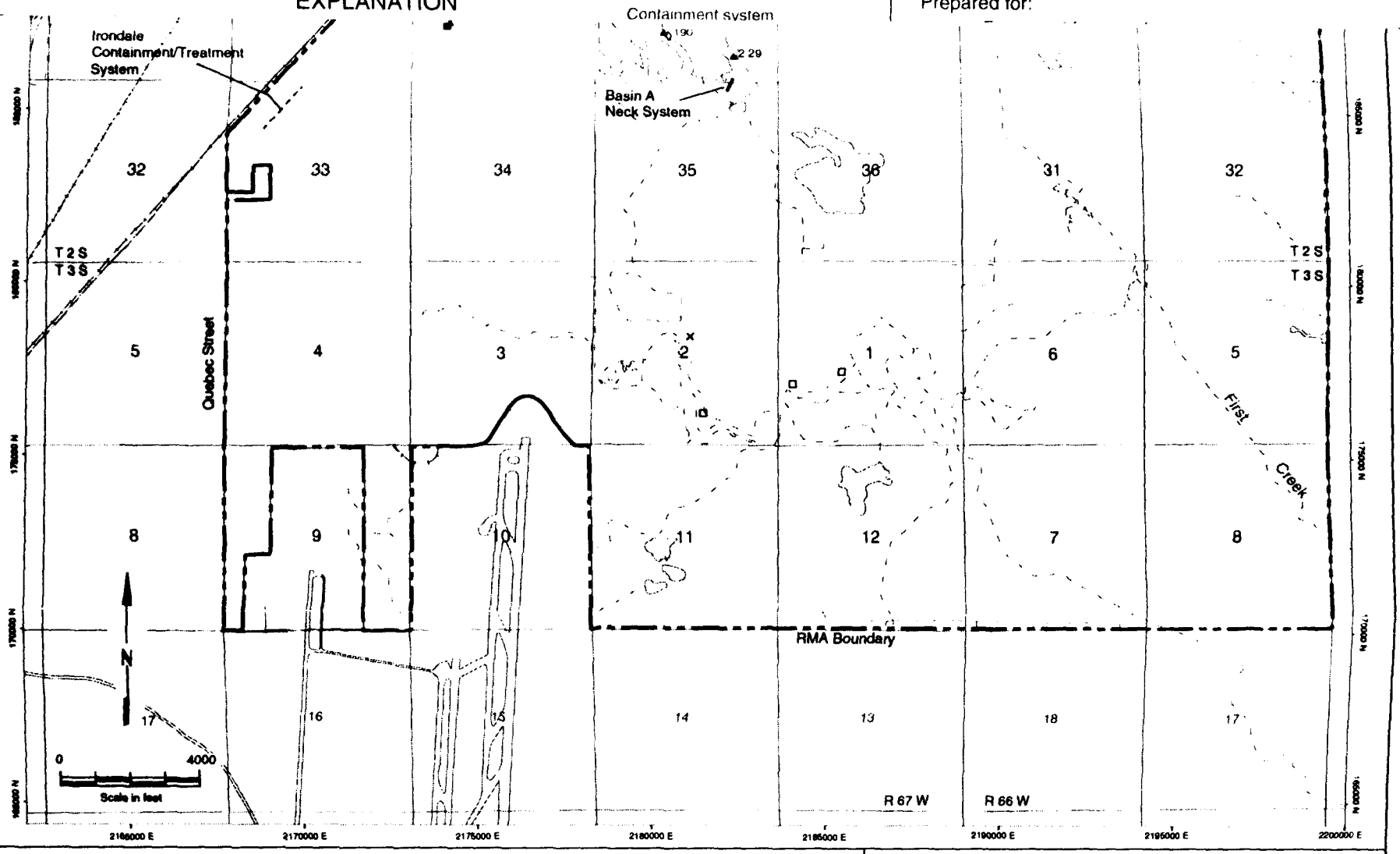
Dibromochloropropane (DBCP) Detections,
Confined Groundwater Flow System,
Winter 1990/1991

GWAR FY91

7/10/92 mark: dbcp DPG


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
River
South Platte
US-85
I-76
O'Brian Canal
Burlington Northern Railroad
Second Creek
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
1 37
4 6
4 74
0 443
16 9
11 7
9 06
4 27
31 7
0 475
0 507
0 2 67
1900


Containment/Treatment System
Basin A
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
Basin A Neck System
Quebec Street
First Creek
RMA Boundary
T2S
T3S
R67W
R66W
0
4000



EXPLANATION

- Denver Zone A
- Denver Zone 1U
- Denver Zone 1
- Denver Zone 2
- Denver Zone 3
- Denver Zone 4
- Denver Zone 5
- Denver Zone 6

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Analyte concentrations in ug/l

Note: Symbols without values indicate nondetections

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

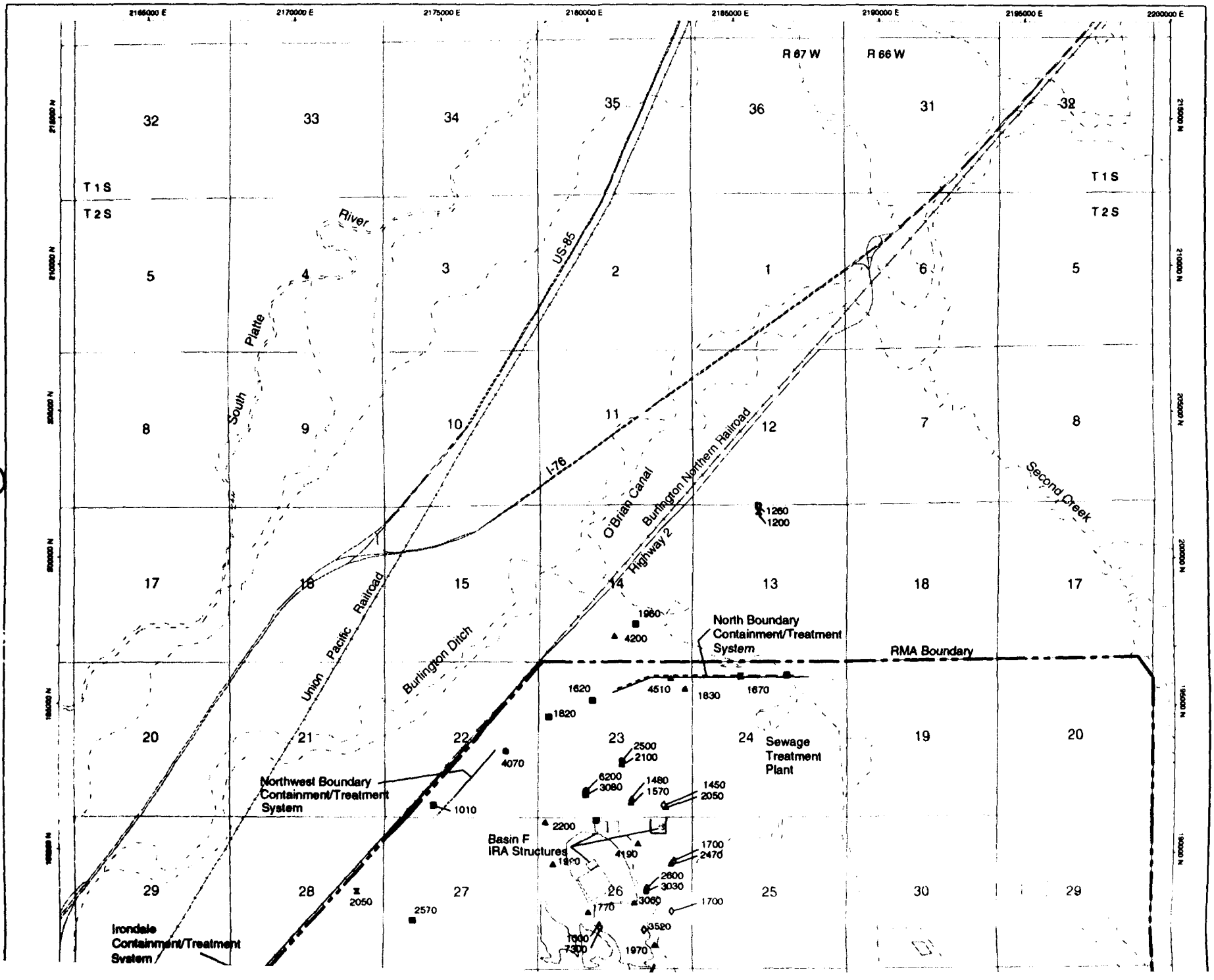
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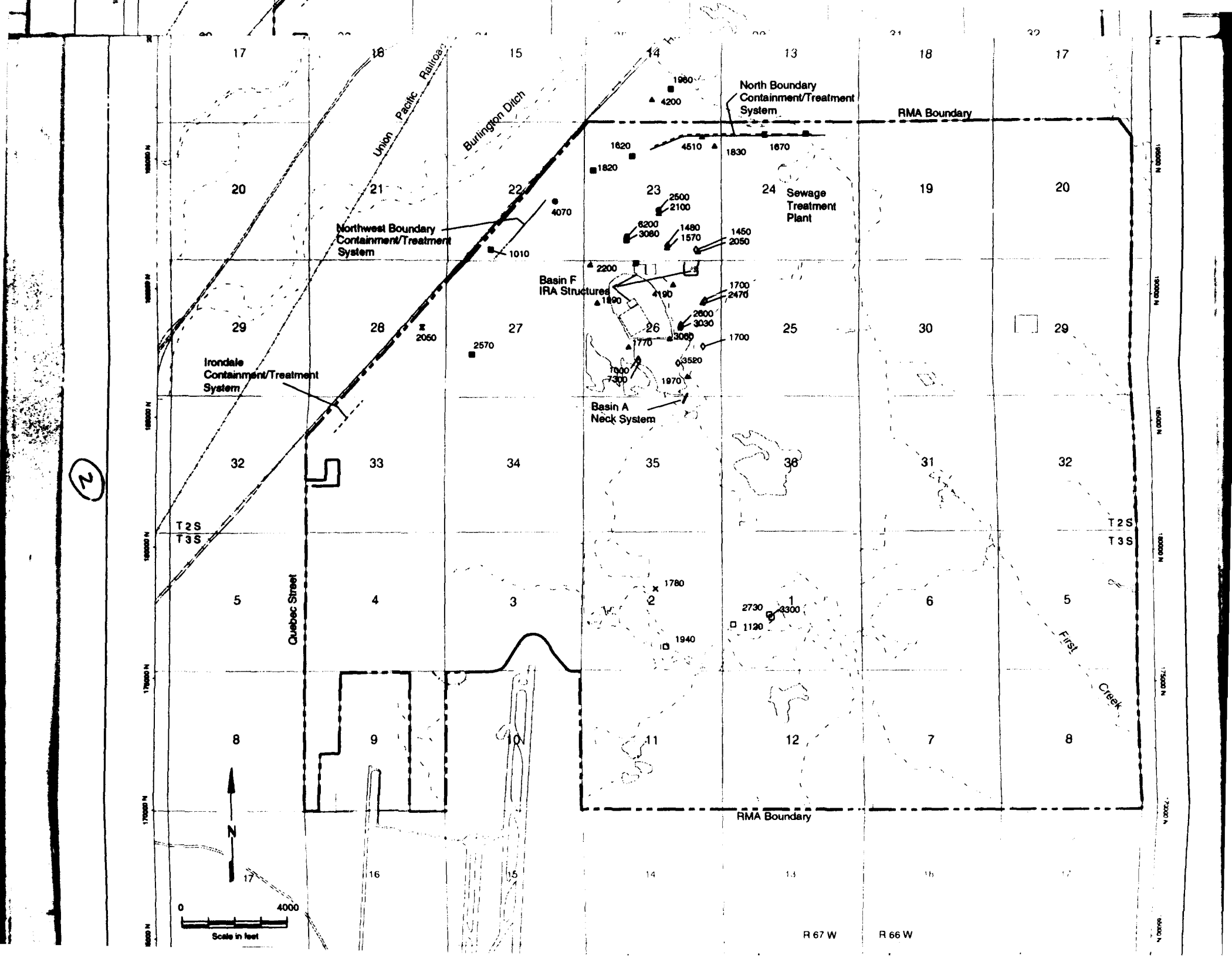
Harding Lawson Associates

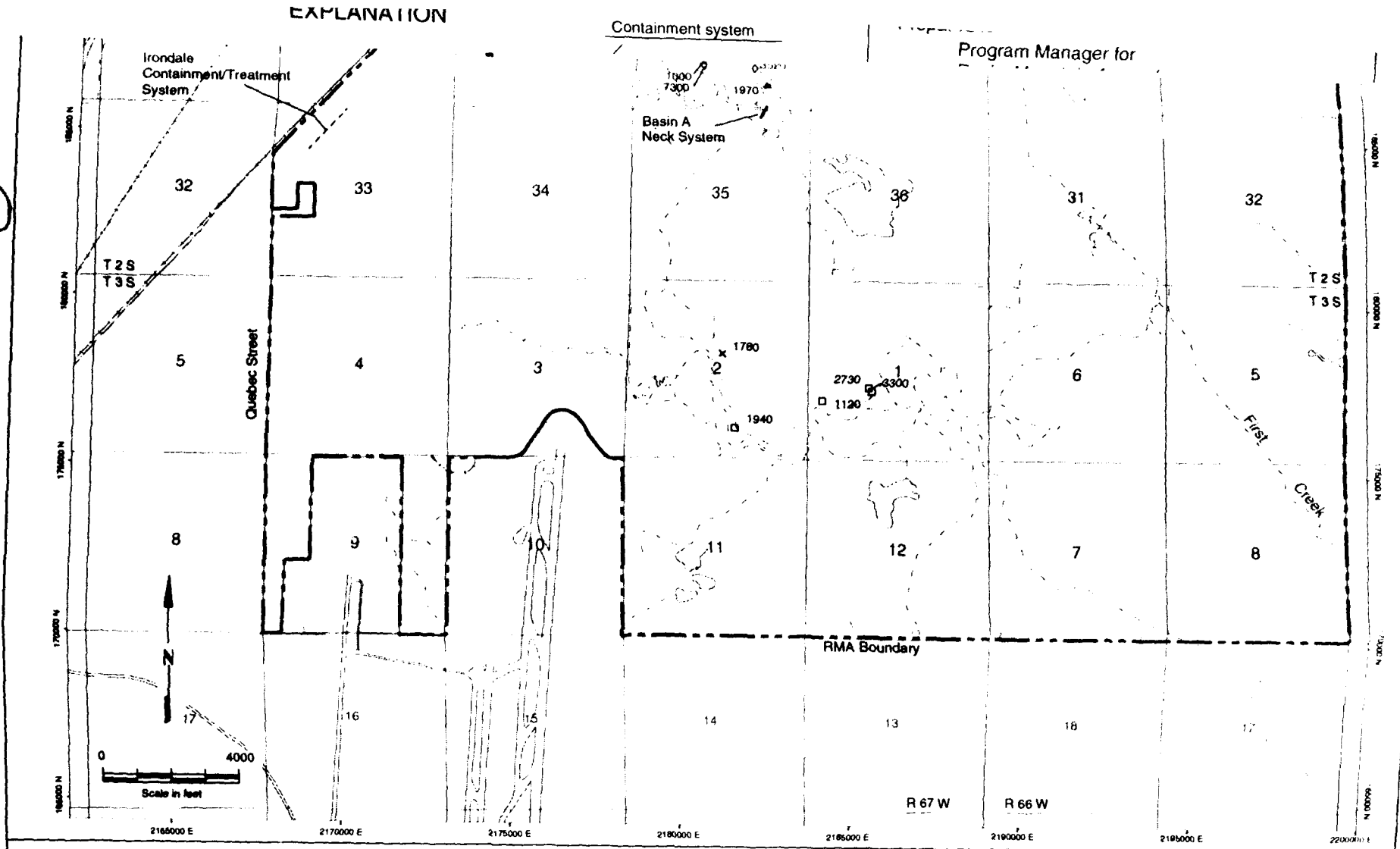
Figure 4.18

Diisopropylmethylphosphonate (DIMP) Detections, Confined Groundwater Flow System, Winter 1990/1991

GWAR FY91


2165000 E
2170000 E
2175000 E
2180000 E
2185000 E
2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
T 1 S
T 2 S
South Platte River
US-85
I-76
Union Pacific Railroad
Burlington Ditch
O'Brian Canal
Burlington Northern Railroad
Highway 2
Second Creek
North Boundary Containment/Treatment System
RMA Boundary
Northwest Boundary Containment/Treatment System
Irondale Containment/Treatment System
Basin F IRA Structures
Sewage Treatment Plant
1260
1200
1960
4200
1620
4510
1830
1670
1820
2500
2100
4070
6200
3080
1480
1570
1450
2050
1010
2200
4190
1700
2470
2600
3030
3060
1700
2050
2570
770
3520
1900
7300
1970


North Boundary Containment/Treatment System
RMA Boundary
Union Pacific Railroad
Burlington Ditch
Northwest Boundary Containment/Treatment System
Sewage Treatment Plant
Basin F IRA Structures
Basin A Neck System
Irondale Containment/Treatment System
Quebec Street
First Creek
RMA Boundary
T2S
T3S
R 67 W
R 66 W
N
0
4000
Scale in feet



EXPLANATION

- Denver Zone A
- Denver Zone 1U
- Denver Zone 1
- Denver Zone 2
- Denver Zone 3
- Denver Zone 4
- Denver Zone 5
- Denver Zone 6

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

Analyte concentrations in ug/l

Note: Symbols without values indicate nondetections

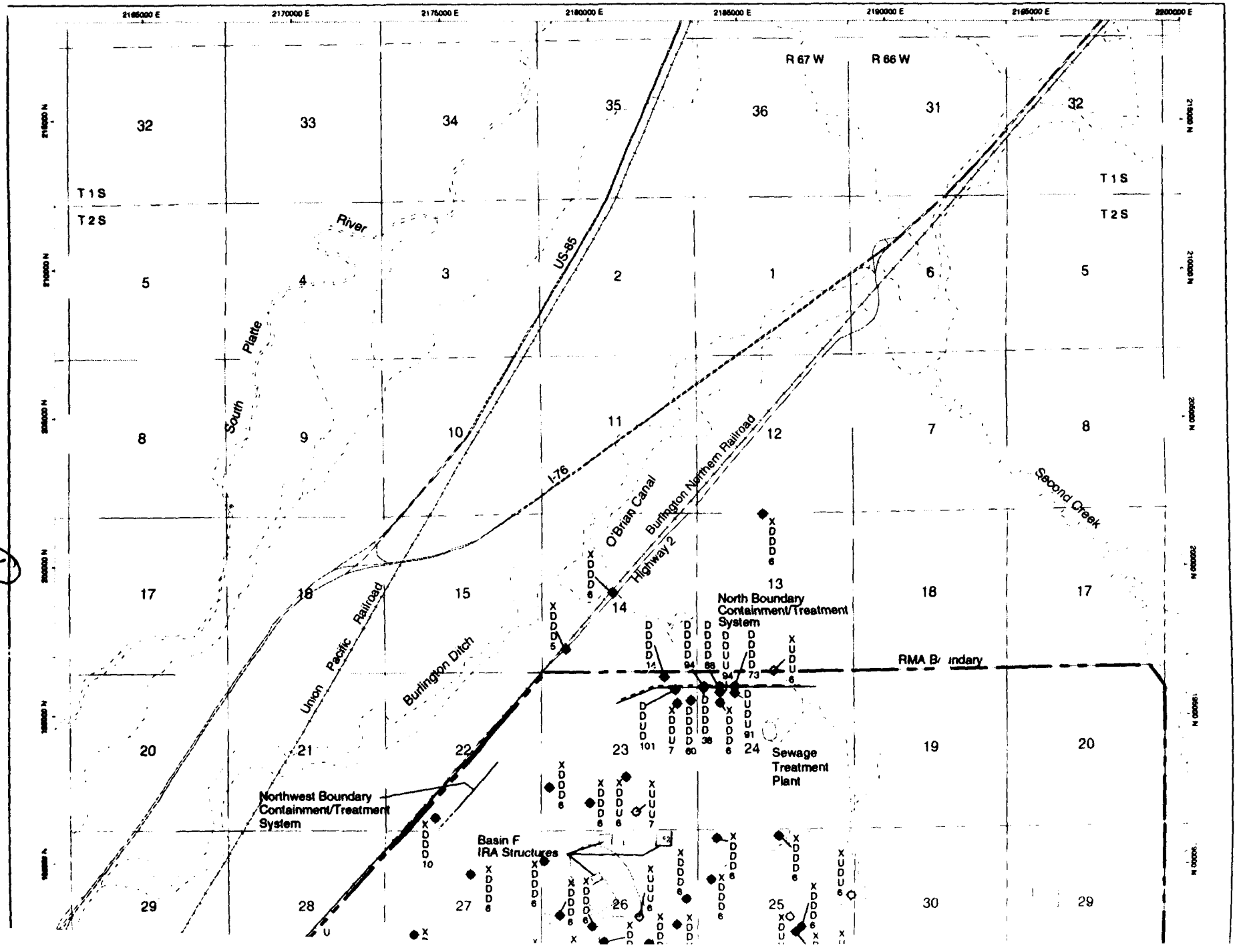
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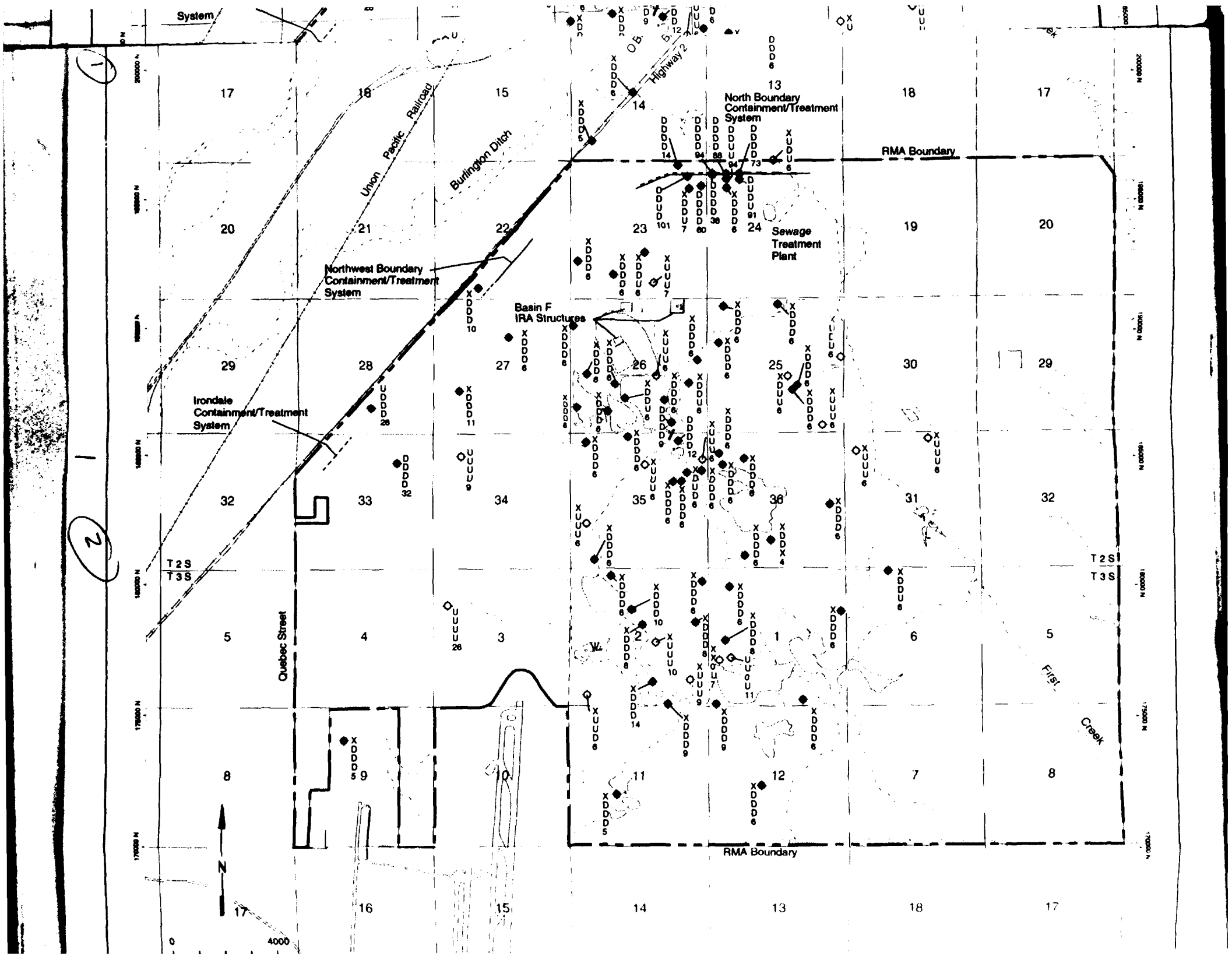
Prepared by:
Harding Lawson Associates

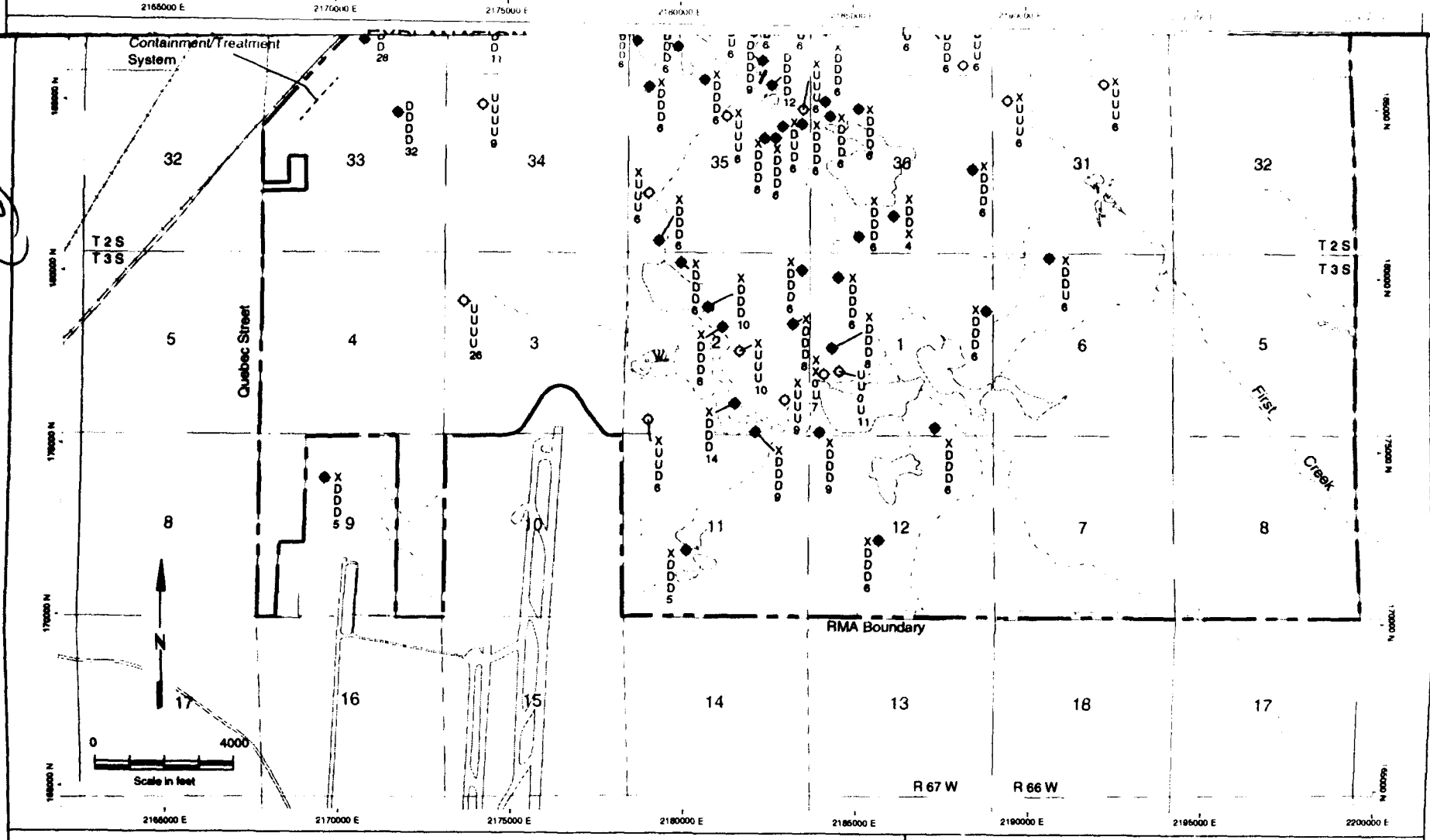
Figure 4.19

Fluoride Detections, Confined Groundwater Flow System, Winter 1990/1991

GWAR FY91


R 67 W
R 66 W
T 1 S
T 2 S
South Platte River
US-85
I-76
Highway 2
O'Brian Canal
Burlington Northern Railroad
Second Creek
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
RMA Boundary


System
Highway 2
Union Pacific Railroad
Burlington Ditch
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Northwest Boundary Containment/Treatment System
Basin F IRA Structures
Irondale Containment/Treatment System
Quebec Street
First Creek
RMA Boundary
T2S
T3S
N
0
4000



EXPLANATION

- Upward vertical gradient for water year 1991
- Downward vertical gradient for water year 1991
- Indeterminant vertical gradient for water year 1991

X — Well cluster not measured in first quarter
U — Upward vertical gradient in second quarter
D — Downward vertical gradient in third quarter
0 — Indeterminant vertical gradient in fourth quarter
9 — Total number of water level measurements for well cluster in water year 1991

Containment system
- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

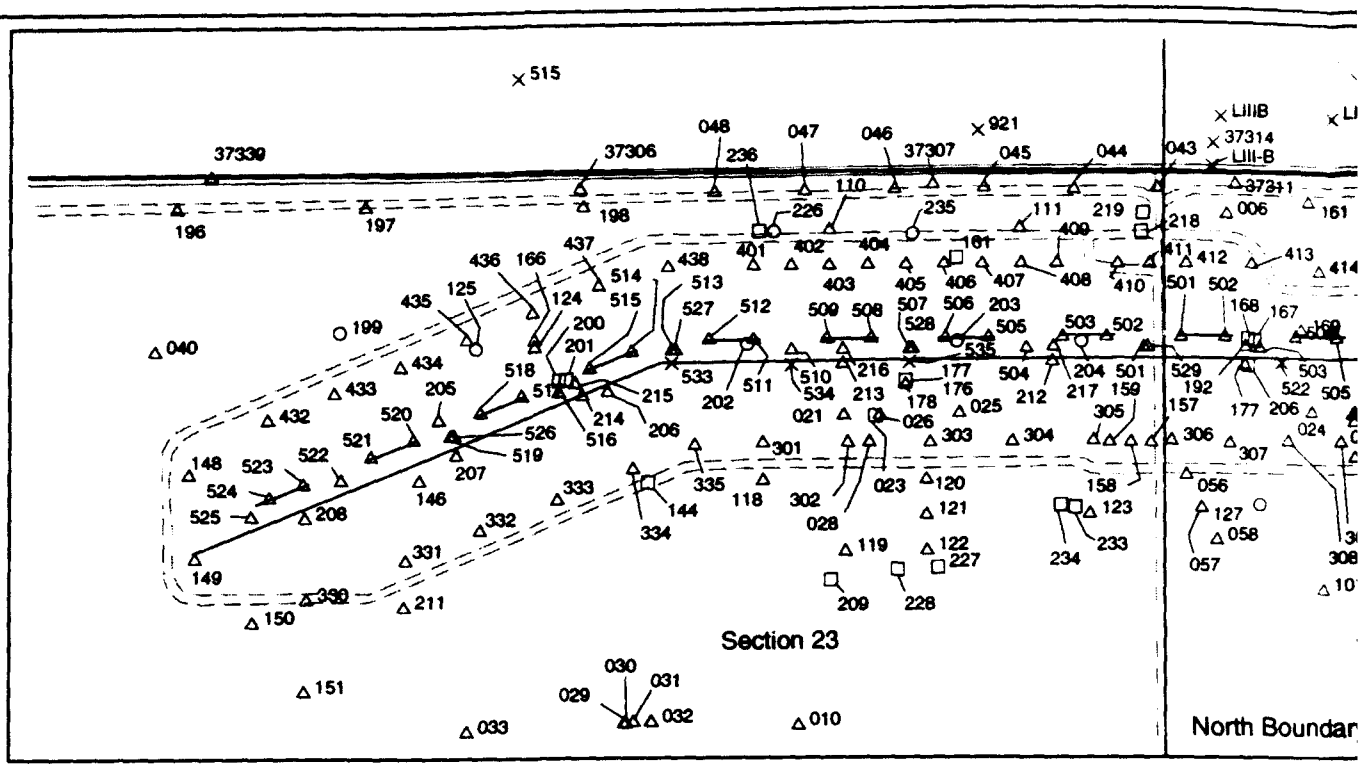
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Commerce City, Colorado
Prepared by:
Harding Lawson Associates

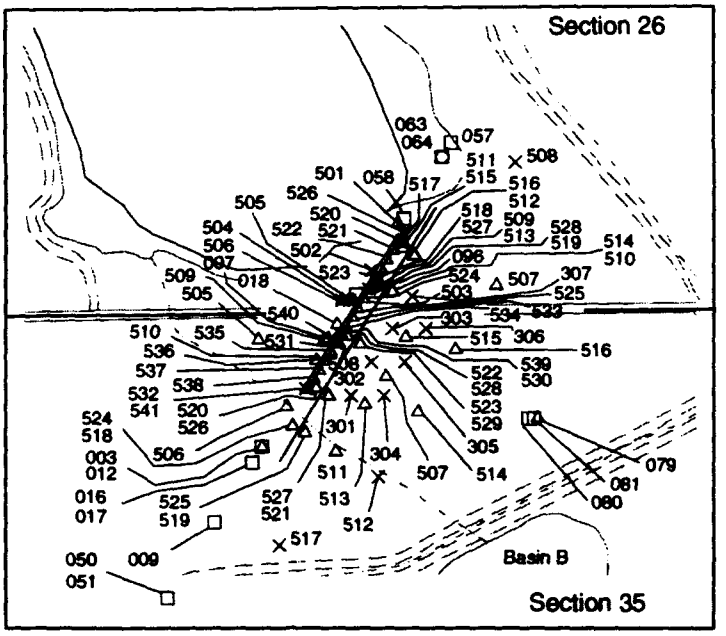
Figure 4.20

Approximate Vertical Gradient Direction between the Unconfined and Confined Flow Systems at Cluster Sites, October 1, 1990, to September 30, 1991

GWAR FY91

RMAVERTGRAD 9/8/92 JMJ

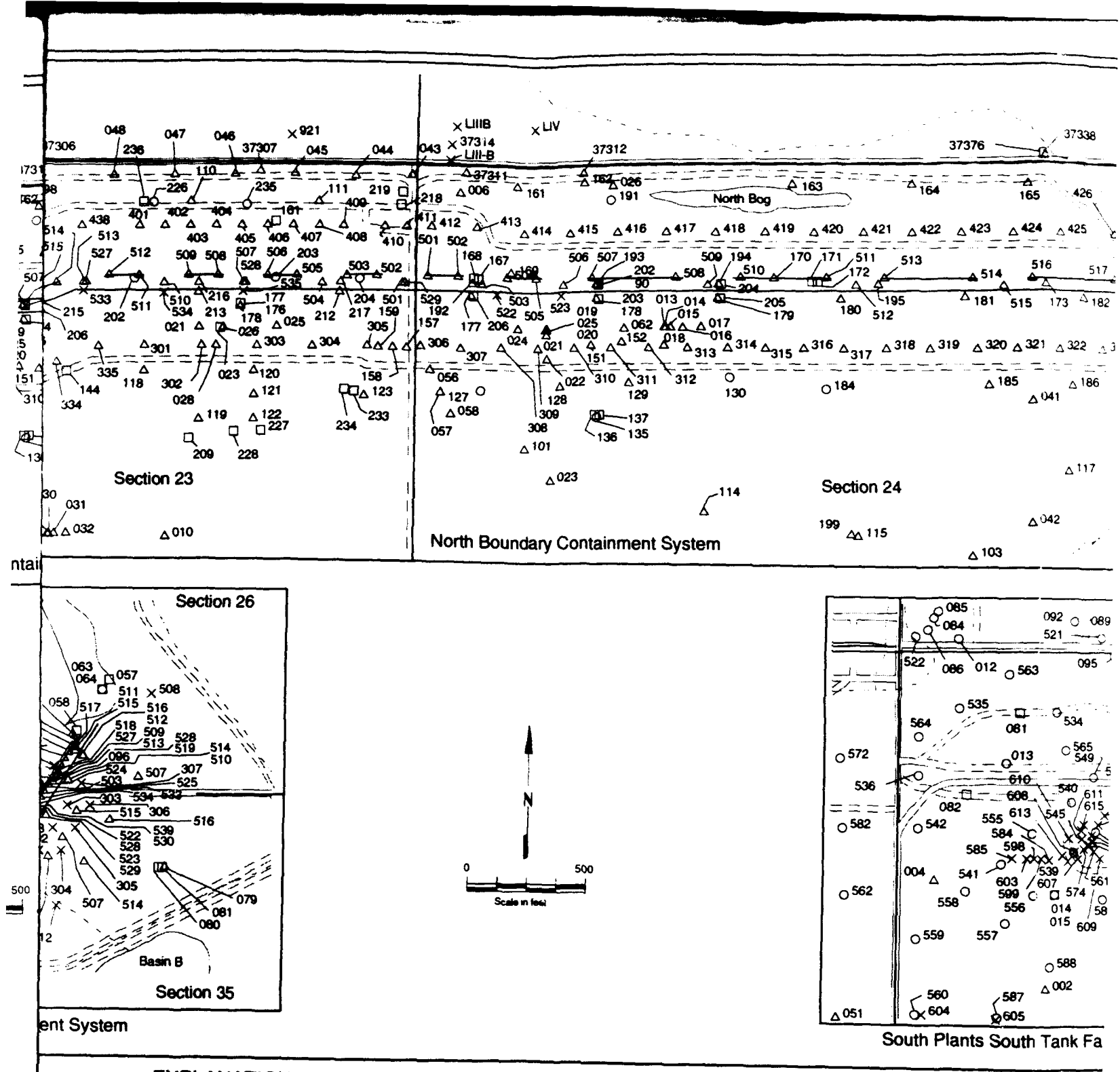




Basin A Neck Containment System

EXPLANATION

- Drainage
- Paved road
- Unpaved road
- △101 Alluvial well
- ○102 Unconfined Denver Formation well
- □103 Confined Denver Formation well
- ×104 Not classified (DP Associates, 1991)



EXPLANATION

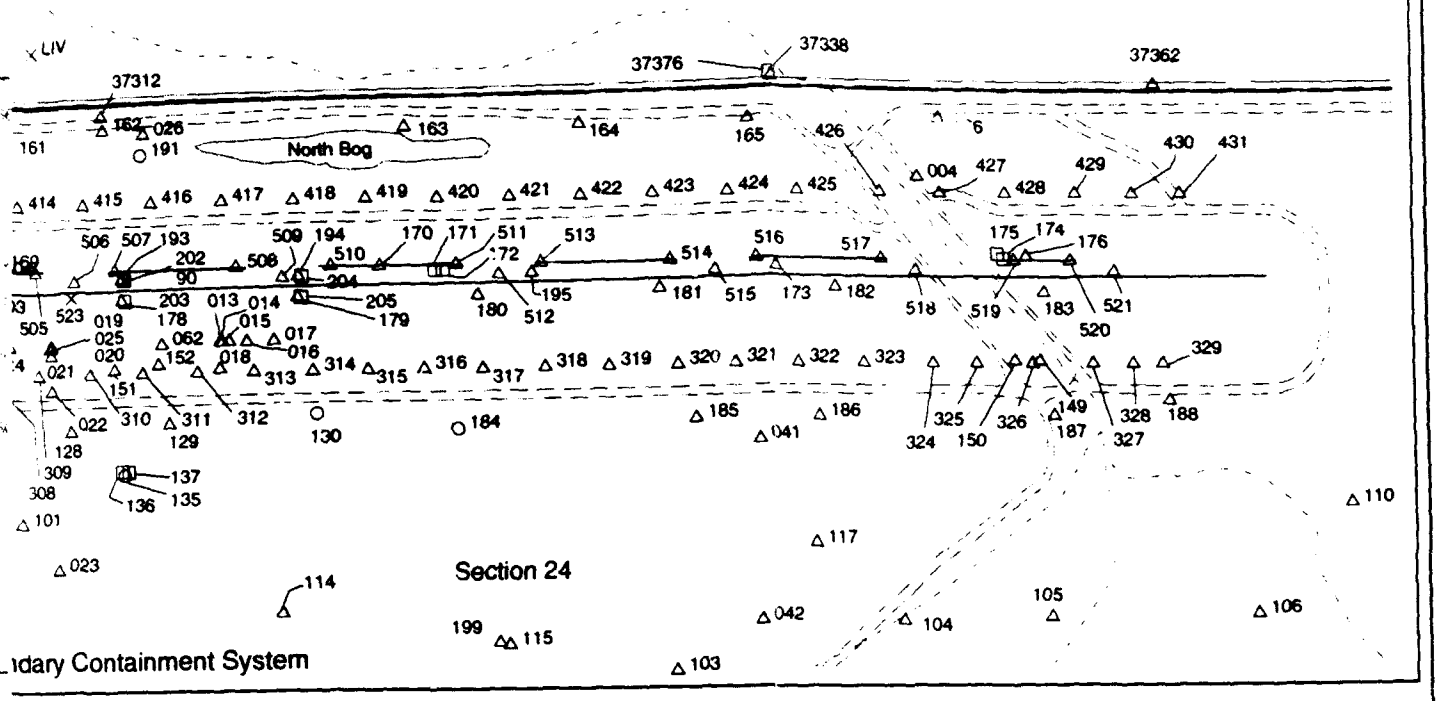
- △101 Alluvial well
- ○102 Unconfined Denver Formation well
- □103 Confined Denver Formation well
- ×104 Not classified (DP Associates, 1991)

Containment System

- Physical barrier
- Hydraulic barrier
- Recharge trenches (Basin A Neck)
- Recharge trenches
- Physical Barrier

(1) (2)

Prep
Prep
Figu
Well
Cont
Cont
Plan
GWA



dary Containment System

South Plants South Tank Farm

Containment System

Physical barrier

Hydraulic barrier

Recharge trenches (Basin A Neck)

Recharge trenches

Physical Barrier

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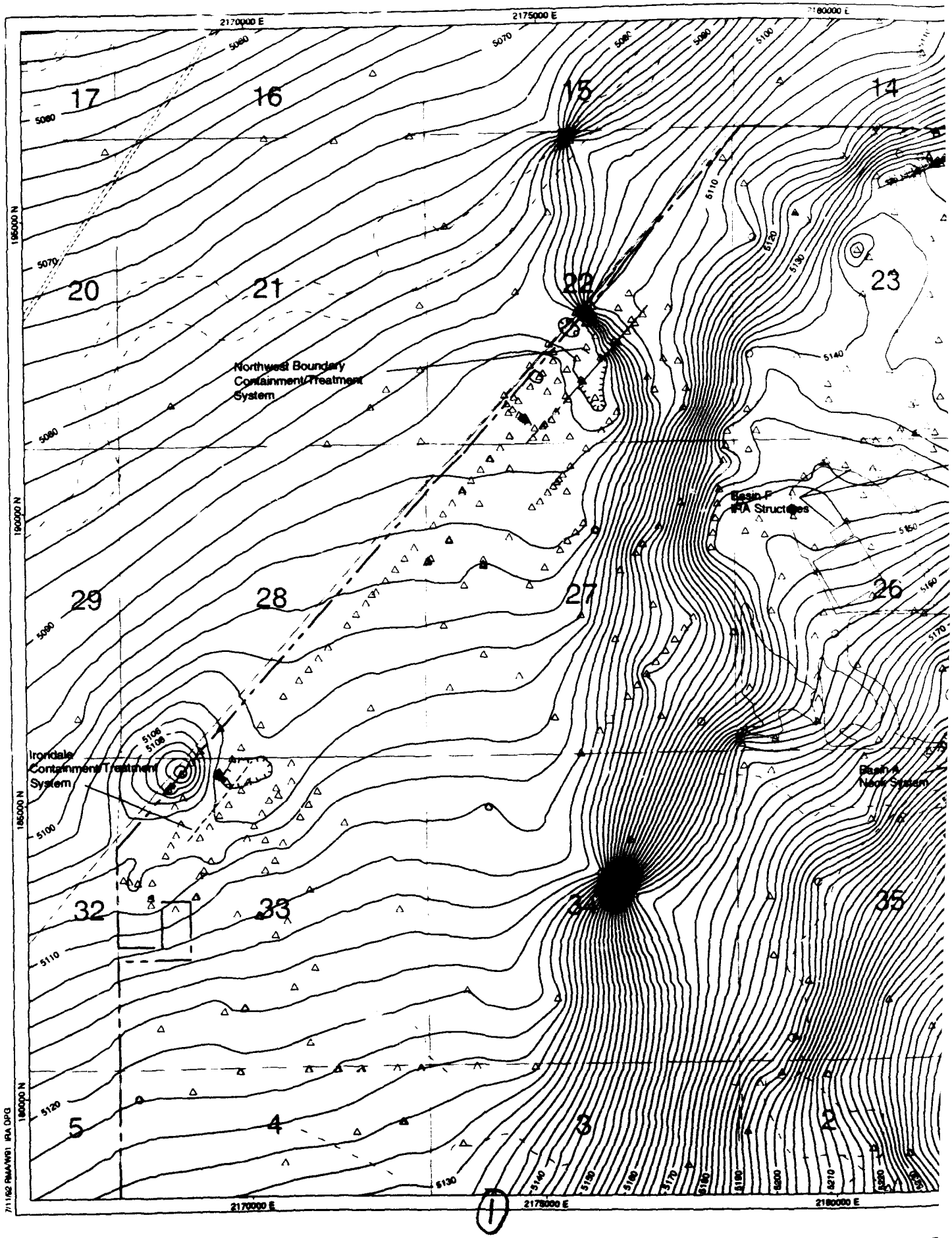
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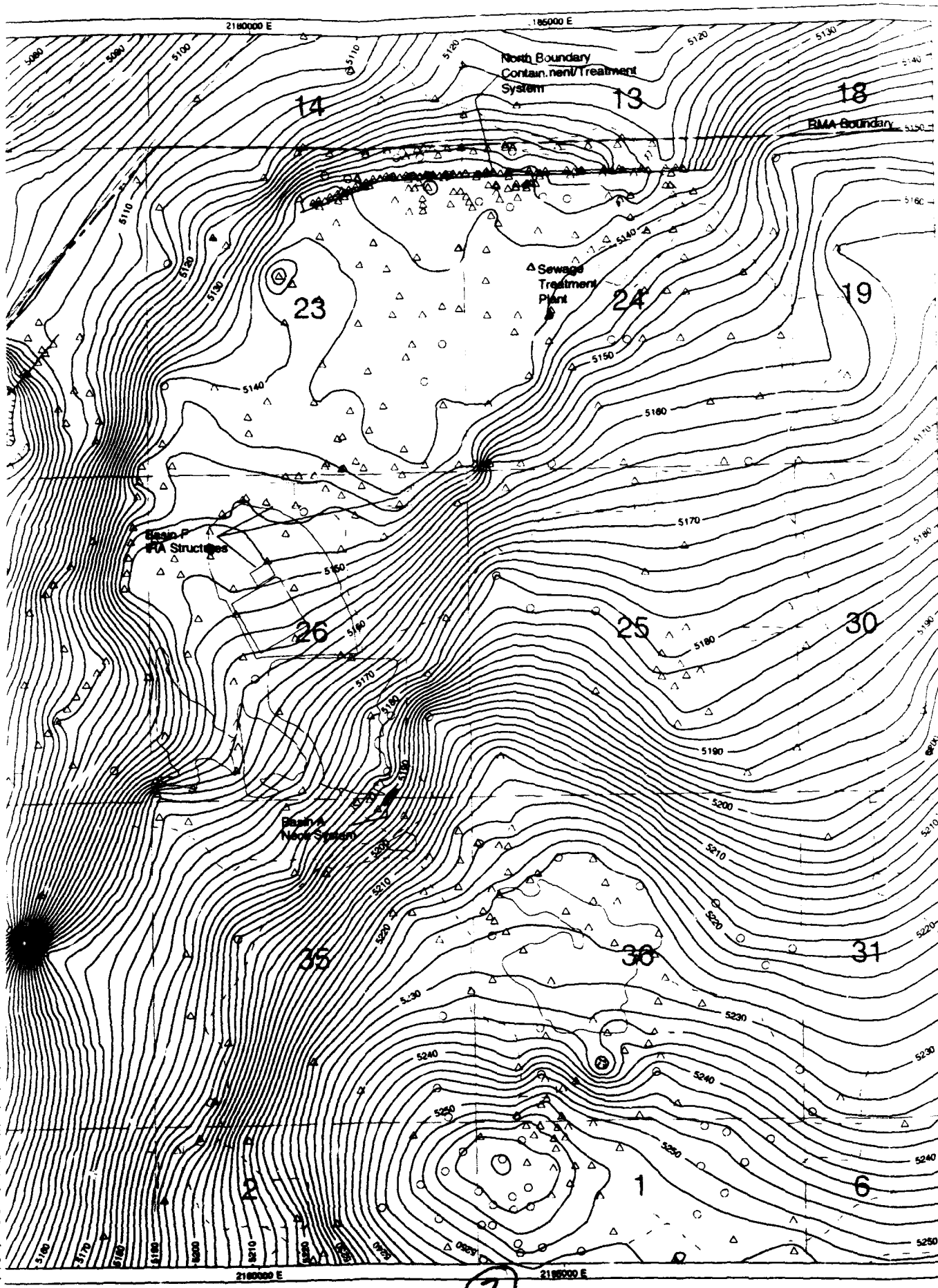
Prepared by:

Harding Lawson Associates

Figure 5.1
Well Location Maps for the North Boundary Containment System, Basin A Neck Containment System, And South Plants South Tank Farm

GWAR FY91


2170000 E
2175000 E
2180000 E
195000 N
190000 N
185000 N
180000 N
17
16
15
14
20
21
22
23
29
28
27
26
32
33
34
35
5
4
3
2
Northwest Boundary
Containment/Treatment
System
Irondale
Containment/Treatment
System
Basin F
IRA Structures
Basin A
Neck System
7/11/92 RMA/WI91 IRA DPG



Cont

Water-le
(water le
to Febru

Well or piezo
water-level e

Alluvi
Unco

Contour inter
Datum mean

Prepared for:

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Rocky M
Comme

Prepared by:

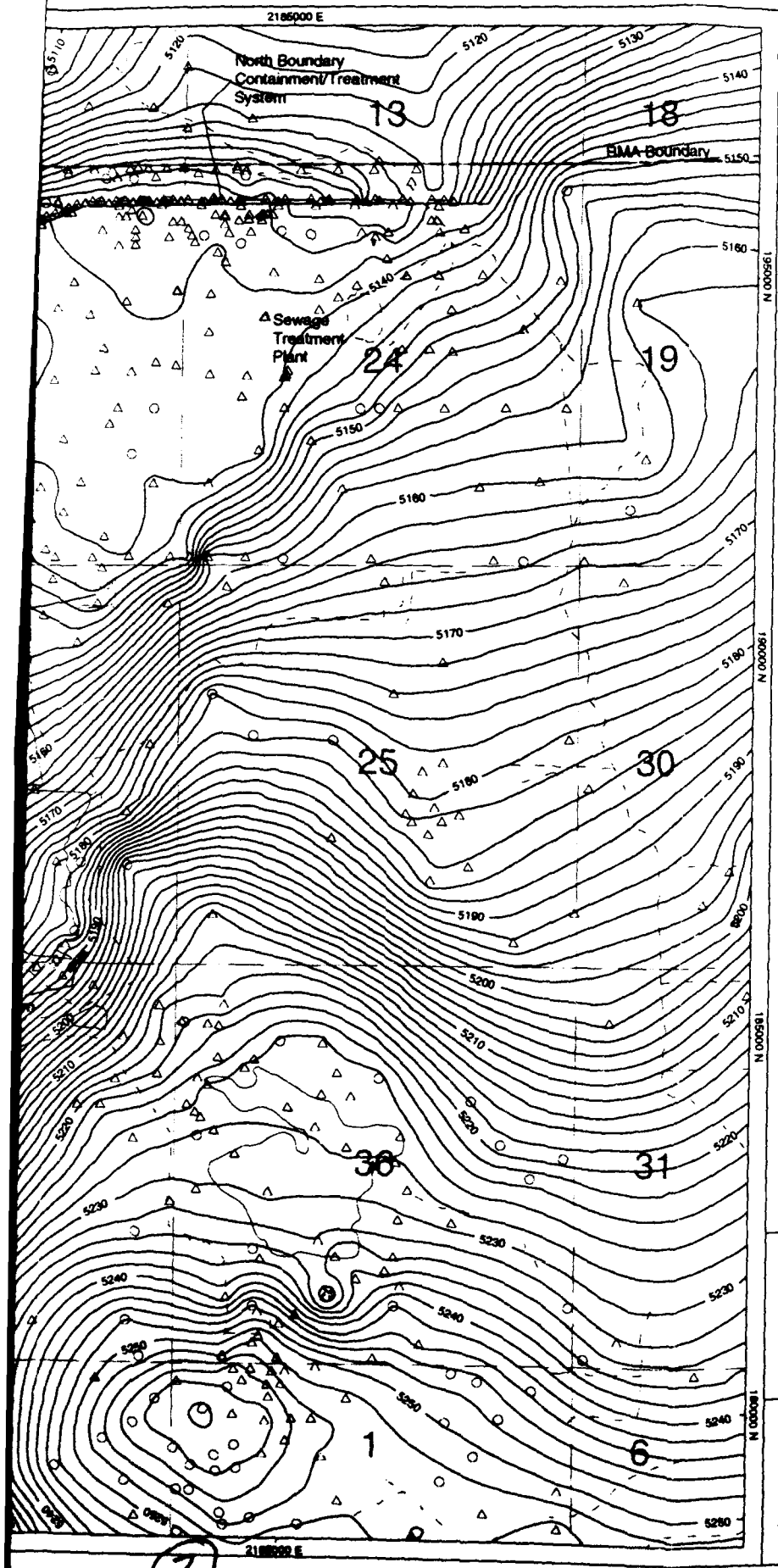
Hardin

Figure 5.2

Unconfined Flo
Elevation Map
Areas, Winter 1

GWAR FY91

(2)



EXPLANATION

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

5170 — Water-level elevation contour (water levels measured from January 23, 1991, to February 4, 1991)

Well or piezometer location yielding water-level elevation:

- △ Alluvial
- ○ Unconfined Denver Formation

Contour interval equals 2 feet
Datum mean sea level

N

0 2000

Scale in feet

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

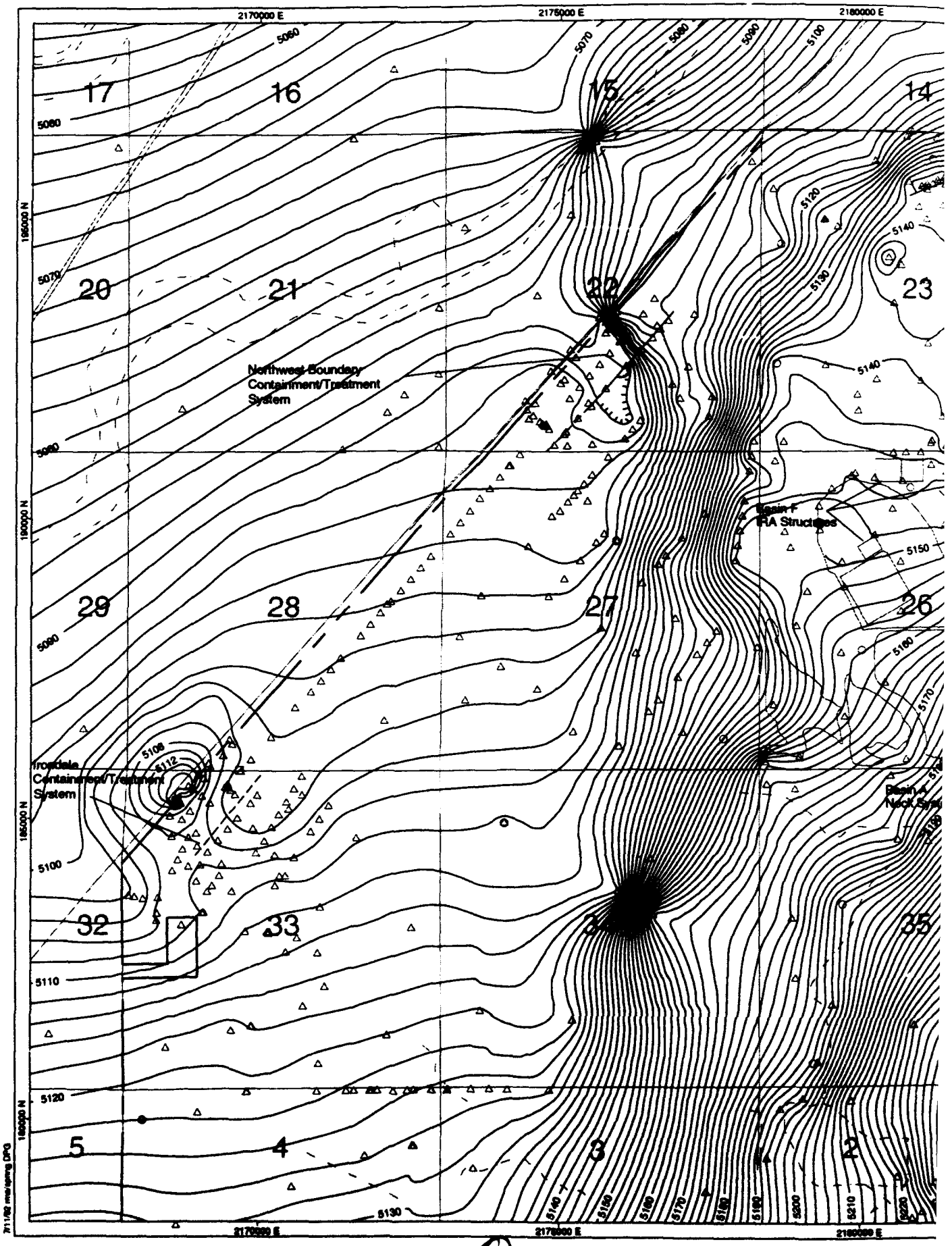
Prepared by:

Harding Lawson Associates

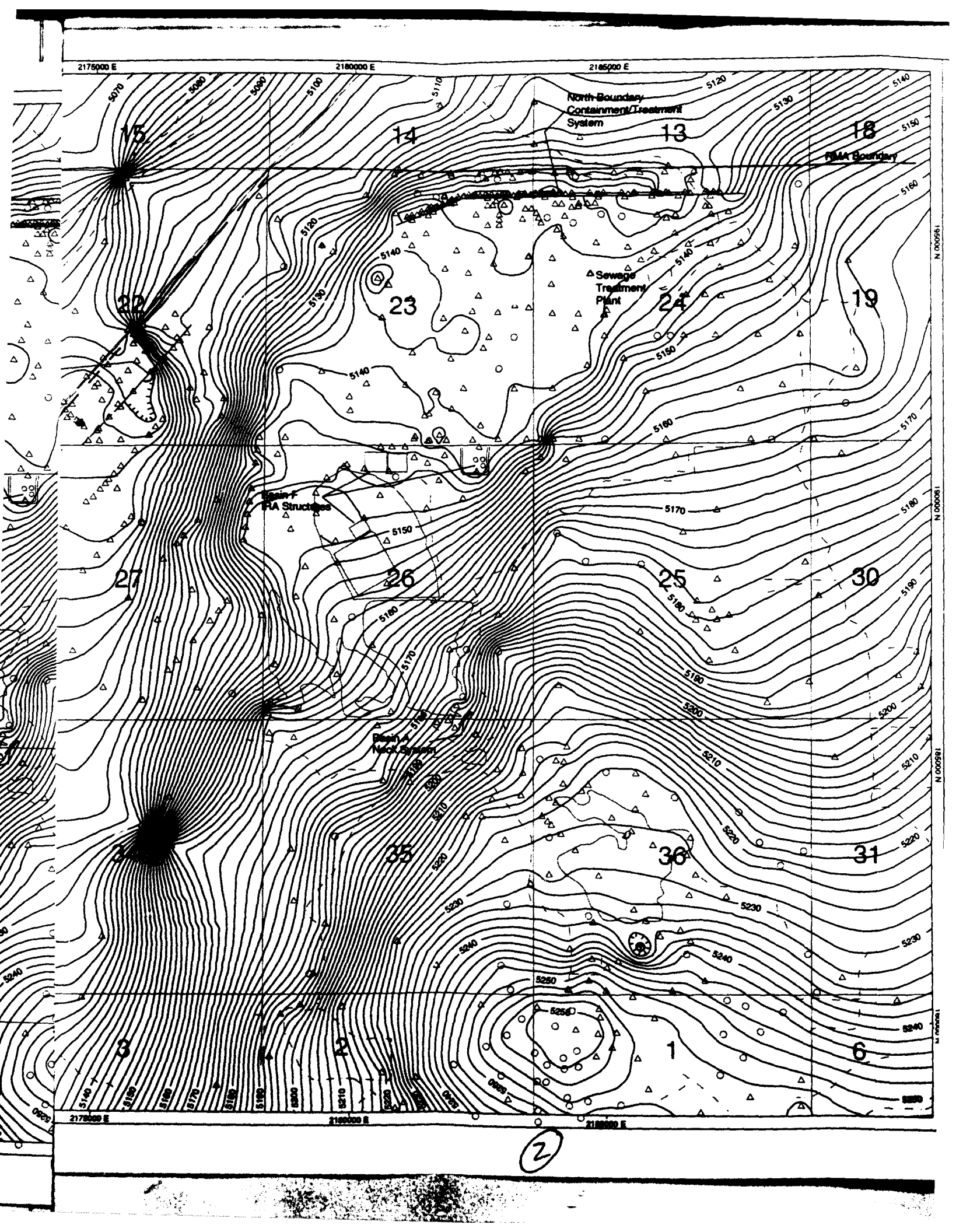
Figure 5.2

Unconfined Flow System Water-Table Elevation Map of the Interim Response Action Areas, Winter 1990/1991

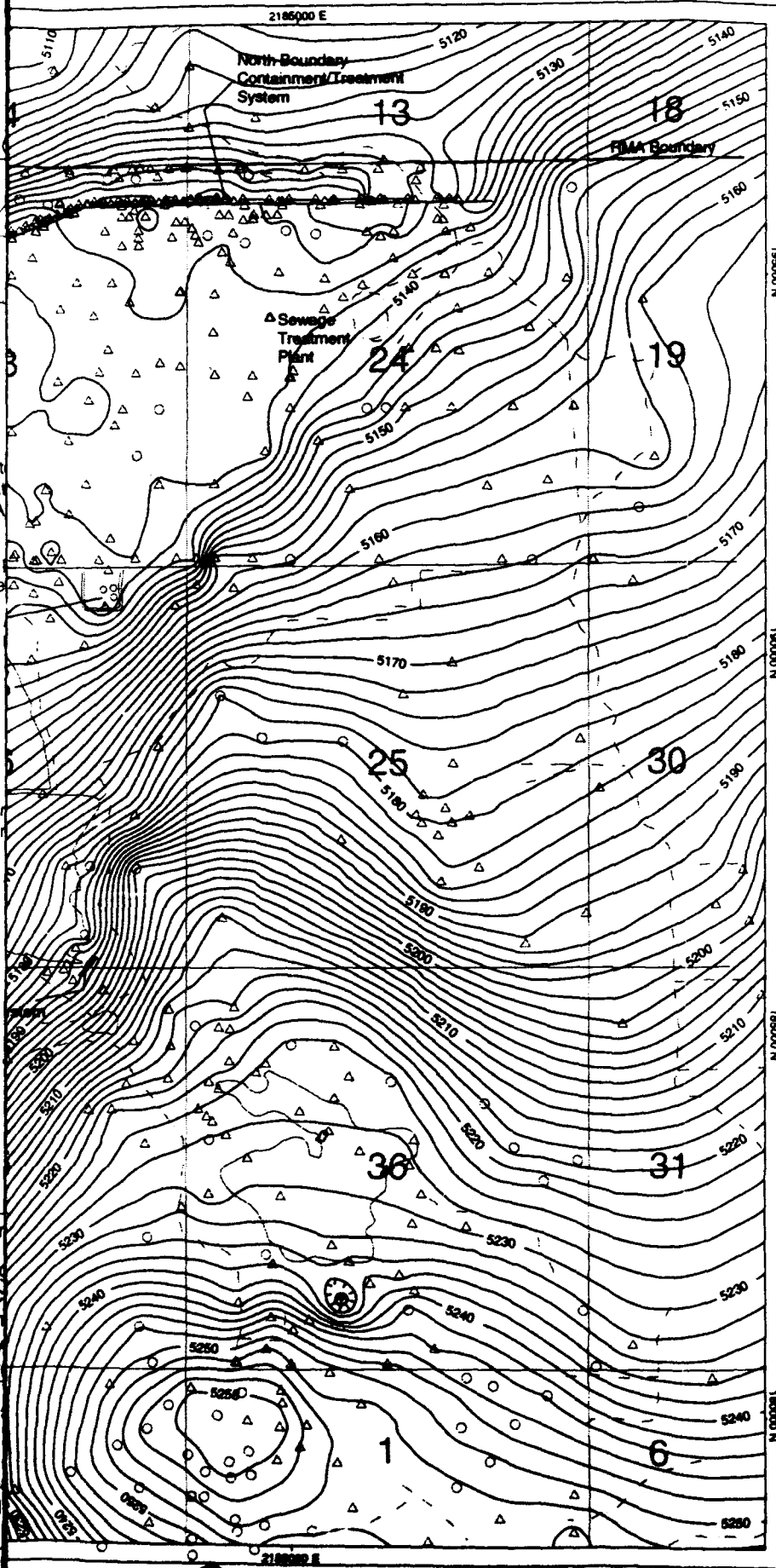
GWAR FY91


2170000 E
2175000 E
2180000 E
185000 N
190000 N
195000 N
17
16
15
14
20
21
22
23
29
28
27
26
32
33
34
35
5
4
3
2
Northwest Boundary
Containment/Treatment
System
Irondale
Containment/Treatment
System
Basin F
RA Structures
5060
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5108
5112

(1)


2175000 E
2180000 E
2185000 E
North Boundary Containment/Treatment System
RMA Boundary
Sewage Treatment Plant
Basin F RIA Structures
Basin A Neck System
15
14
13
18
22
23
24
19
27
26
25
30
34
35
36
31
3
2
1
6
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260
N 190000
N 185000
2175000 E
2180000 E
2185000 E

(2)



EXPLANATION

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

5170 Water-level elevation contour (water levels measured from April 1,1991, to April 9, 1991)

Well or piezometer location yielding water-level elevation:

- △ Alluvial
- ○ Unconfined Denver Formation

Contour interval equals 2 feet
Datum mean sea level

N

0 2000

Scale in feet

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Harding Lawson Associates

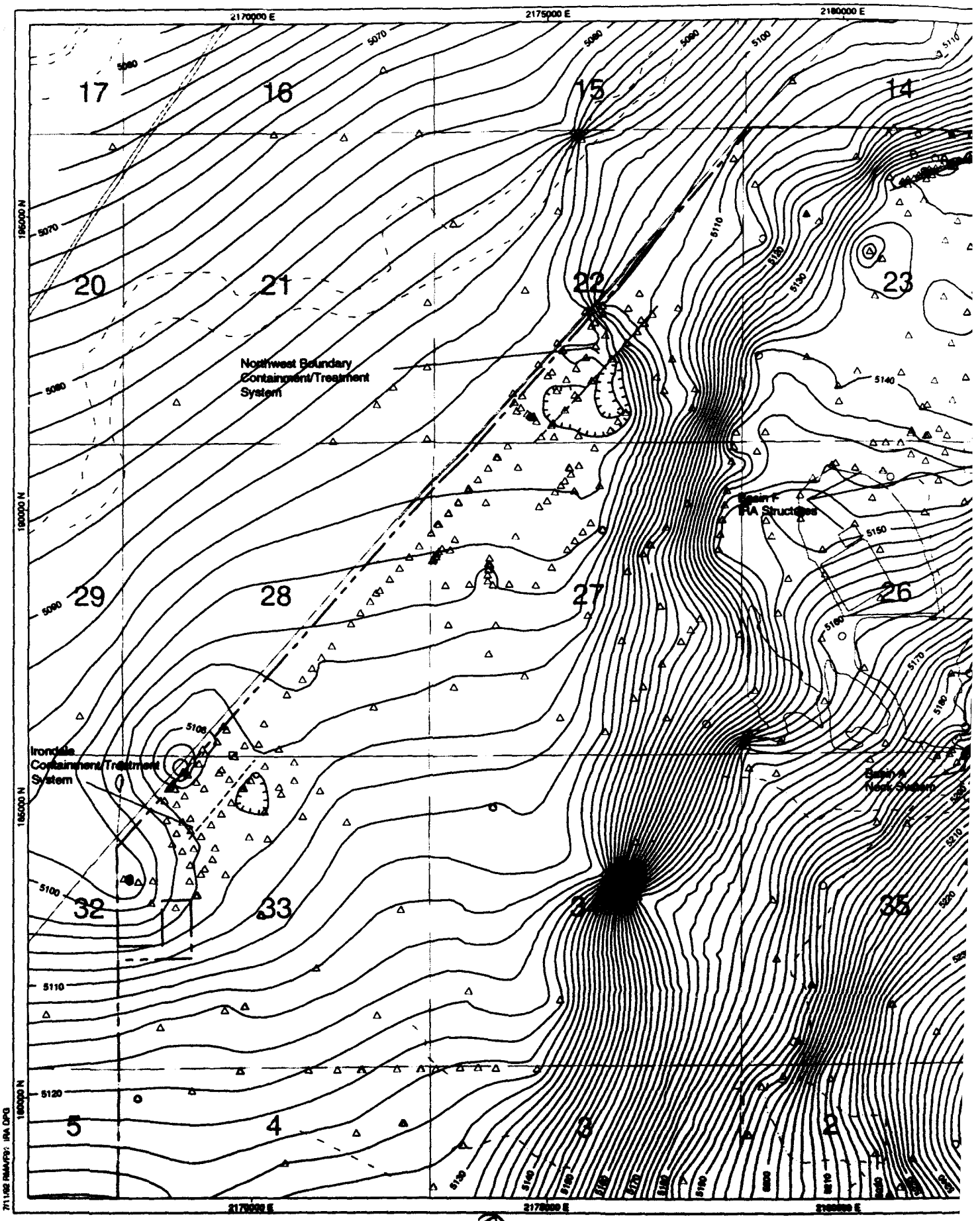
Figure 5.3

Unconfined Flow System Water-Table Elevation Map of the IRA Areas, Spring 1991

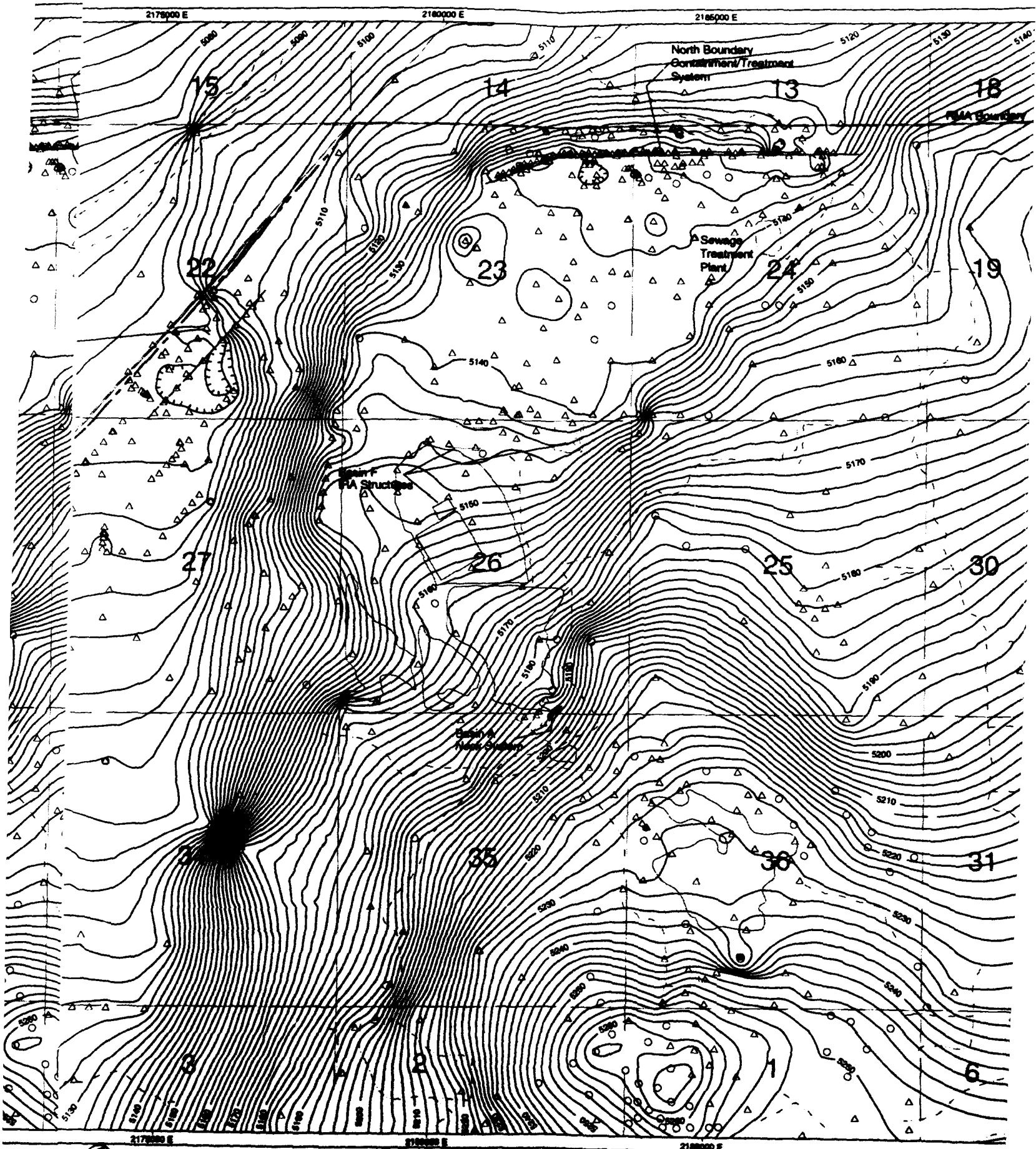
GWAR FY91

(2)

(3)

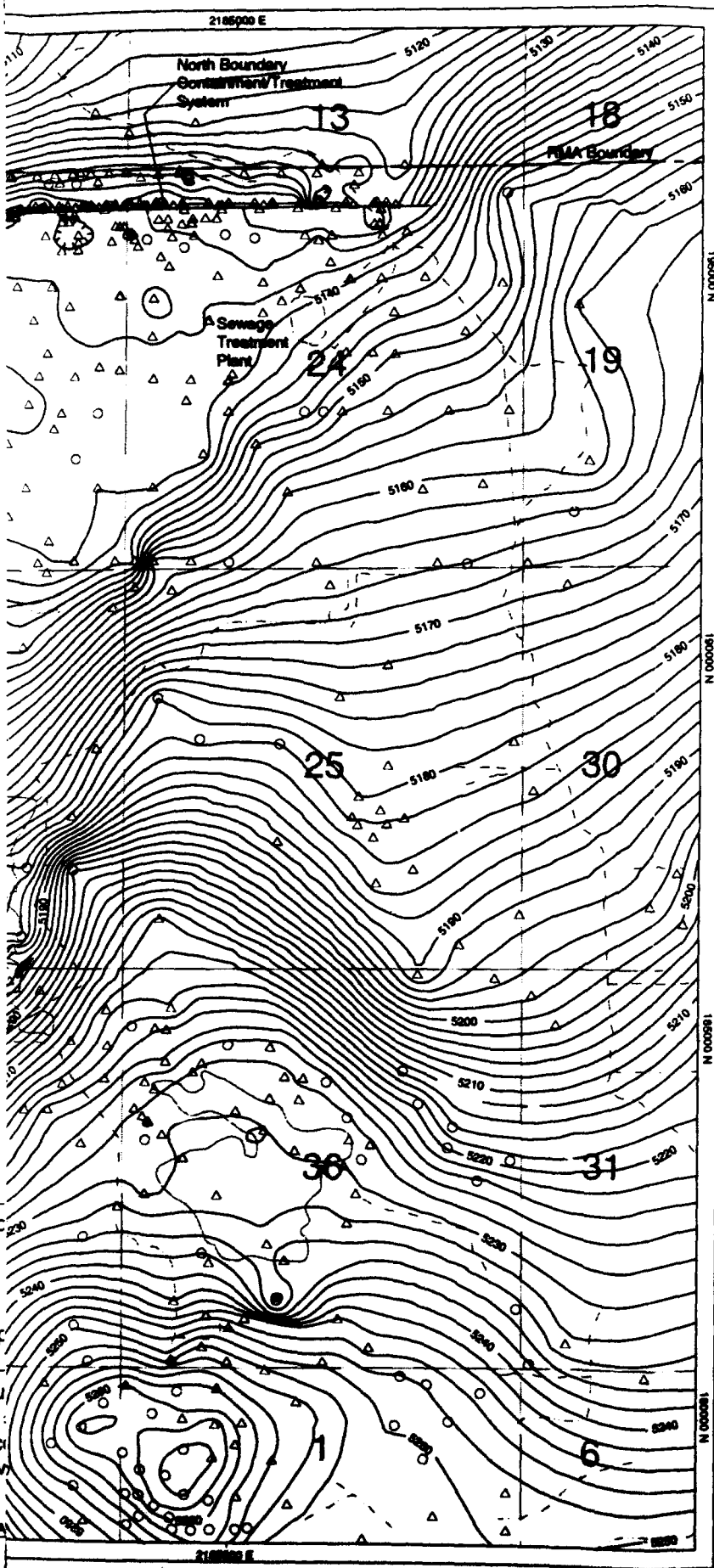

2170000 E
2175000 E
2180000 E
195000 N
190000 N
185000 N
180000 N
17
16
15
14
20
21
22
23
29
28
27
26
32
33
34
35
5
4
3
2
Northwest Boundary
Containment/Treatment
System
Irondale
Containment/Treatment
System
Basin F
IRA Structures
Basin A
Neck System
5070
5080
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
7/11/96 RMA/PSI: IRA.DPG

(1)


2179000 E
2180000 E
2185000 E
North Boundary
Containment/Treatment
System
PIAA Boundary
Sewage
Treatment
Plant
Basin F
PIA Structural
Basin A
Water Treatment
15
14
13
18
22
23
24
19
27
26
25
30
35
36
31
3
2
1
6
5090
5100
5110
5120
5130
5140
5150
5160
5170
5180
5190
5200
5210
5220
5230
5240
5250
5260
5270
5280
5290
5300

(1)

(2)



EXPLANATION

Containment system

- Physical barrier
- Hydraulic barrier
- Recharge trenches
- Barrier wall

5170 Water-level elevation contour (water levels measured from September 16, 1991, to September 27, 1991)

Well or piezometer location yielding water-level elevation:

- △ Alluvial
- ○ Unconfined Denver Formation

Contour interval equals 2 feet
Datum mean sea level

N

0 2000

Scale in feet

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Harding Lawson Associates

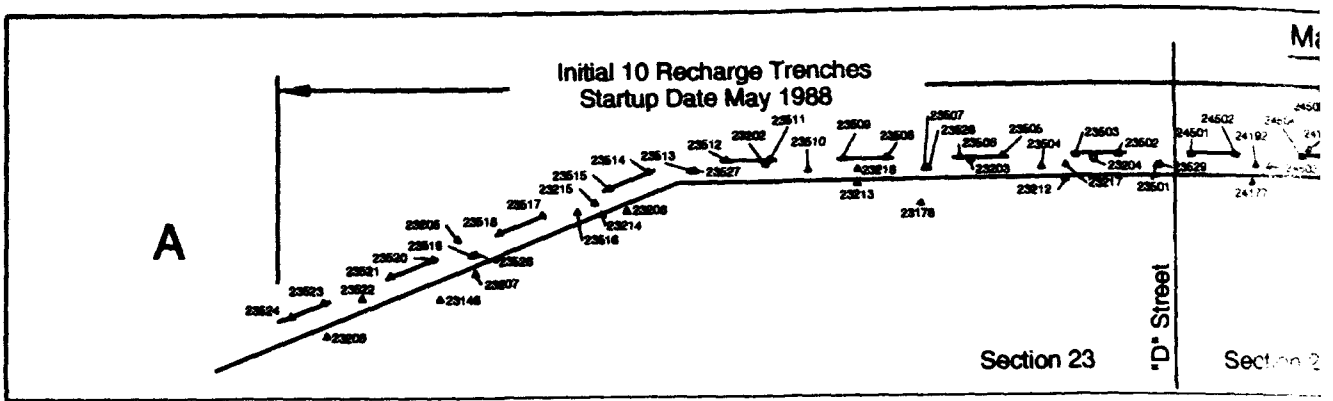
Figure 5.4

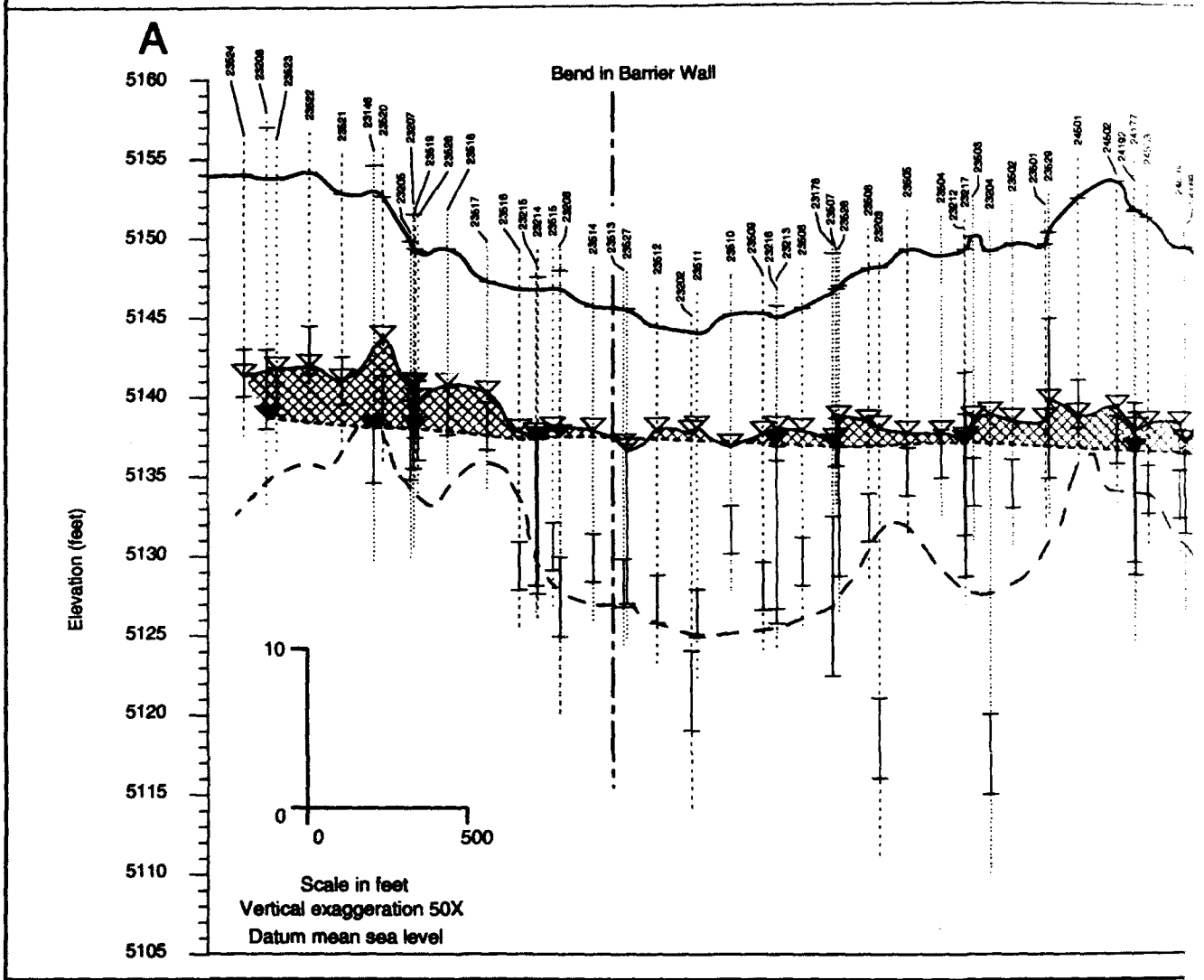
Unconfined Flow System Water-Table Elevation Map of the IRA Areas, Fall 1991

GWAR FY91

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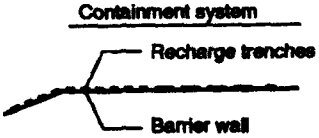




EXPLANATION

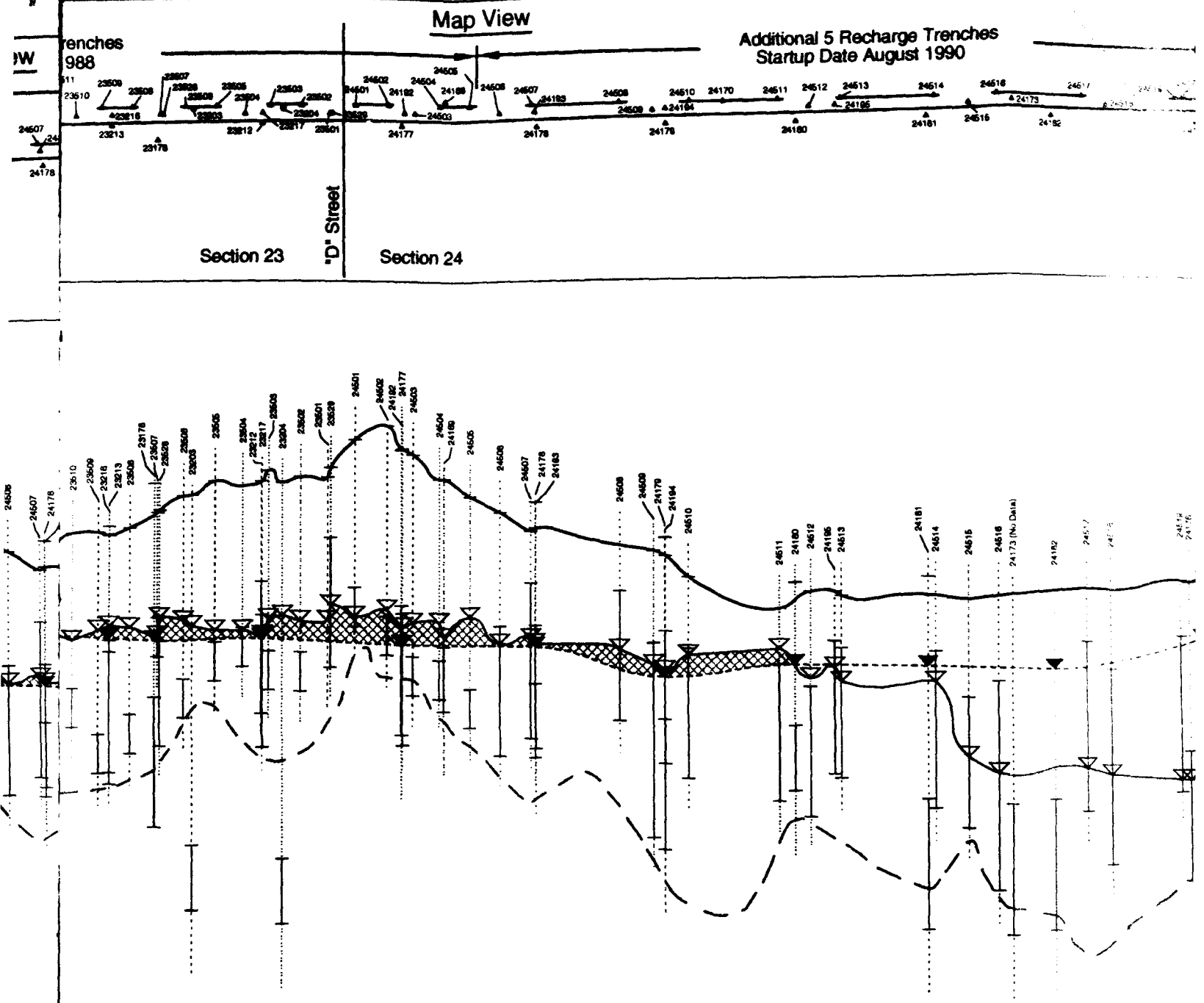
- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987, plate G-04)
- Water-level elevation upgradient (south) of barrier wall
- Water-level elevation downgradient (north) of barrier wall
- Water-level elevation marker north of barrier wall
- Water-level elevation marker south of barrier wall
- Alluvial well
- Unconfined Denver Formati

Containment system



7/11/88 mr/sect1 DPG

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EXPLANATION

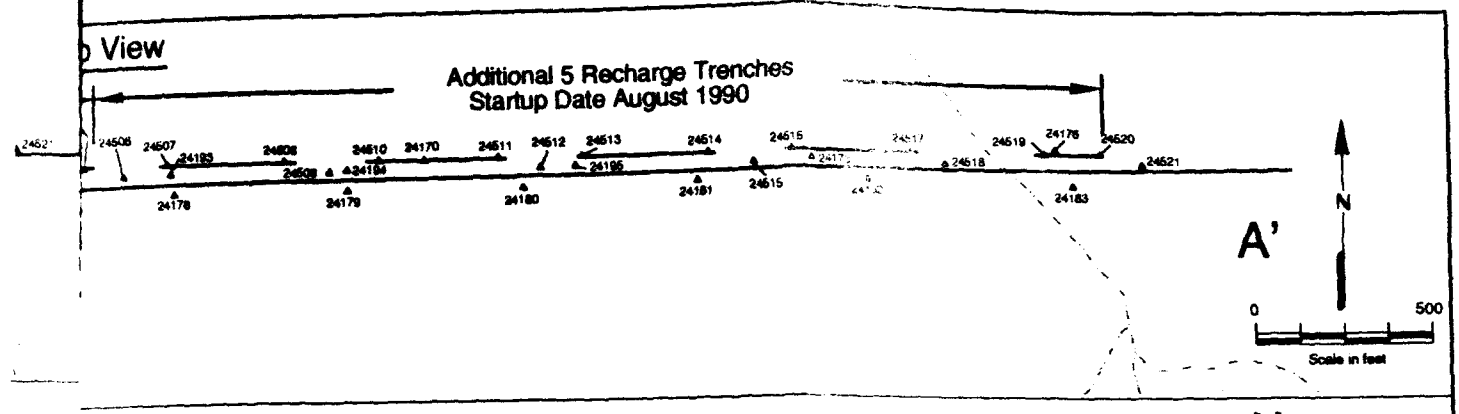
- Alluvial well
- Unconfined Denver Formation well
- Containment system
  - Recharge trenches
  - Barrier wall
- Well number
- Ground surface (south of the barrier wall)
- Ground surface (north of the barrier wall)
- Cased interval
- Screened interval
- Cased interval

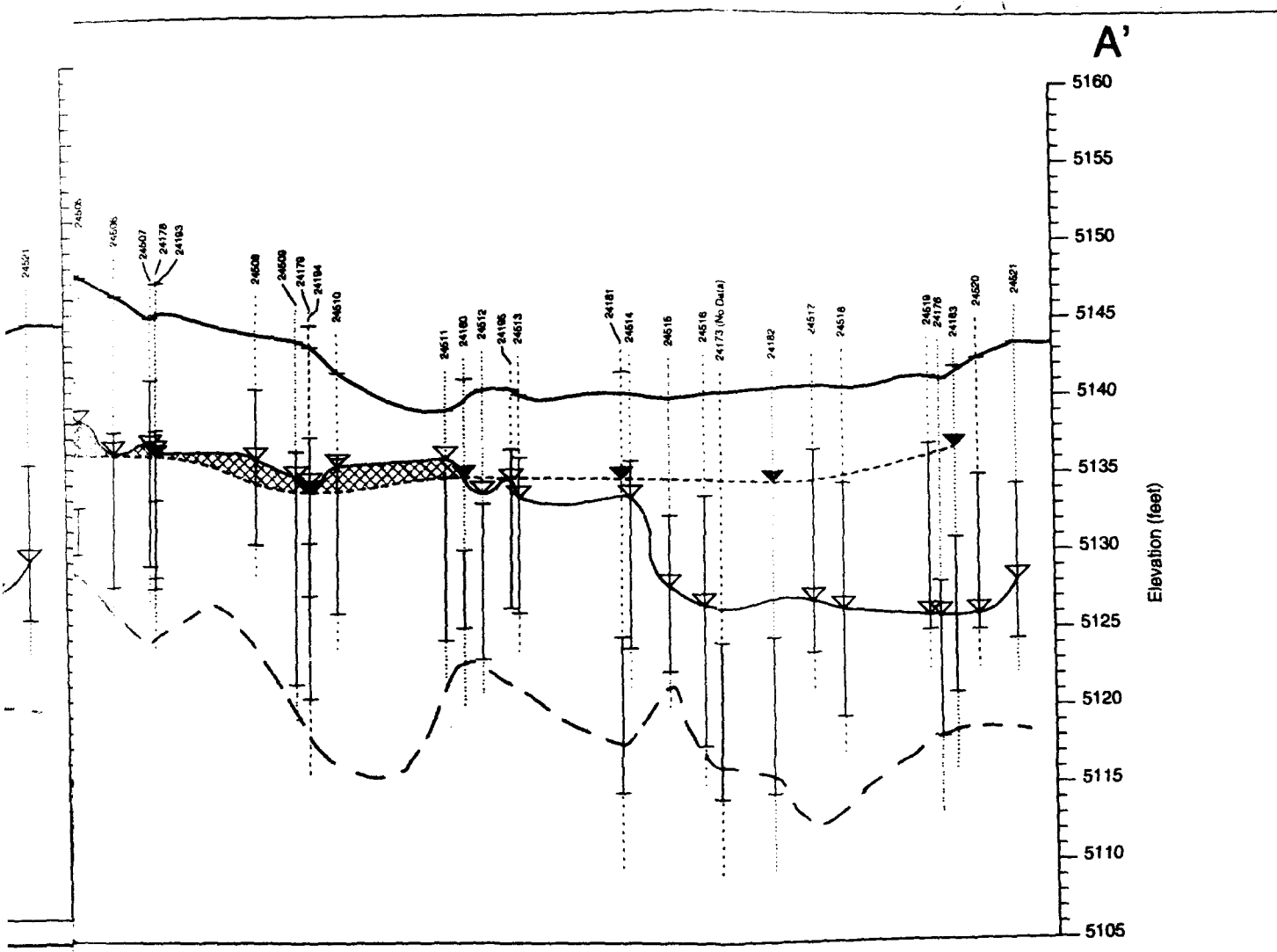
Prepared for:
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Prepared by:
Harding Law

Figure 5.5
Cross Section of Apr
Elevations at the No
Treatment System fr
December 31, 1990

CMP GWAR FY91





Well number
Ground surface (south of the barrier wall)
Ground surface (north of the barrier wall)
Cased interval
Screened interval
Cased interval

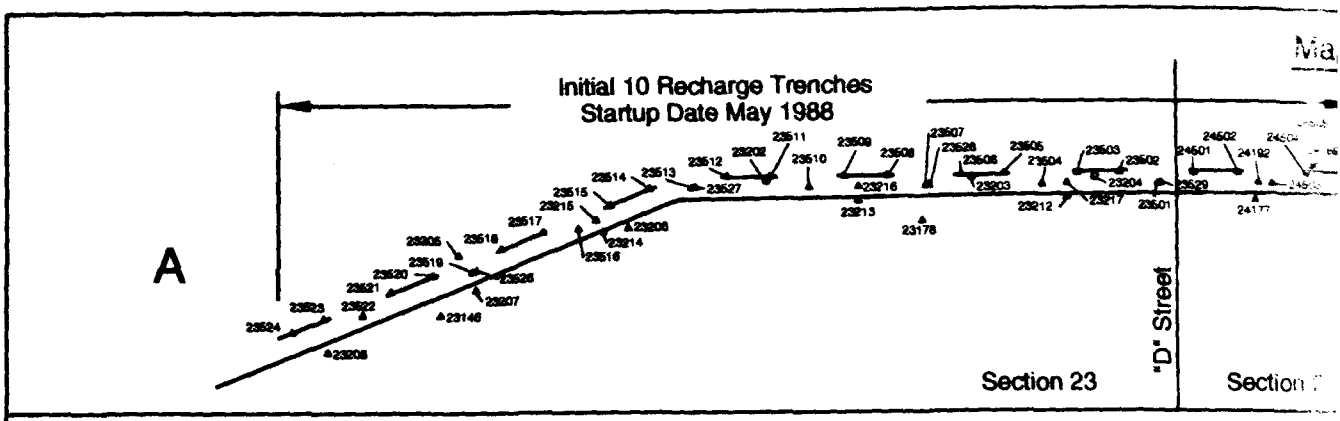
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

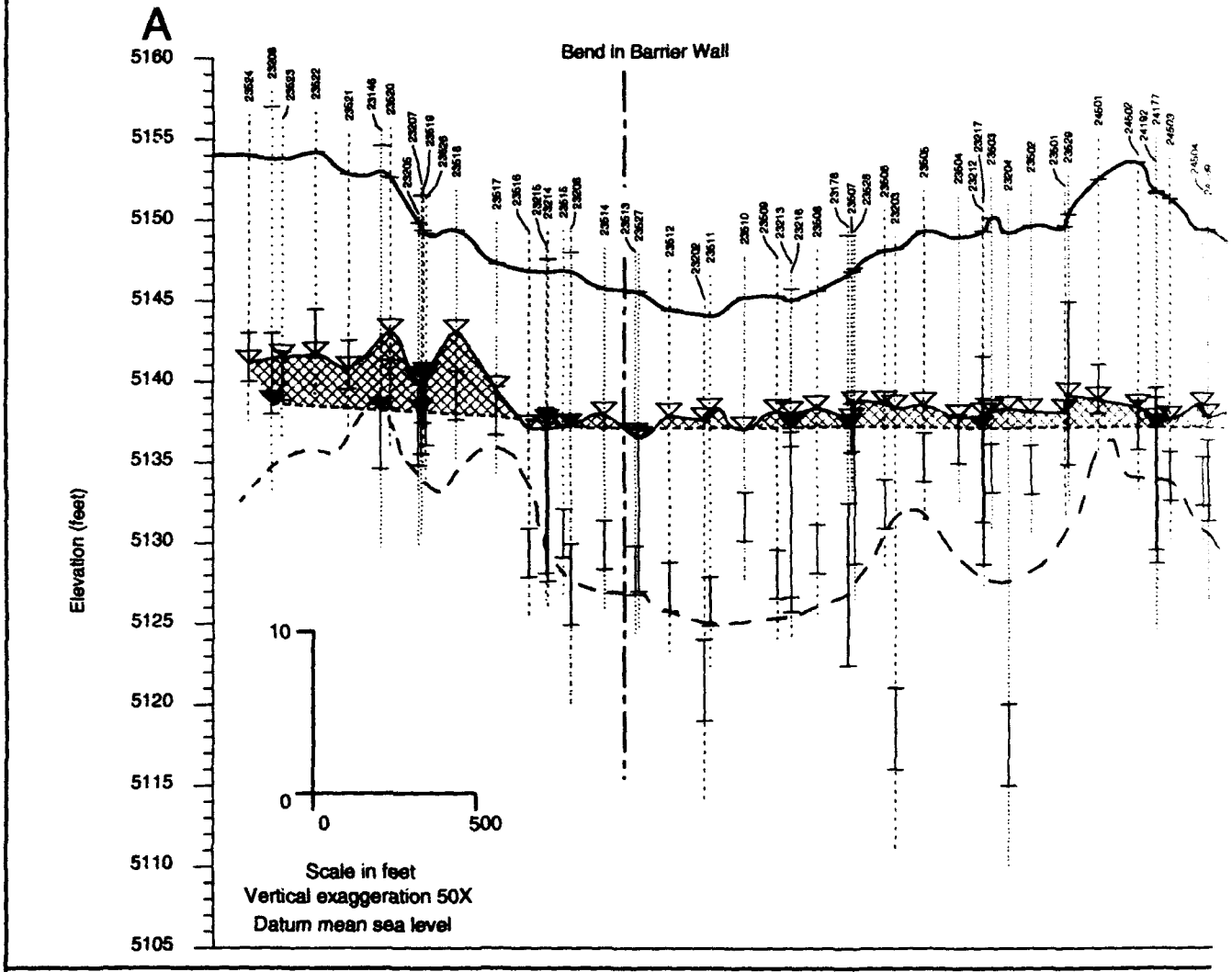
Figure 5.5
Cross Section of Approximate Water-Table Elevations at the North Boundary Containment/ Treatment System from October 1 to December 31, 1990

CMP GWAR FY91

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EXPLANATION

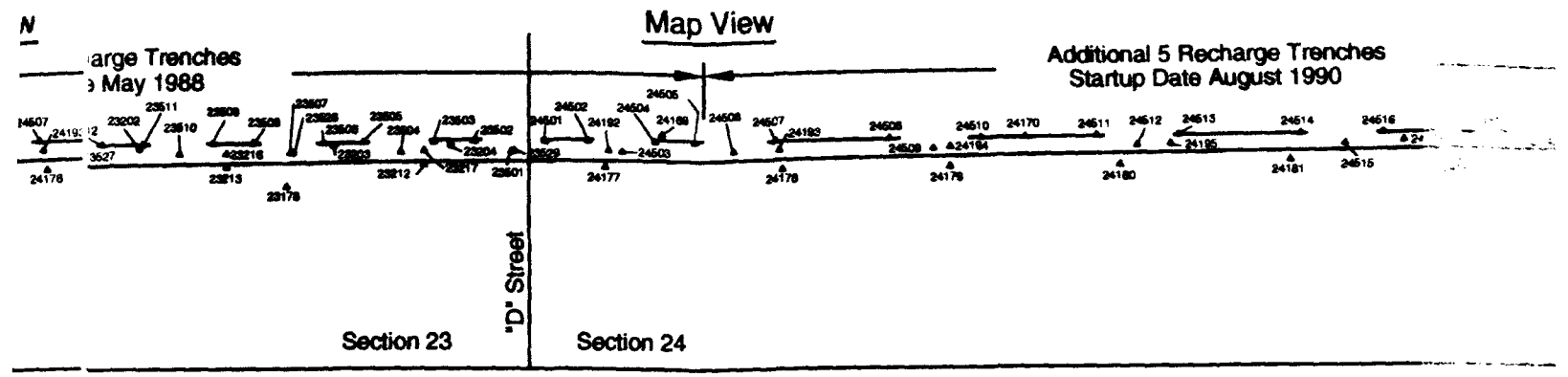
- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987, plate G-04)
- Water-level elevation upgradient (south) of barrier wall
- Water-level elevation downgradient (north) of barrier wall
- Water-level elevation marker north of barrier wall
- Water-level elevation marker south of barrier wall

- Alluvial well
- Unconfined Denver Formatic

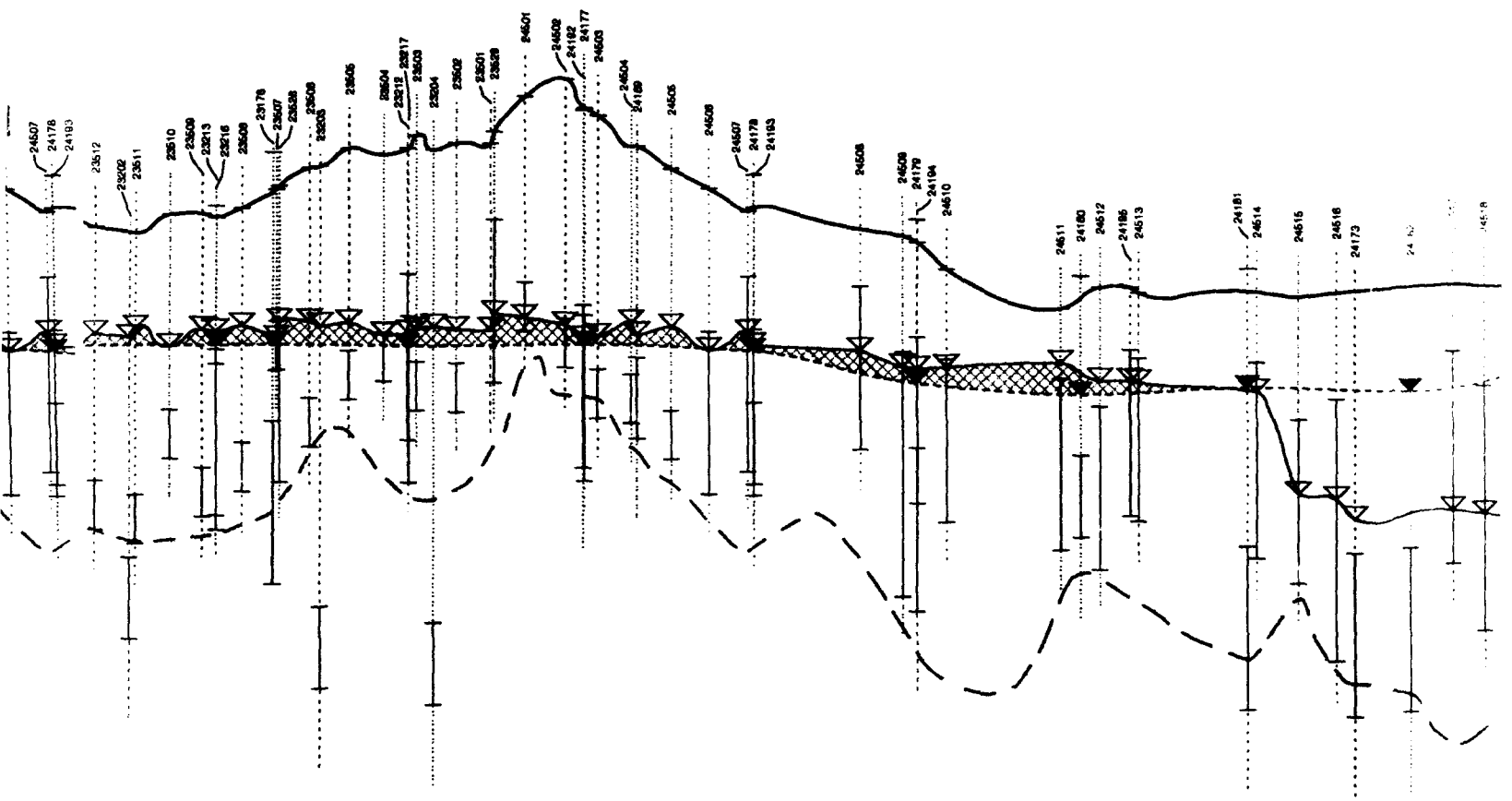
Containment system
- Recharge trenches
- Barrier wall

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rrier Wall



EXPLANATION

- Alluvial well
- Unconfined Denver Formation well

Containment system
- Recharge trenches
- Barrier wall

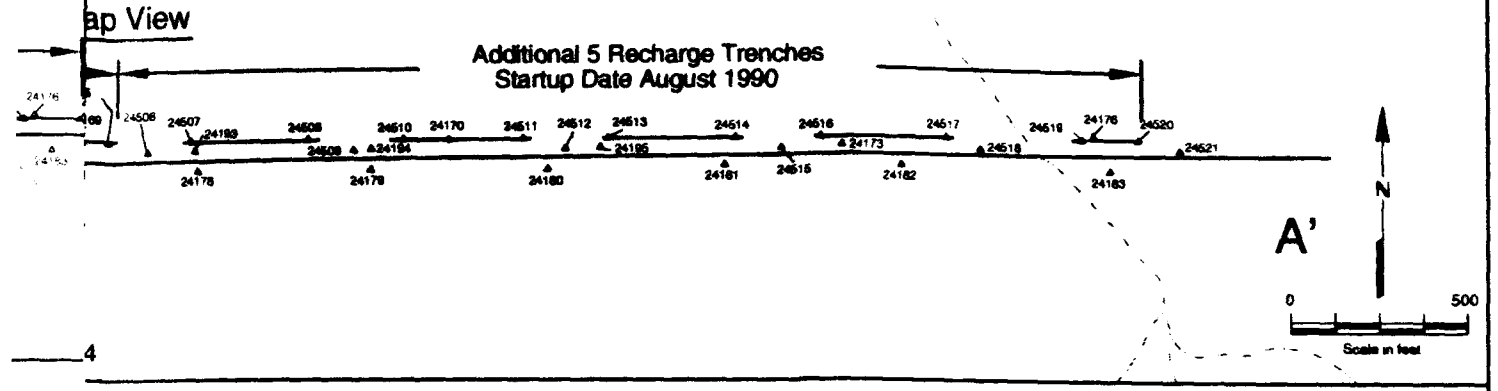
- Well number
- Ground surface (south of the barrier wall)
- Ground surface (north of the barrier wall)
- Cased interval
- Screened interval
- Cased interval

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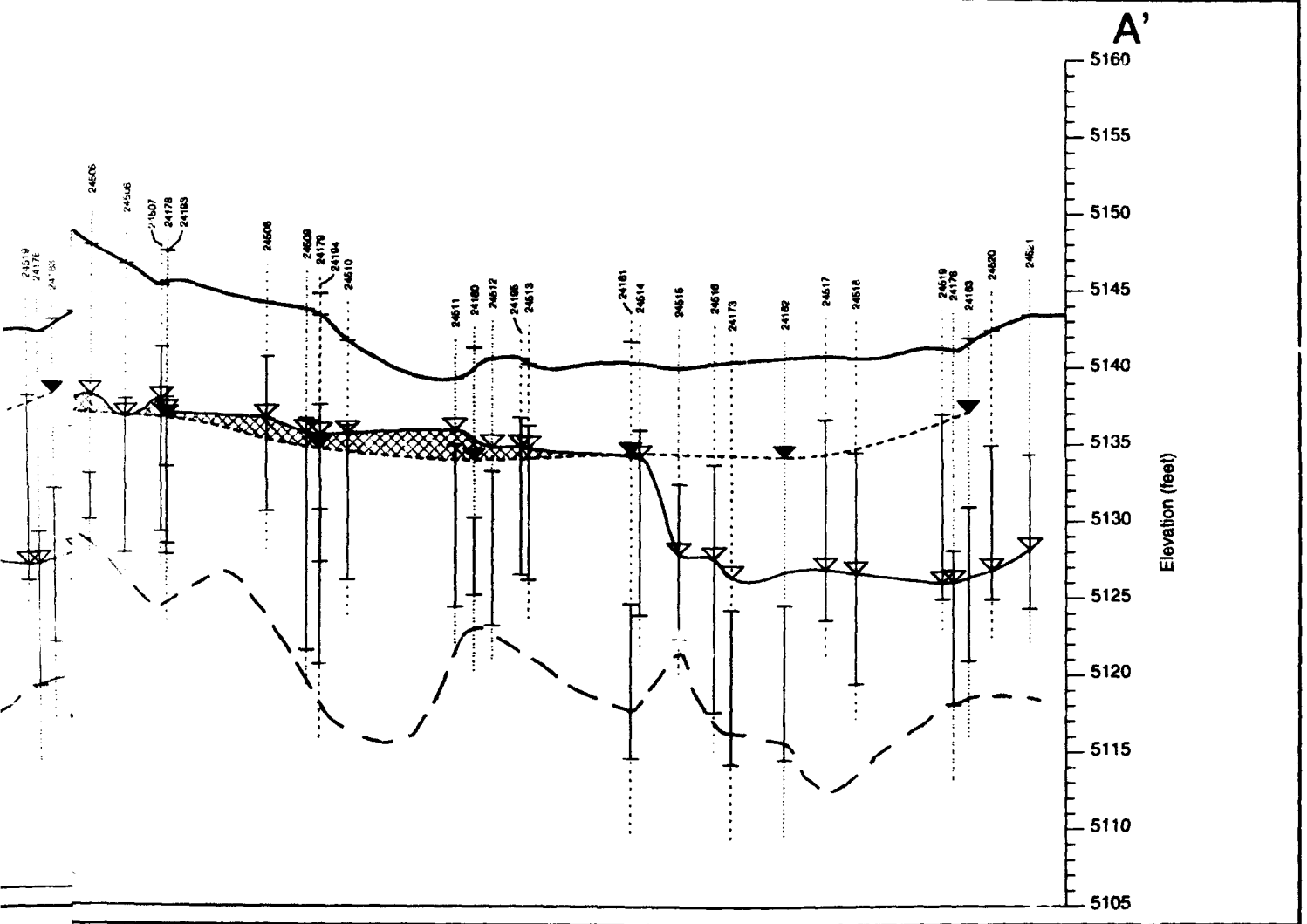
Figure 5.6
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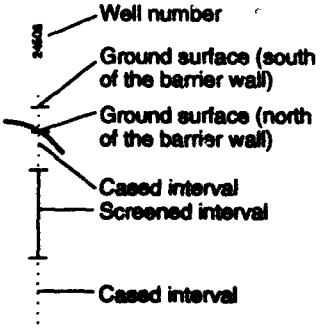
GWAR FY91

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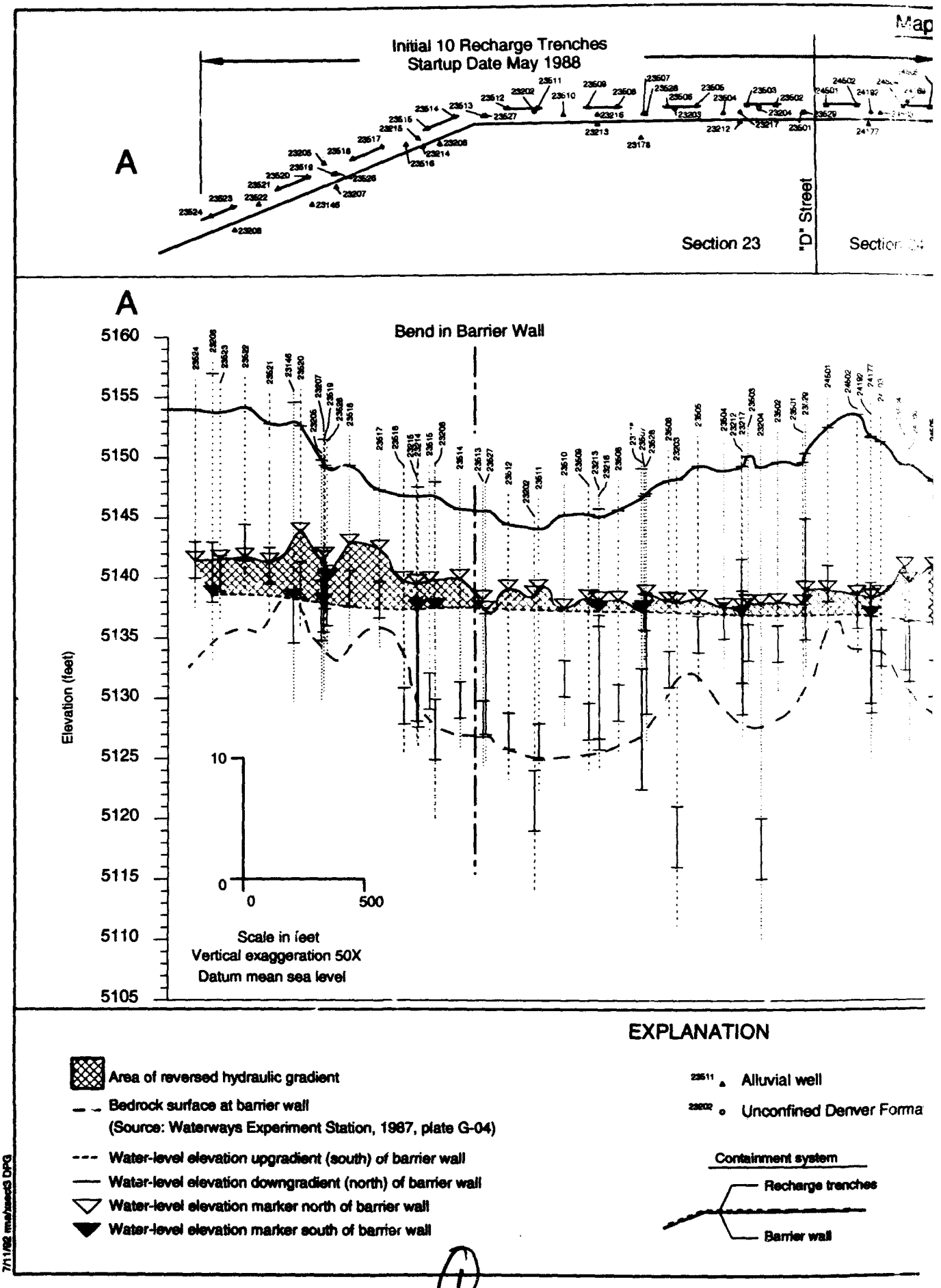


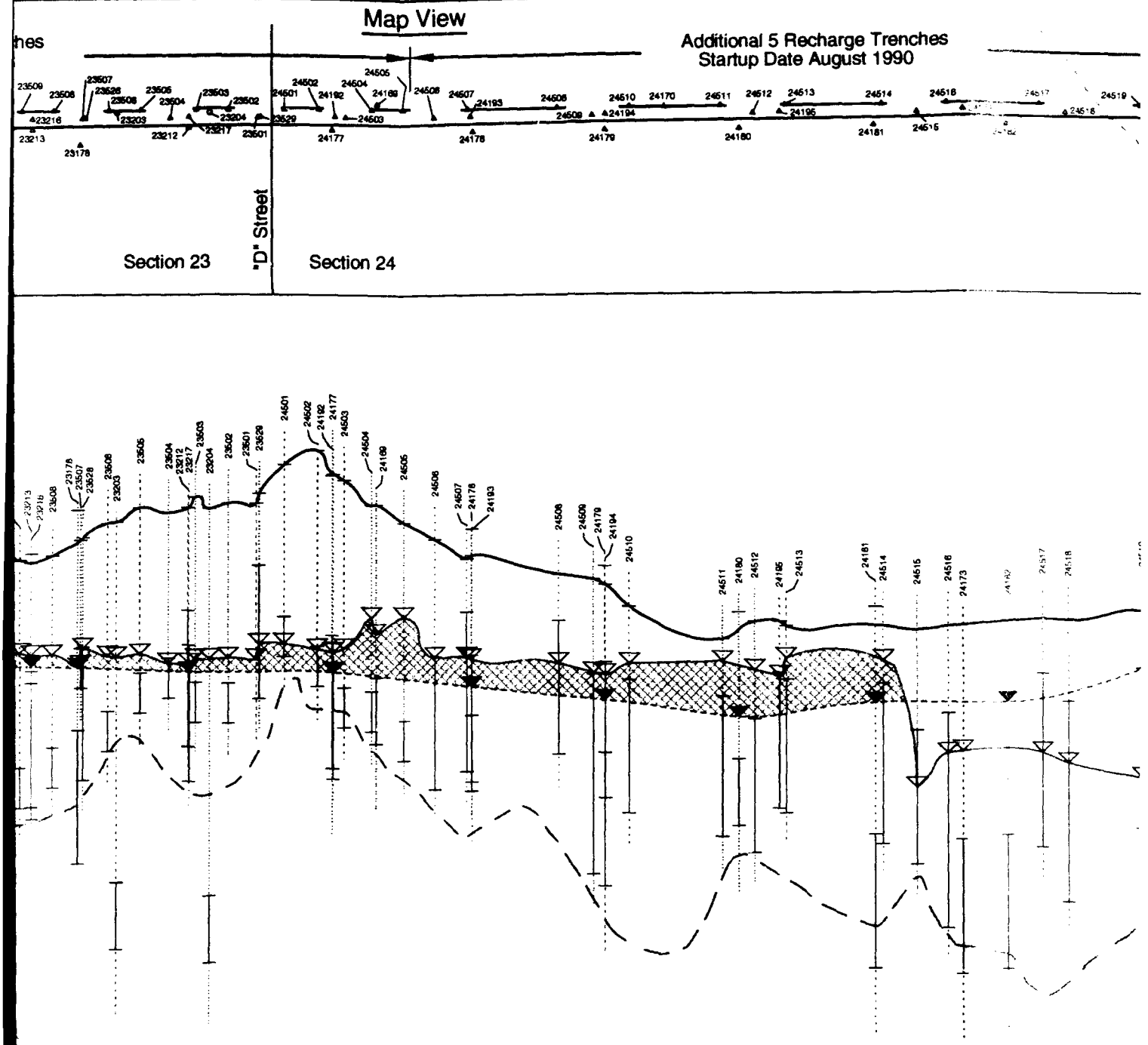
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.6
Cross Section of Approximate Water-Table Elevations at the North Boundary Containment/ Treatment System from January 1 to March 31, 1991

GWAR FY91

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Initial 10 Recharge Trenches
Startup Date May 1988
A
Section 23
"D" Street
A
Bend in Barrier Wall
Elevation (feet)
5160
5155
5150
5145
5140
5135
5130
5125
5120
5115
5110
5105
10
0
0
500
Scale in feet
Vertical exaggeration 50X
Datum mean sea level
EXPLANATION
Area of reversed hydraulic gradient
Bedrock surface at barrier wall
(Source: Waterways Experiment Station, 1987, plate G-04)
Water-level elevation upgradient (south) of barrier wall
Water-level elevation downgradient (north) of barrier wall
Water-level elevation marker north of barrier wall
Water-level elevation marker south of barrier wall
Alluvial well
Unconfined Denver Forma
Containment system
Recharge trenches
Barrier wall
7/11/92 mw/exec3 DPG



EXPLANATION

- Alluvial well
- Unconfined Denver Formation well

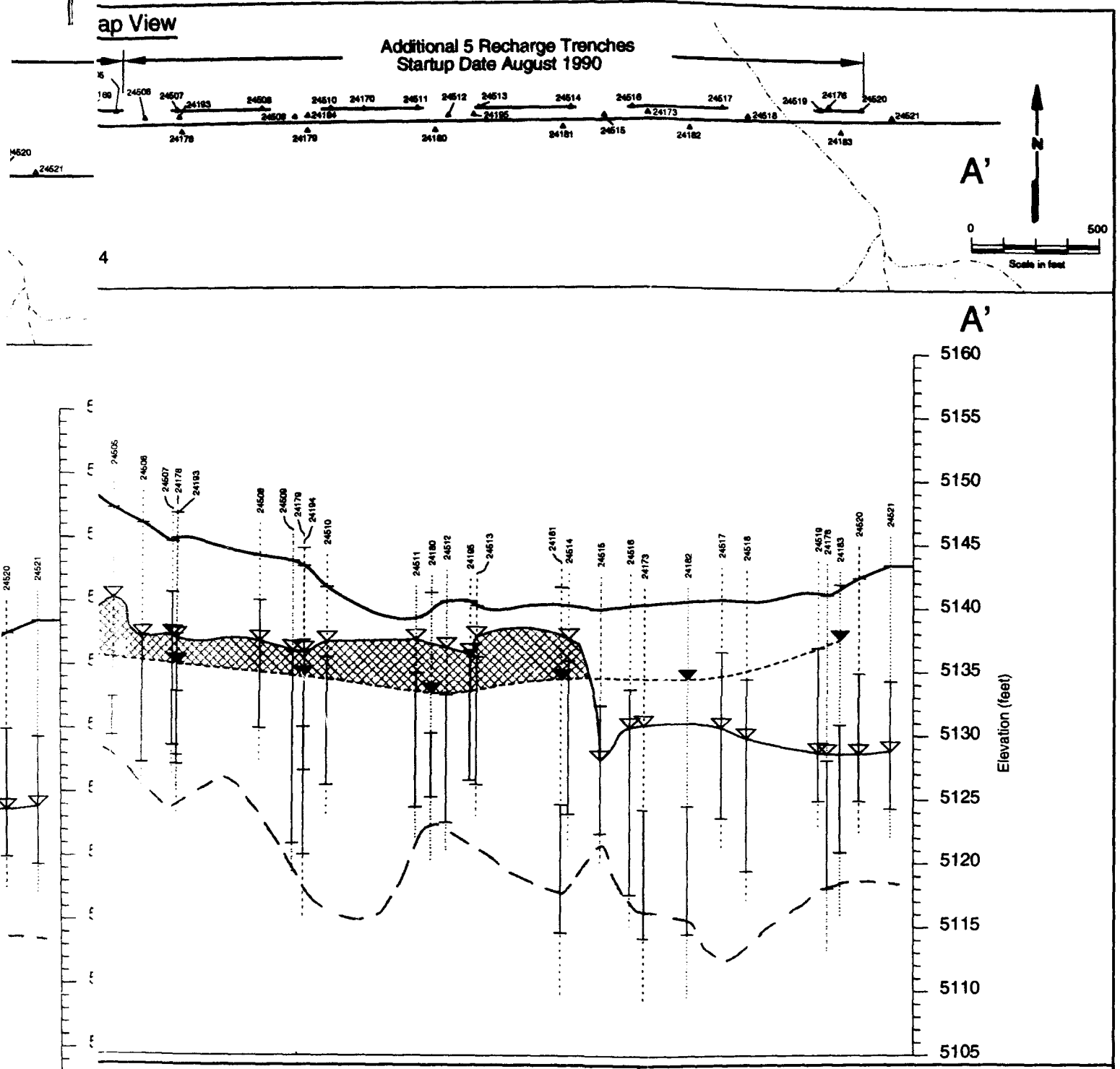
Containment system
- Recharge trenches
- Barrier wall

- Well number
- Ground surface (south of the barrier wall)
- Ground surface (north of the barrier wall)
- Cased interval
- Screened interval
- Cased interval

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Rocky Mountai
Commerce City
Prepared by:
Harding Lawso

Figure 5.7
Cross Section of A
Elevations at the N
Treatment System

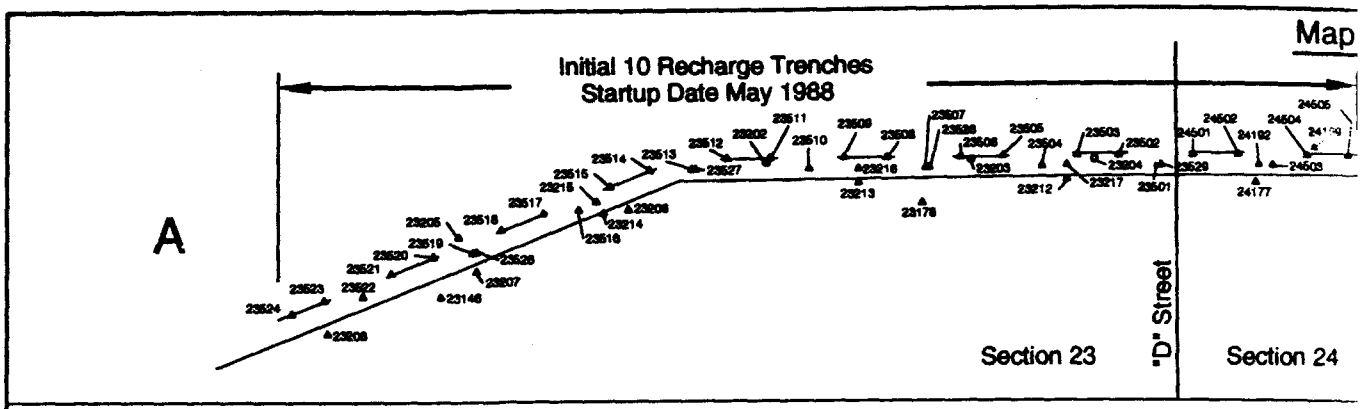
GWAR FY91

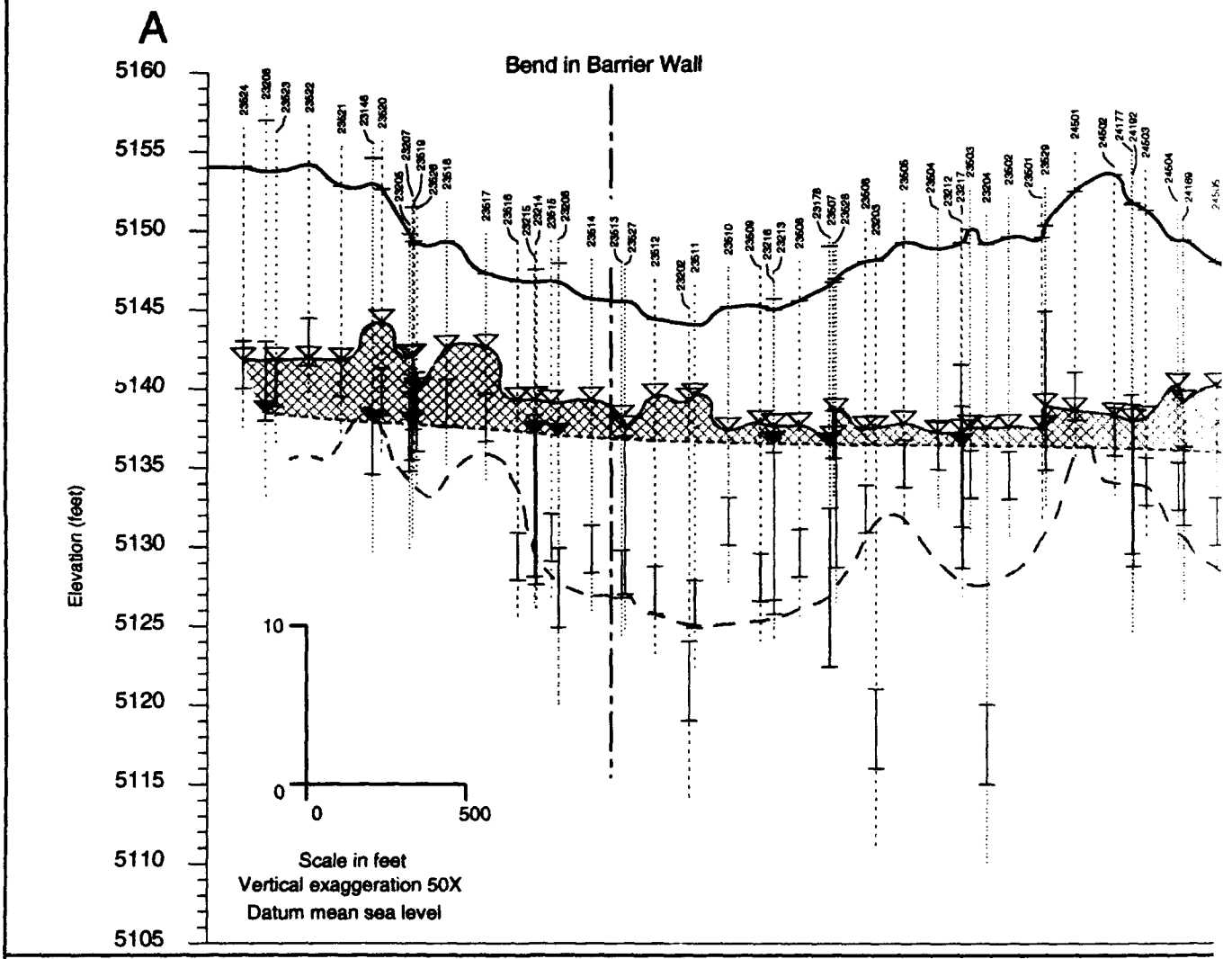


Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.7
Cross Section of Approximate Water-Table Elevations at the North Boundary Containment/ Treatment System from April 1 to June 30, 1991

GWAR FY91



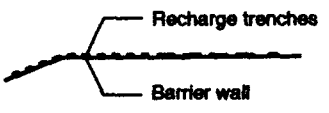


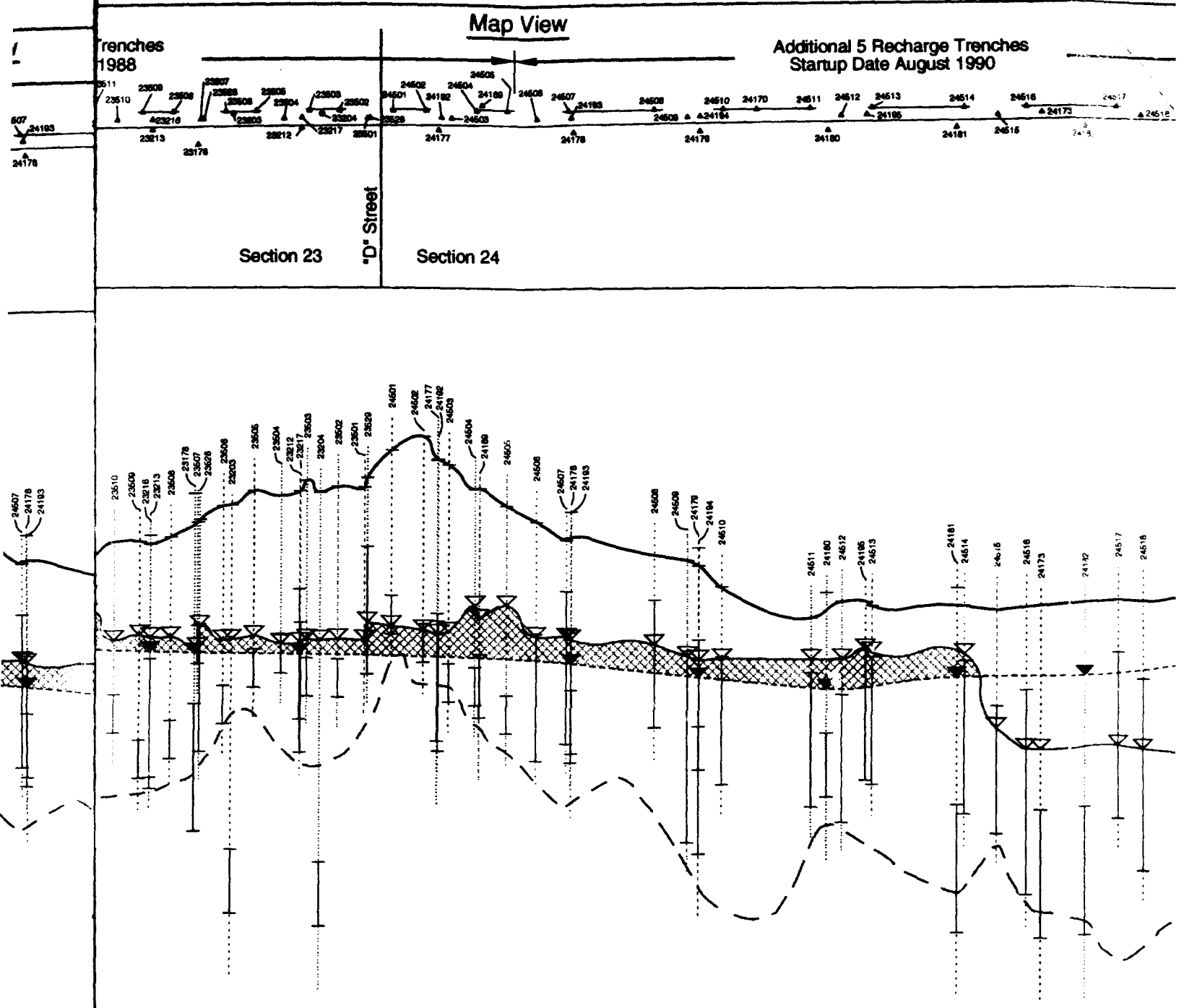
EXPLANATION

- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987, plate G-04)
- Water-level elevation upgradient (south) of barrier wall
- Water-level elevation downgradient (north) of barrier wall
- Water-level elevation marker north of barrier wall
- Water-level elevation marker south of barrier wall

- Alluvial well
- Unconfined Denver Formation w

Containment system





EXPLANATION

23511 ▲ Alluvial well

23202 ○ Unconfined Denver Formation well

Containment system

- Recharge trenches
- Barrier wall

24508 Well number

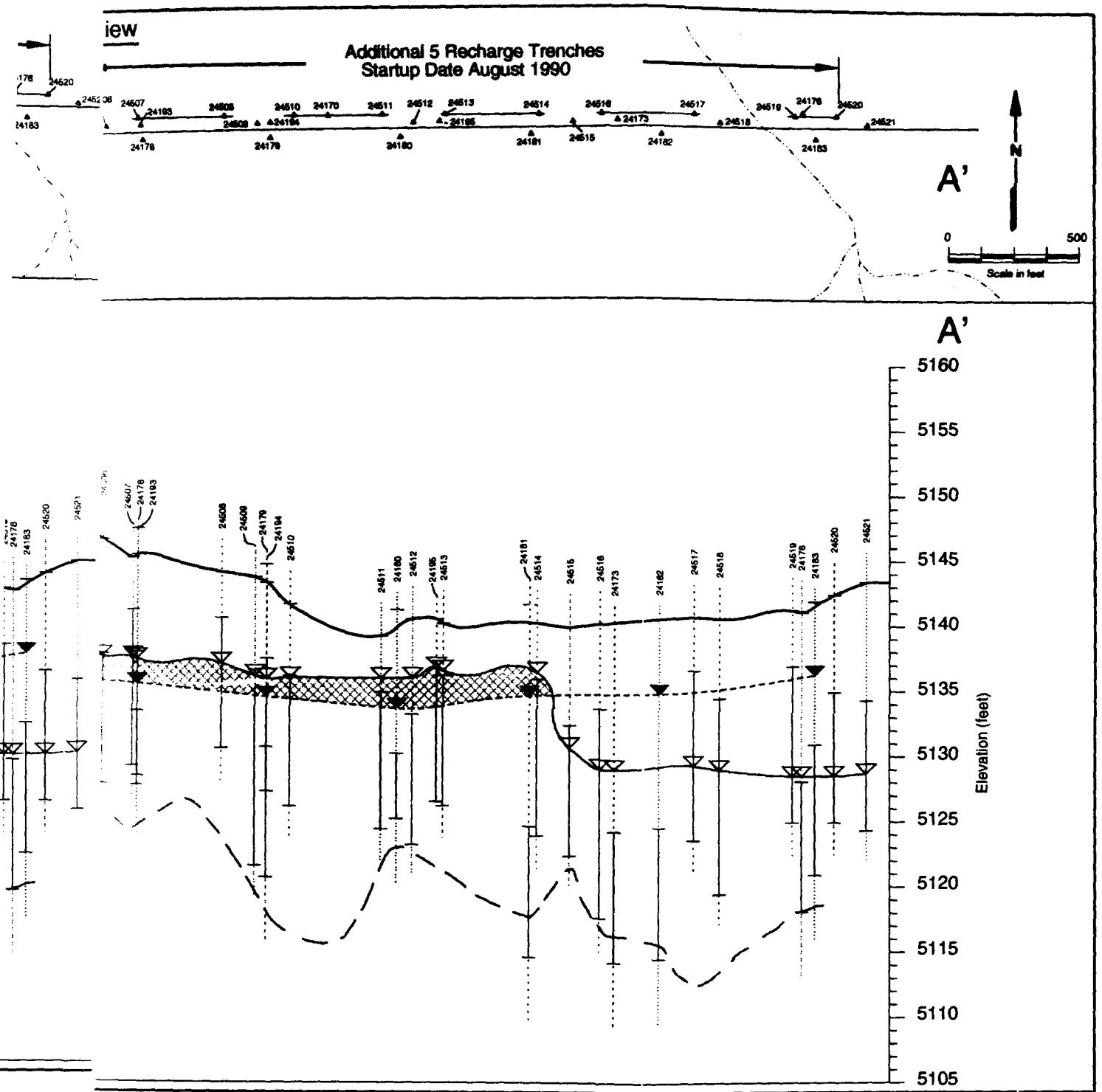
- Ground surface (south of the barrier wall)
- Ground surface (north of the barrier wall)
- Cased interval
- Screened interval
- Cased interval

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Figure 5.8
Cross Section
Elevations at t
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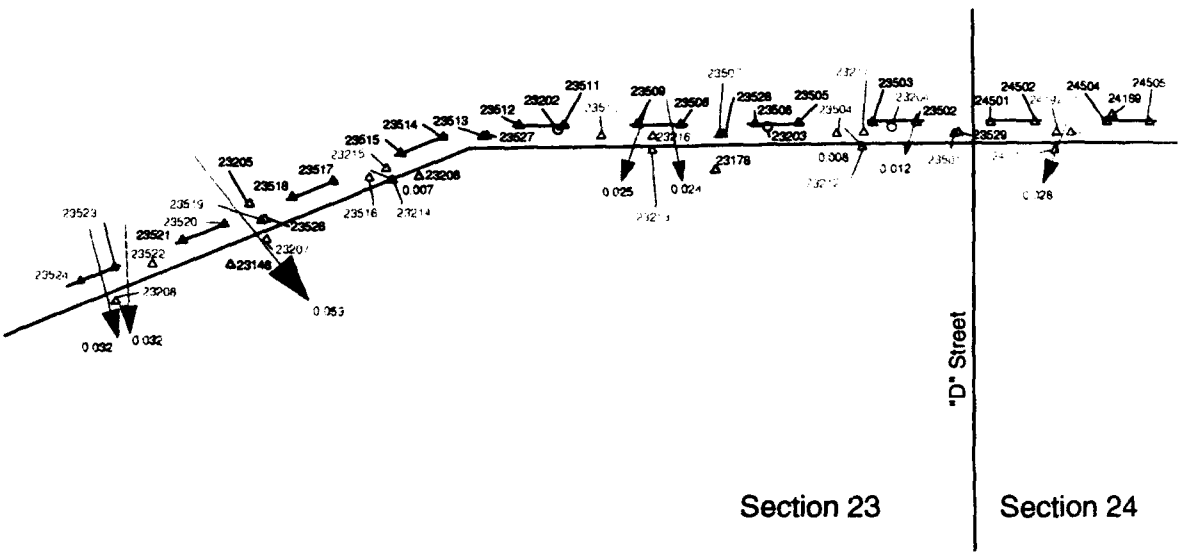
GWAR FY91

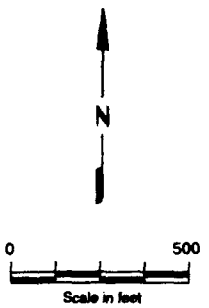


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Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.8
Cross Section of Approximate Water-Table Elevations at the North Boundary Containment/ Treatment System from July 1 to September 30, 1991

GWAR FY91





EXPLANATION

▲23101 Alluvial well

○23102 Unconfined Denver Formation well

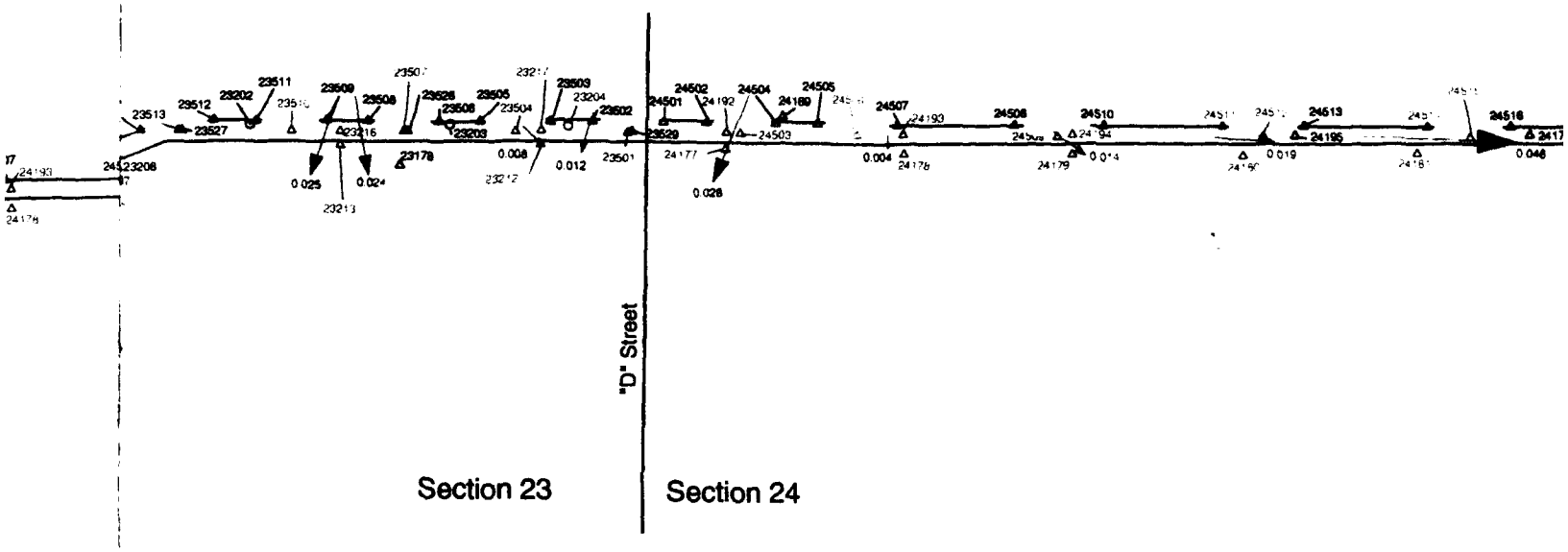
0.025 Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Drainage

Contair

8/27/92 RMA/3PTORT1R.JWJ



EXPLANATION

well

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Containment system

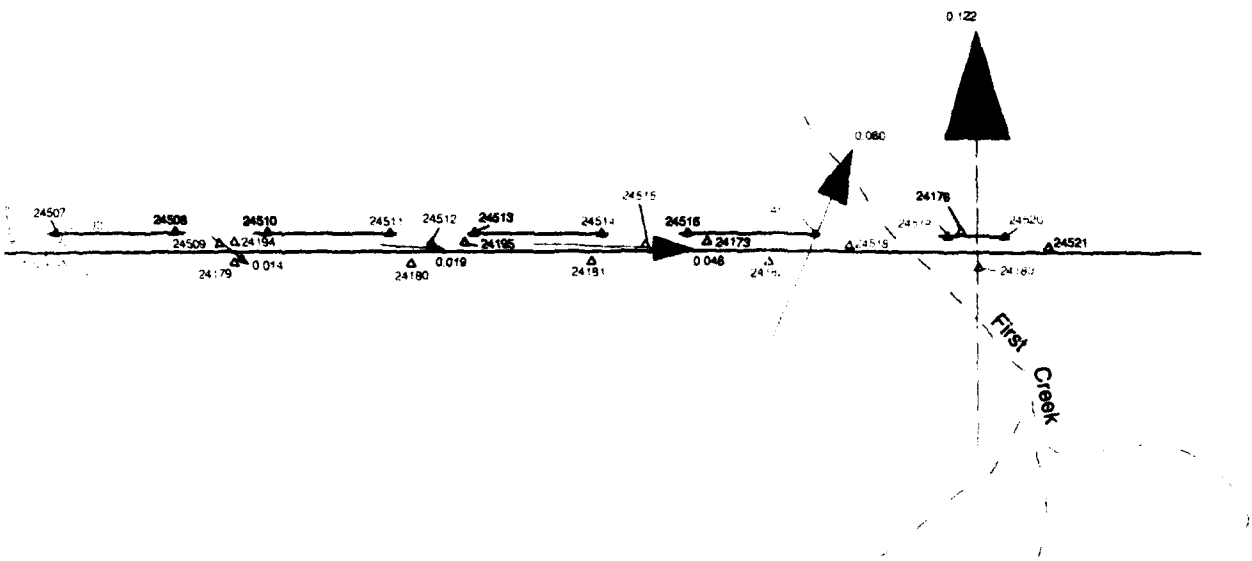
Recharge trenches

Barrier wall

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Figure 5.9

Direction a
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October 1
GWAR FY91

Recharge trenches

Barrier wall

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

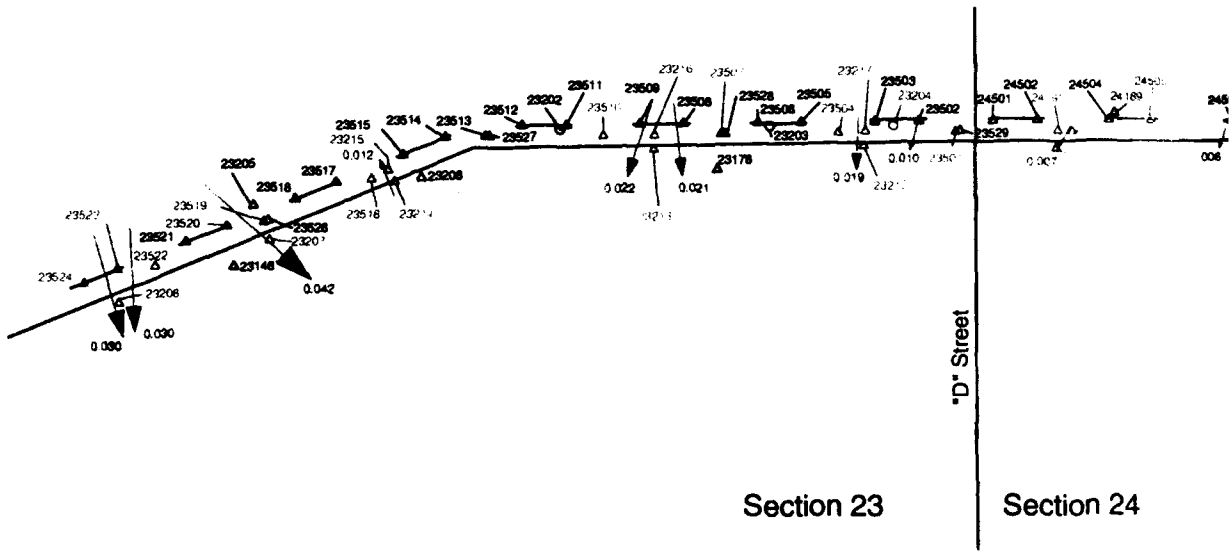
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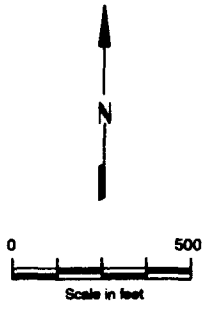
Harding Lawson Associates

Figure 5.9

Direction and Magnitude of Water-Table Gradients in the Vicinity of the North Boundary Containment/ Treatment System Barrier Wall from October 1 to December 31, 1990

GWAR FY91





EXPLANATION

△23101 Alluvial well

○23102 Unconfined Denver Formation well

0.025 Direction and magnitude of water-table gradient in feet/feet

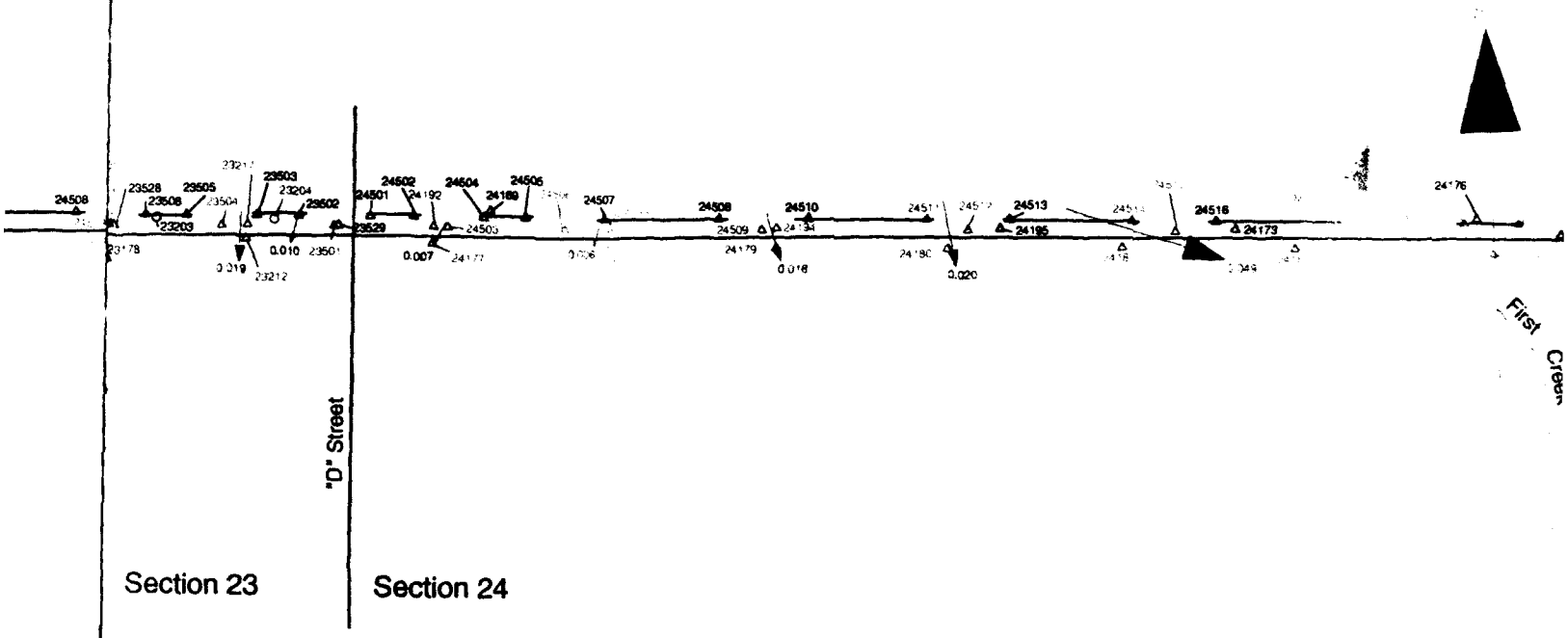
Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Drainage

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EXPLANATION

Containment system

Recharge trenches

Barrier wall

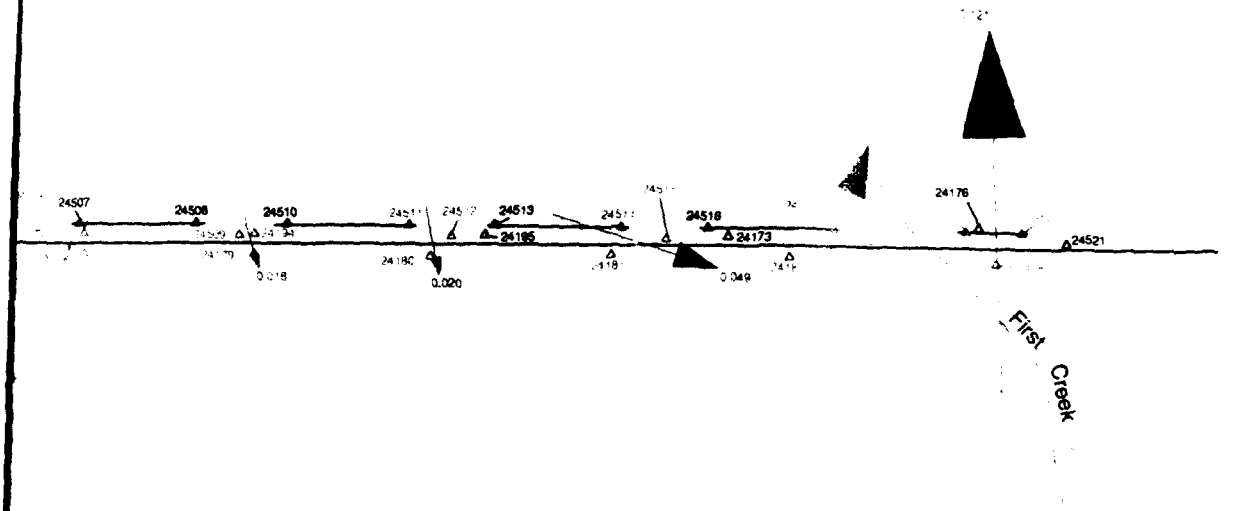
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Prepared for:
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Figure 5.10
Direction and Magnit
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Treatment System B
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GWAR FY91



ment system

Recharge trenches

Barrier wall

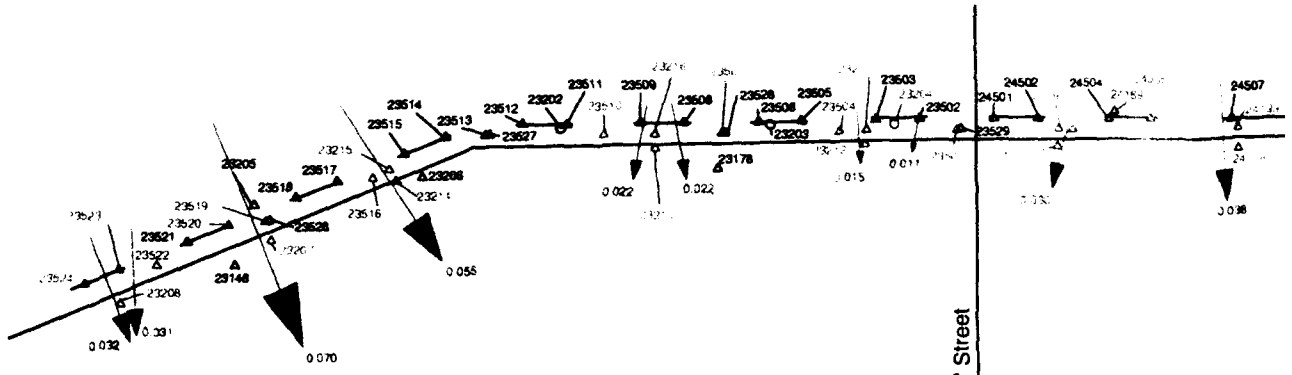
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

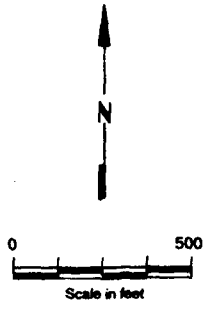
Prepared by:
Harding Lawson Associates

Figure 5.10

Direction and Magnitude of Water-Table Gradients in the Vicinity of the North Boundary Containment/ Treatment System Barrier Wall from January 1 to March 31, 1991

GWAR FY91





EXPLANATION

△23101 Alluvial well

○23102 Unconfined Denver Formation well

0.025 Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

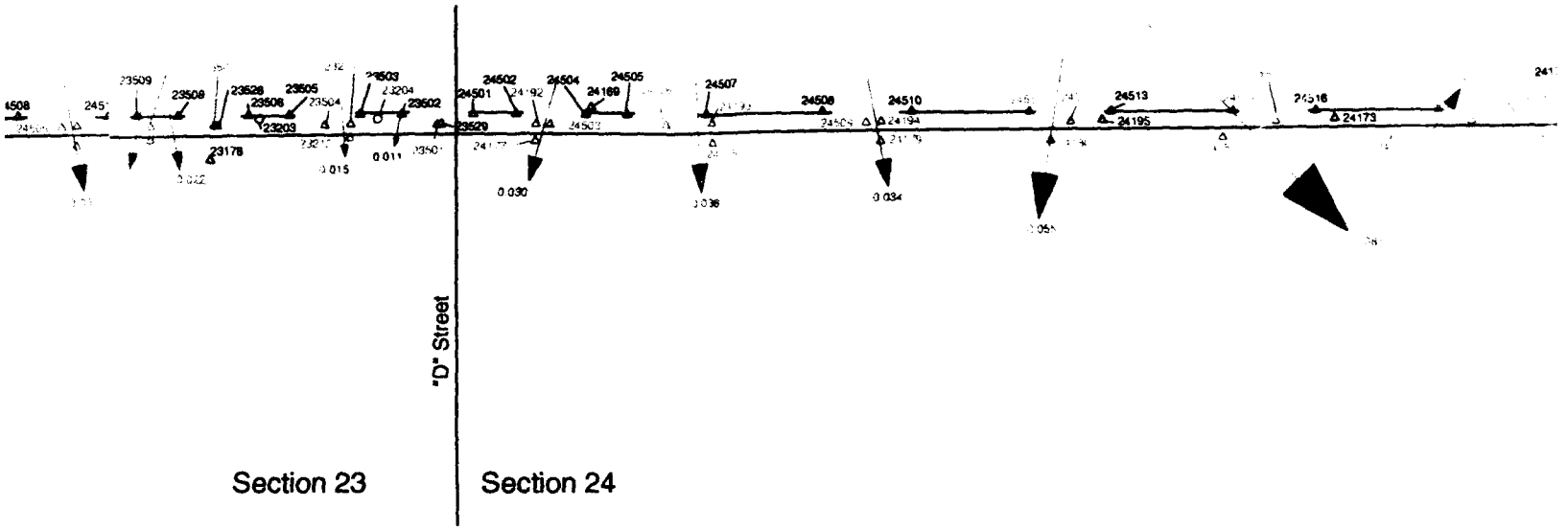
Drainage

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EXPLANATION

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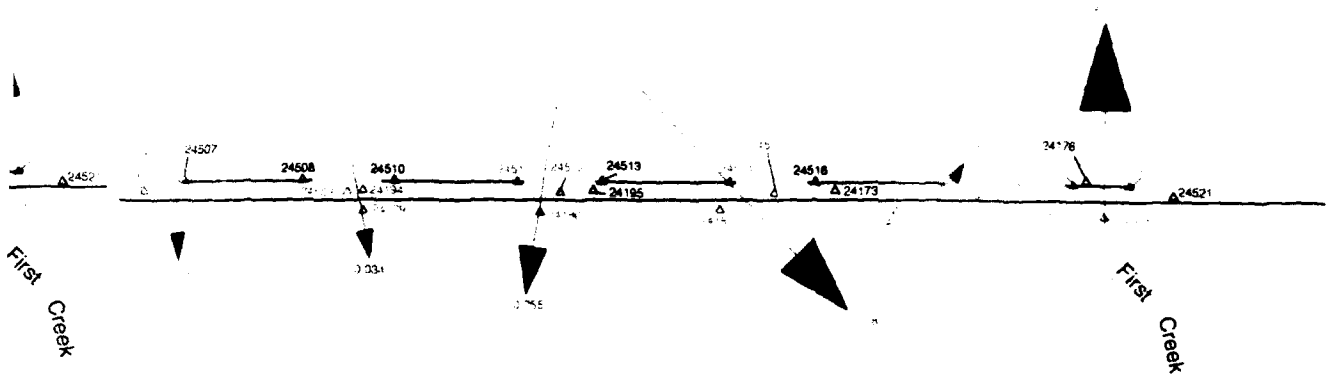
Recharge trenches

Barrier wall

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Figure 5.
Direction
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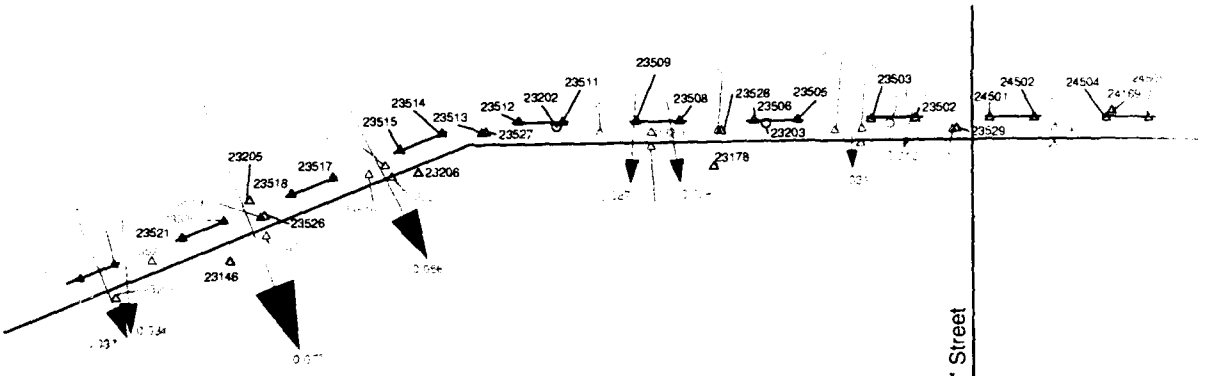
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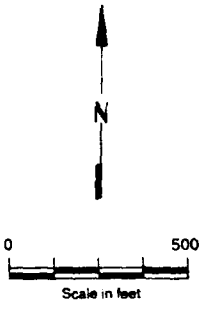
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.11

Direction and Magnitude of Water-Table Gradients in the Vicinity of the North Boundary Containment/ Treatment System Barrier Wall from April 1 to June 30, 1991

GWAR FY91

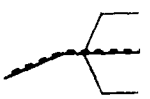




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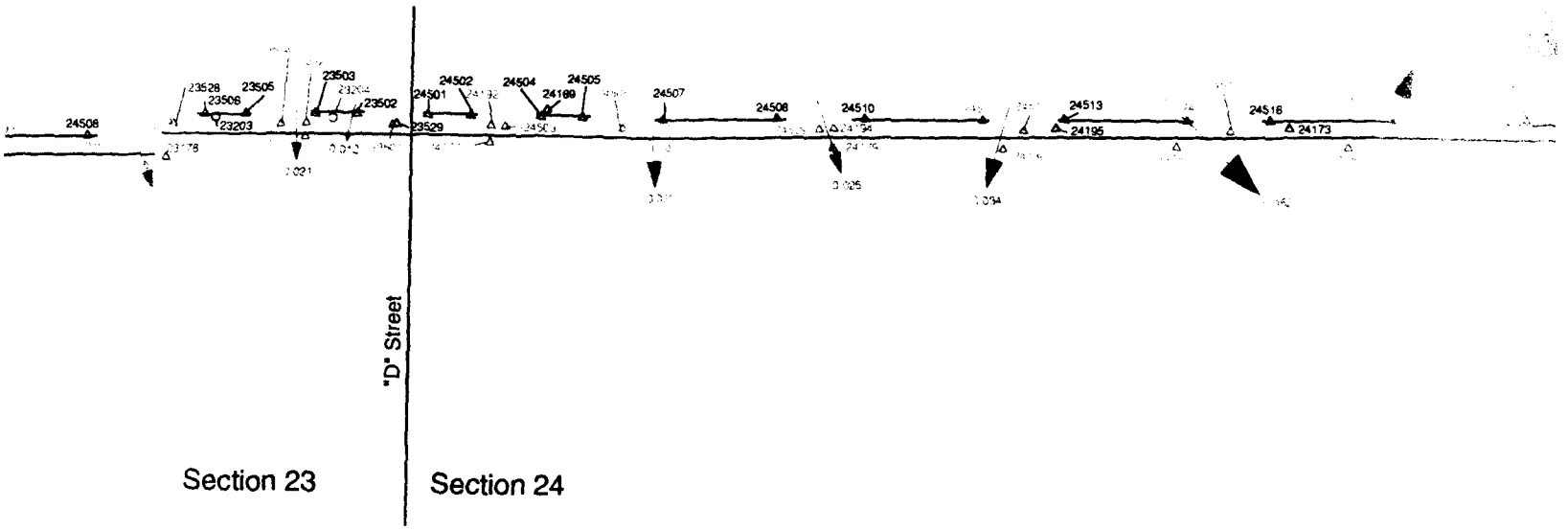
▲23101	Alluvial well
o23102	Unconfined Denver Formation well
	Direction and magnitude of water-table gradient in feet/feet
	Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.
	Drainage

Containm



8/27/92 3PTQRT4R.JWJ

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EXPLANATION

Containment system

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Barrier wall

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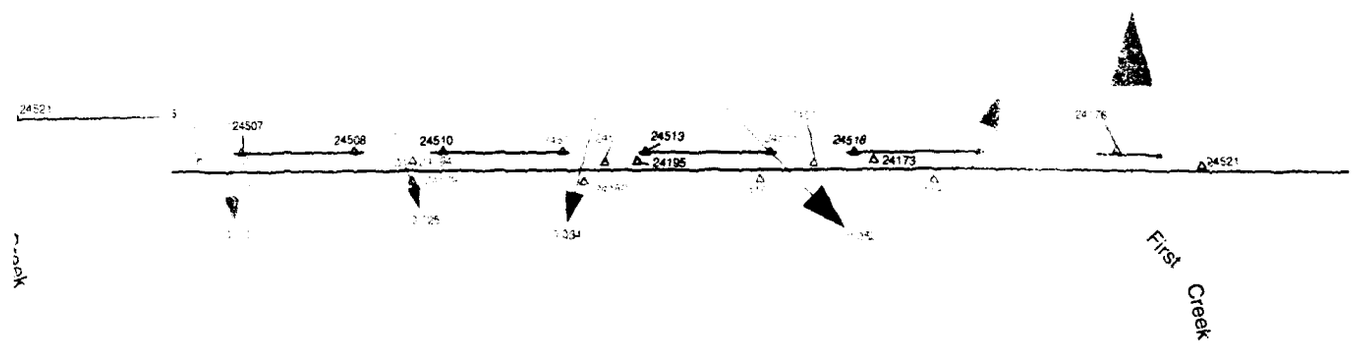
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Rocky
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Prepared by:
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Figure 5.12
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July 1 to Sept
GWAR FY91

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City, Colorado

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North Boundar
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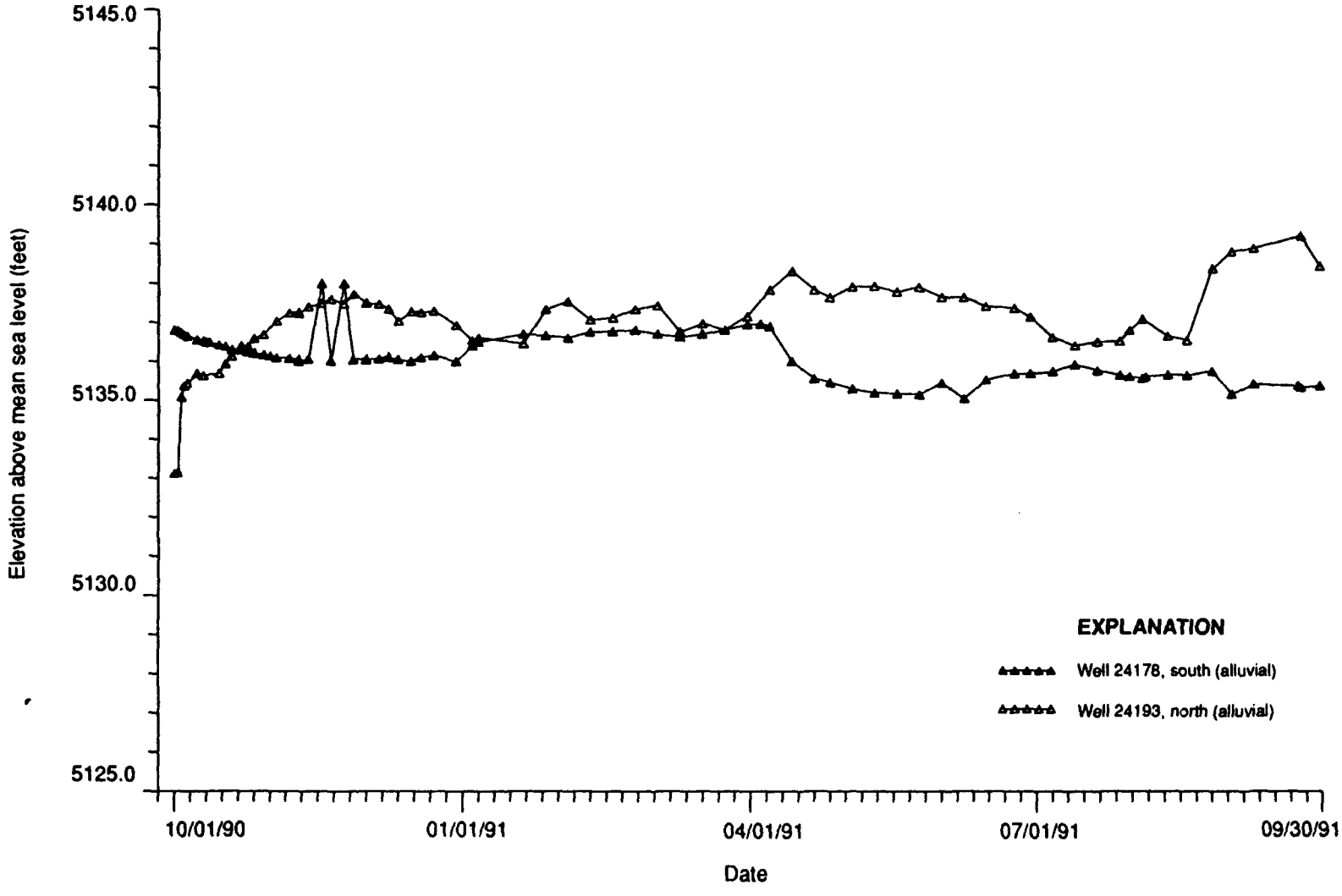
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.12
Direction and Magnitude of Water-Table Gradients in the Vicinity of the North Boundary Containment/ Treatment System Barrier Wall from July 1 to September 30,1991
GWAR FY91

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RMA 1076.3



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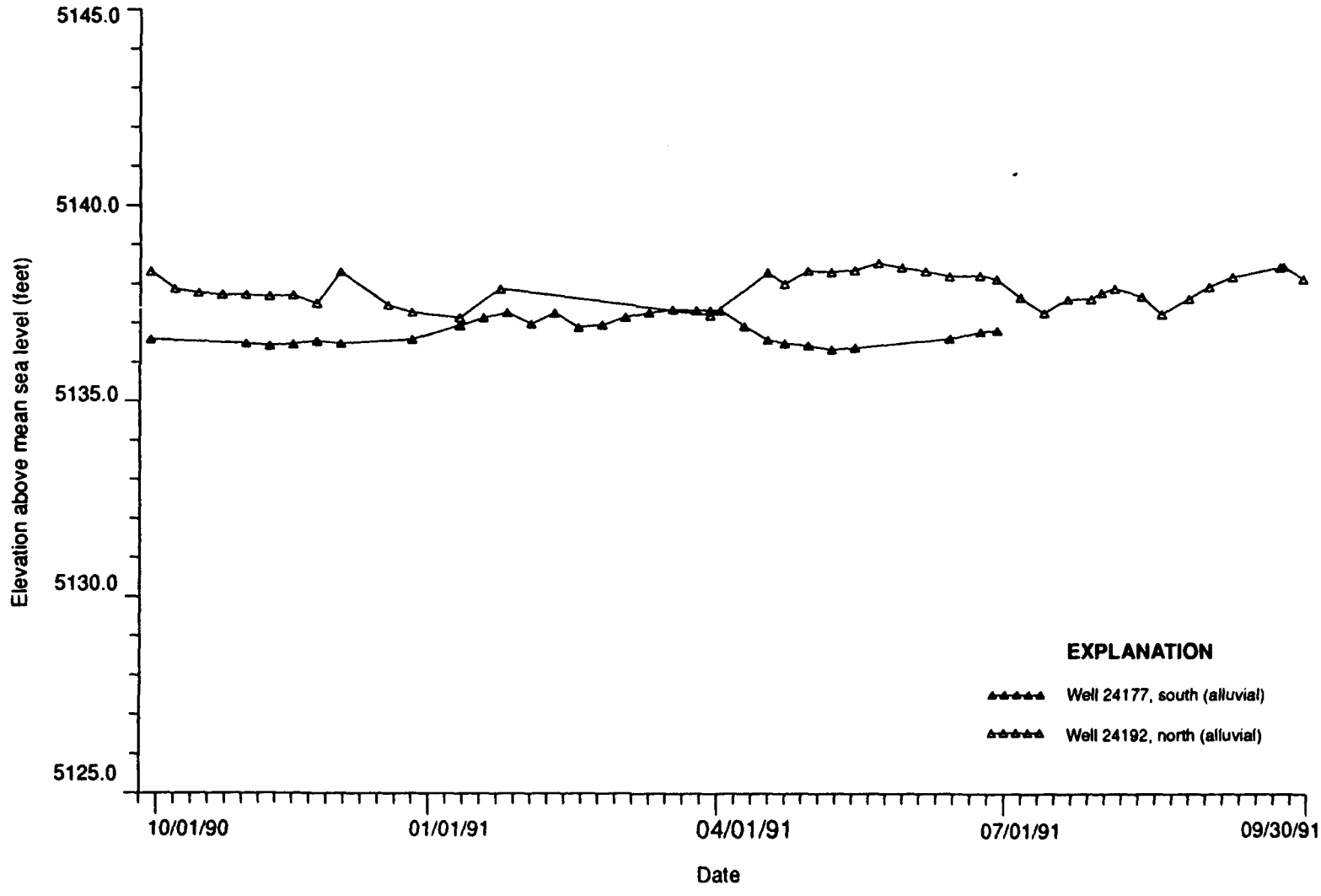
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Figure 5.13

Hydrograph of Unconfined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 24178 and 24193)

GWAR FY91

RMA 1076.4



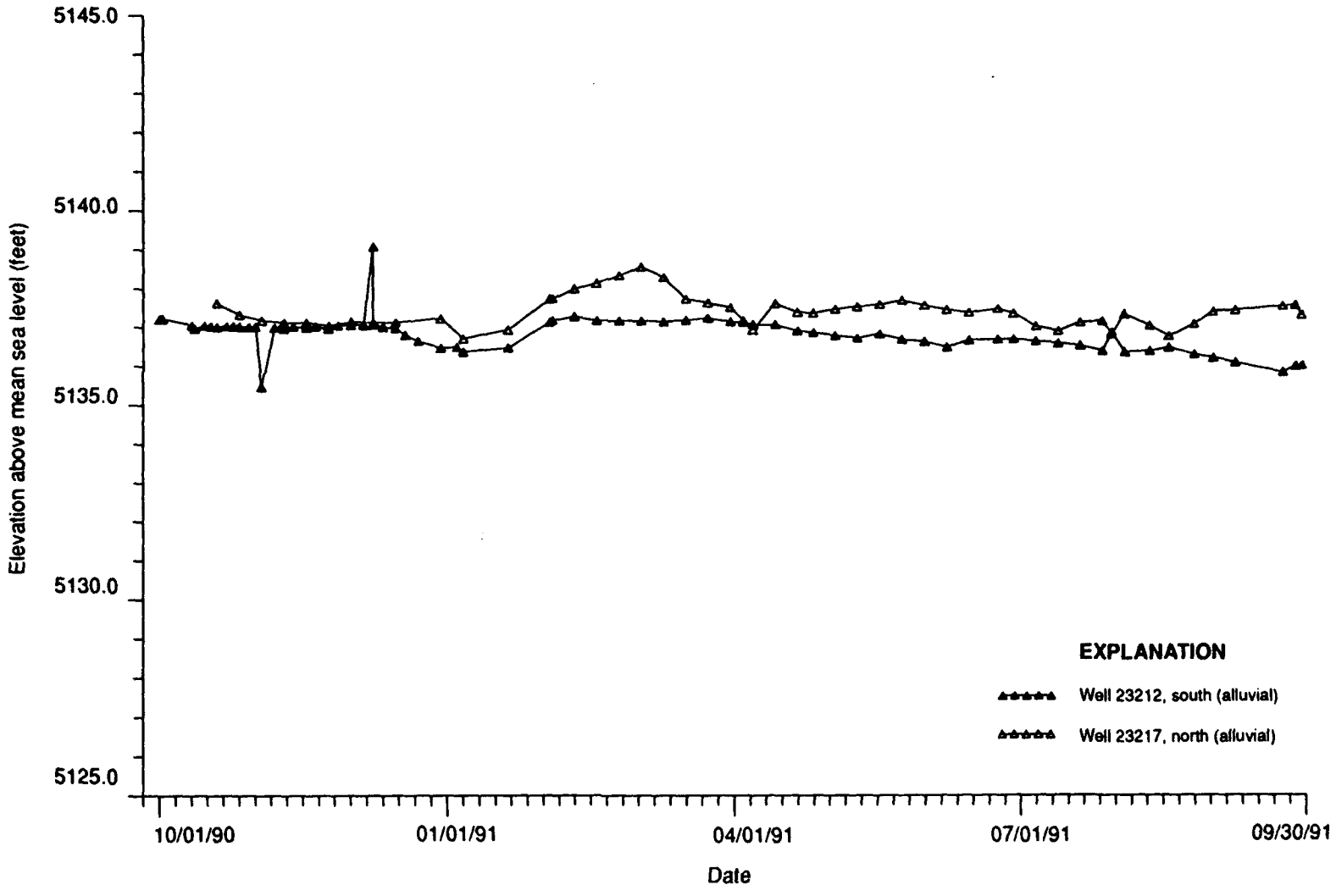
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Figure 5.14

Hydrograph of Unconfined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 24177 and 24192)

RMA 1076.5



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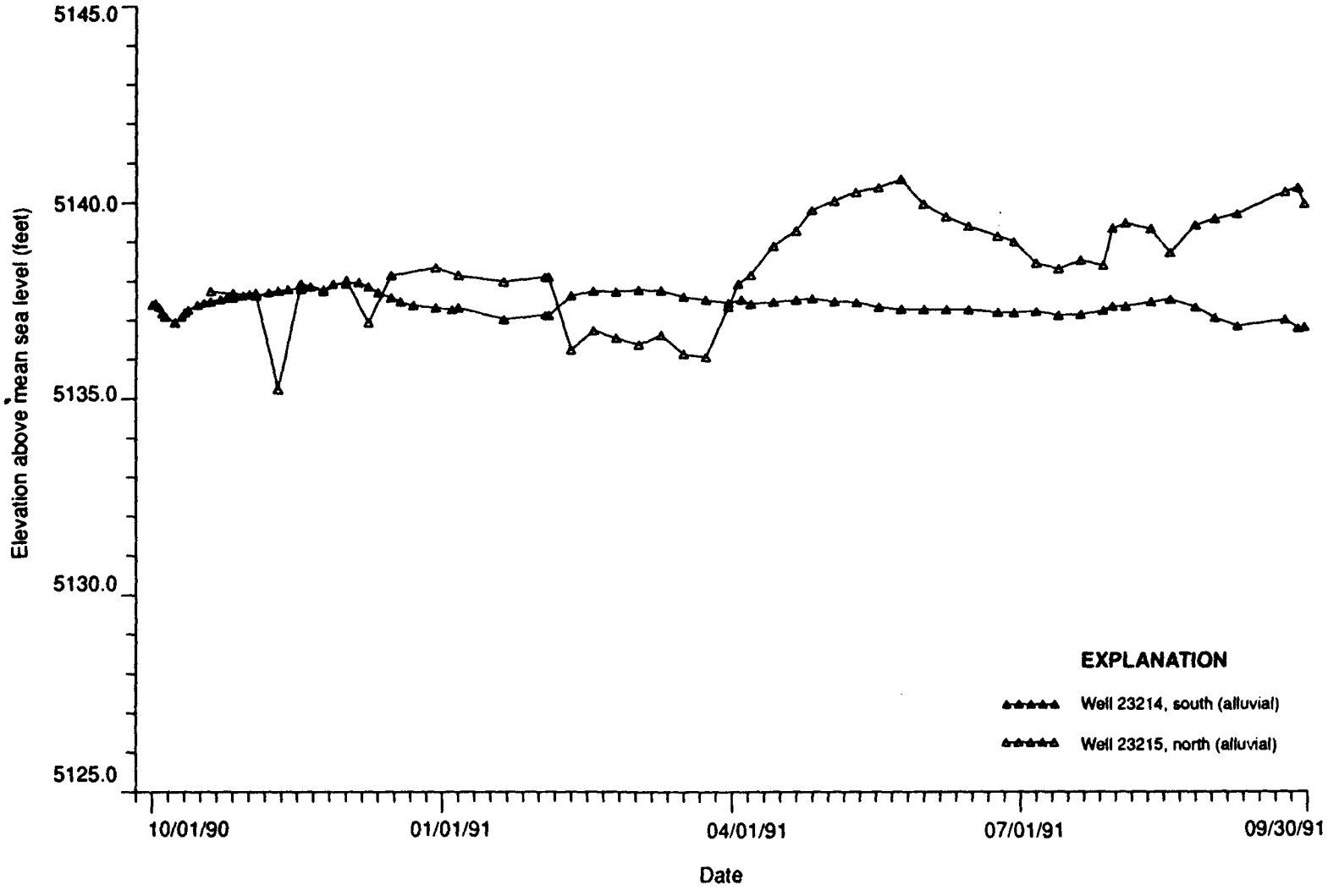
Prepared by:

Figure 5.15

Hydrograph of Unconfined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 23212 and 23217)

GWAR FY91

RMA 1076.7



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Rocky Mountain Arsenal
Commerce City, Colorado

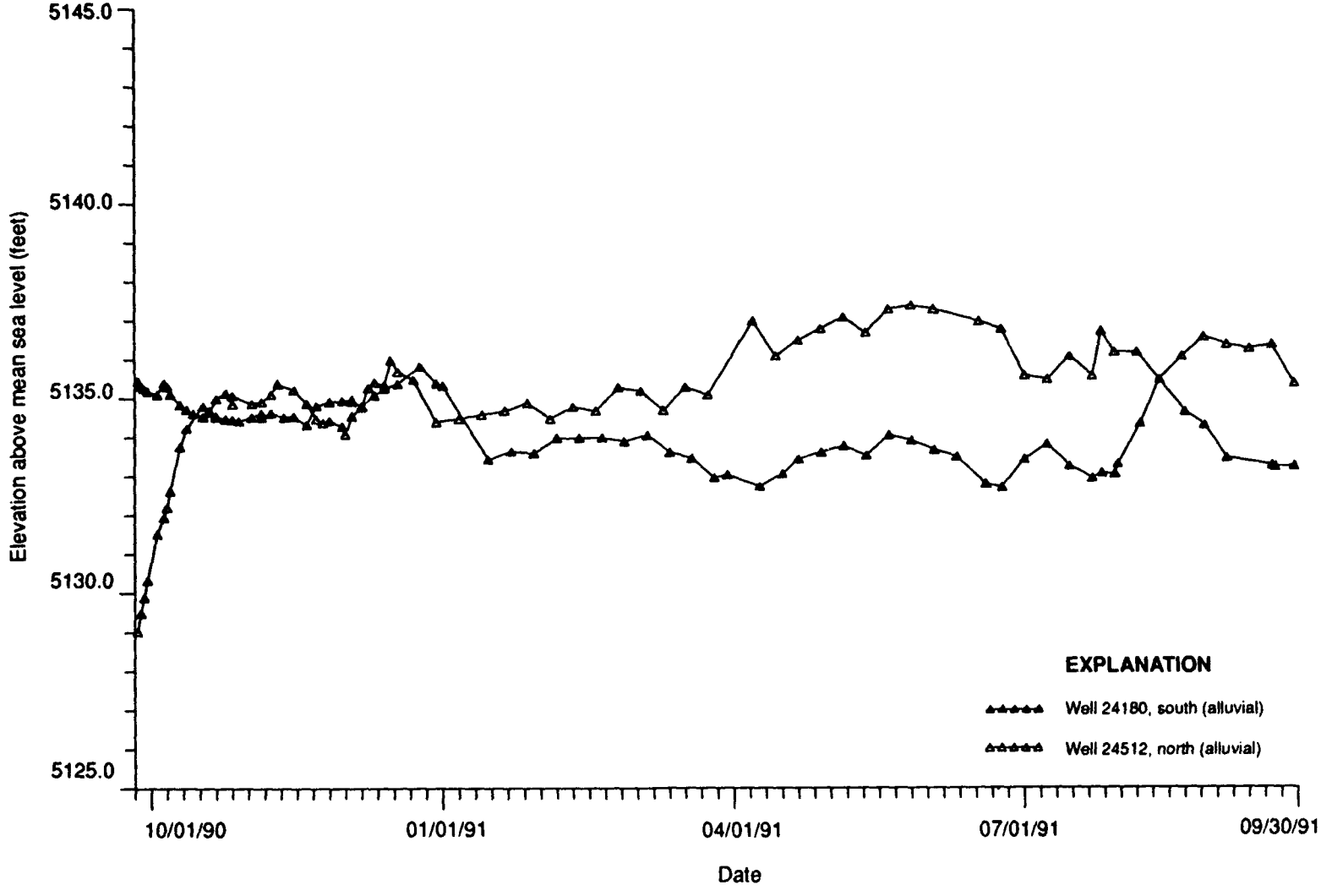
Prepared by:

Figure 5.16

Hydrograph of Unconfined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 23214 and 23215)

GWAR FY91

RMA 1076.1

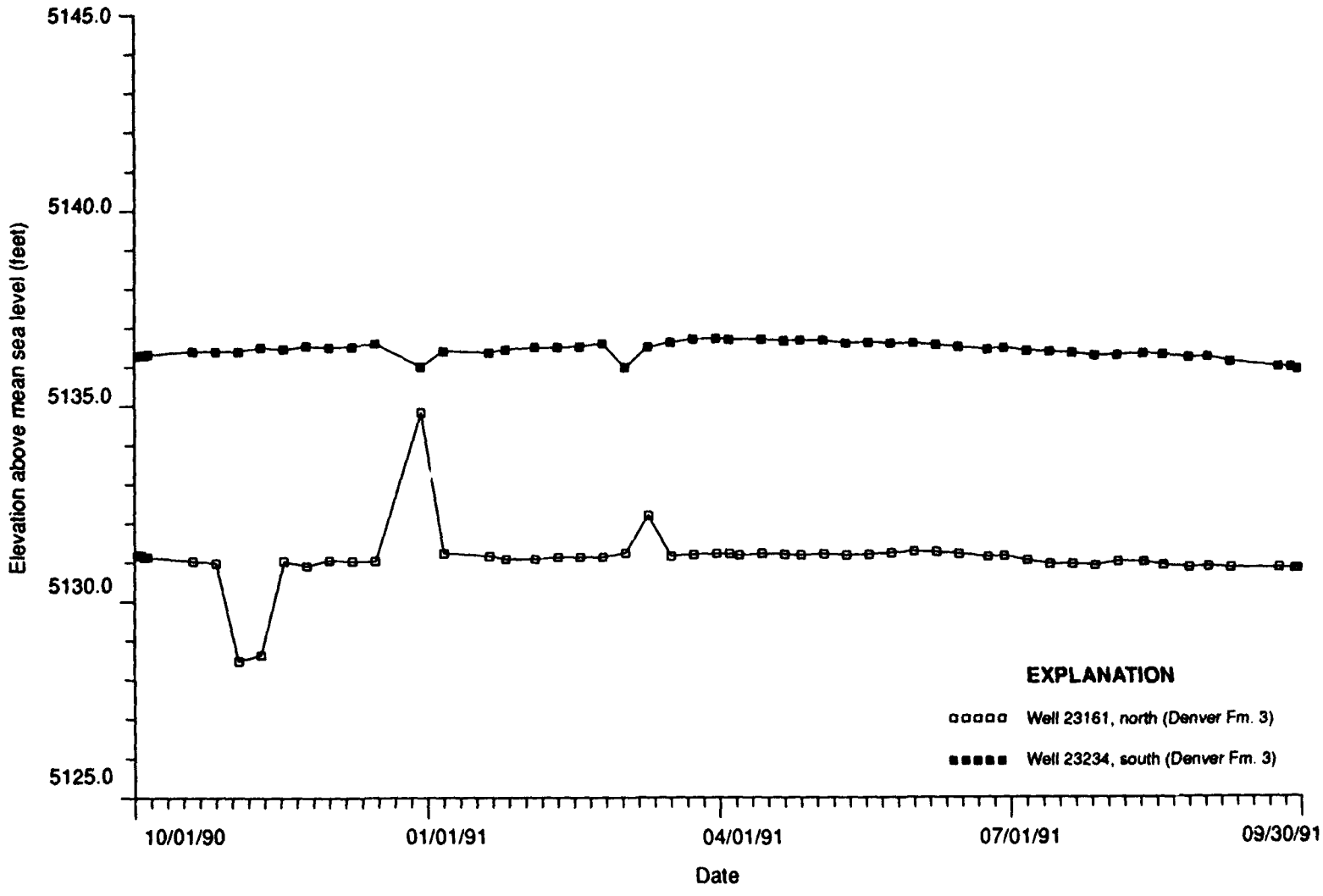


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Figure 5.17

Hydrograph of Unconfined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 24180 and 24512)

RMA 1076.12



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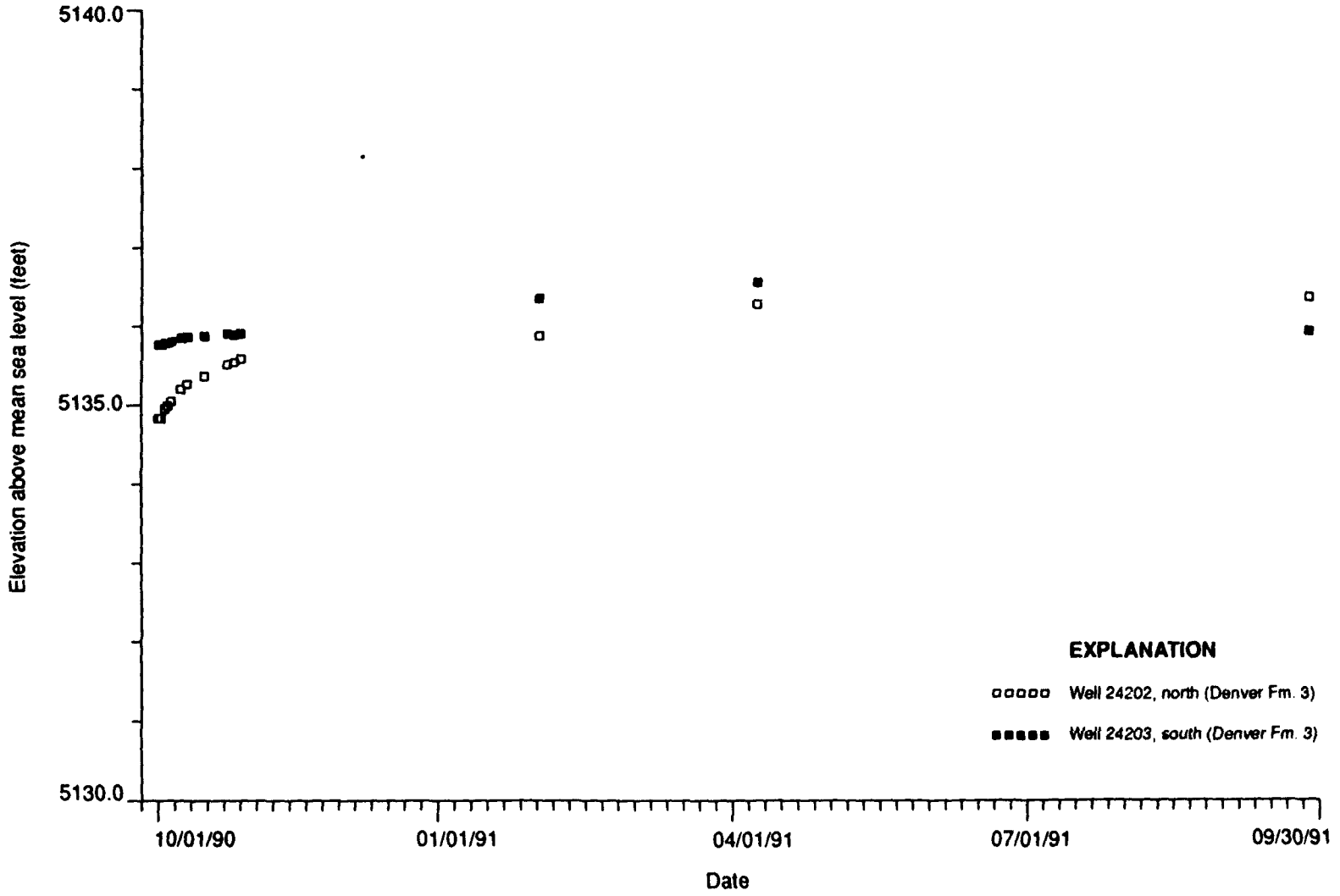
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Figure 5.18

Hydrograph of Confined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 23161 and 23234)

GWAR FY91

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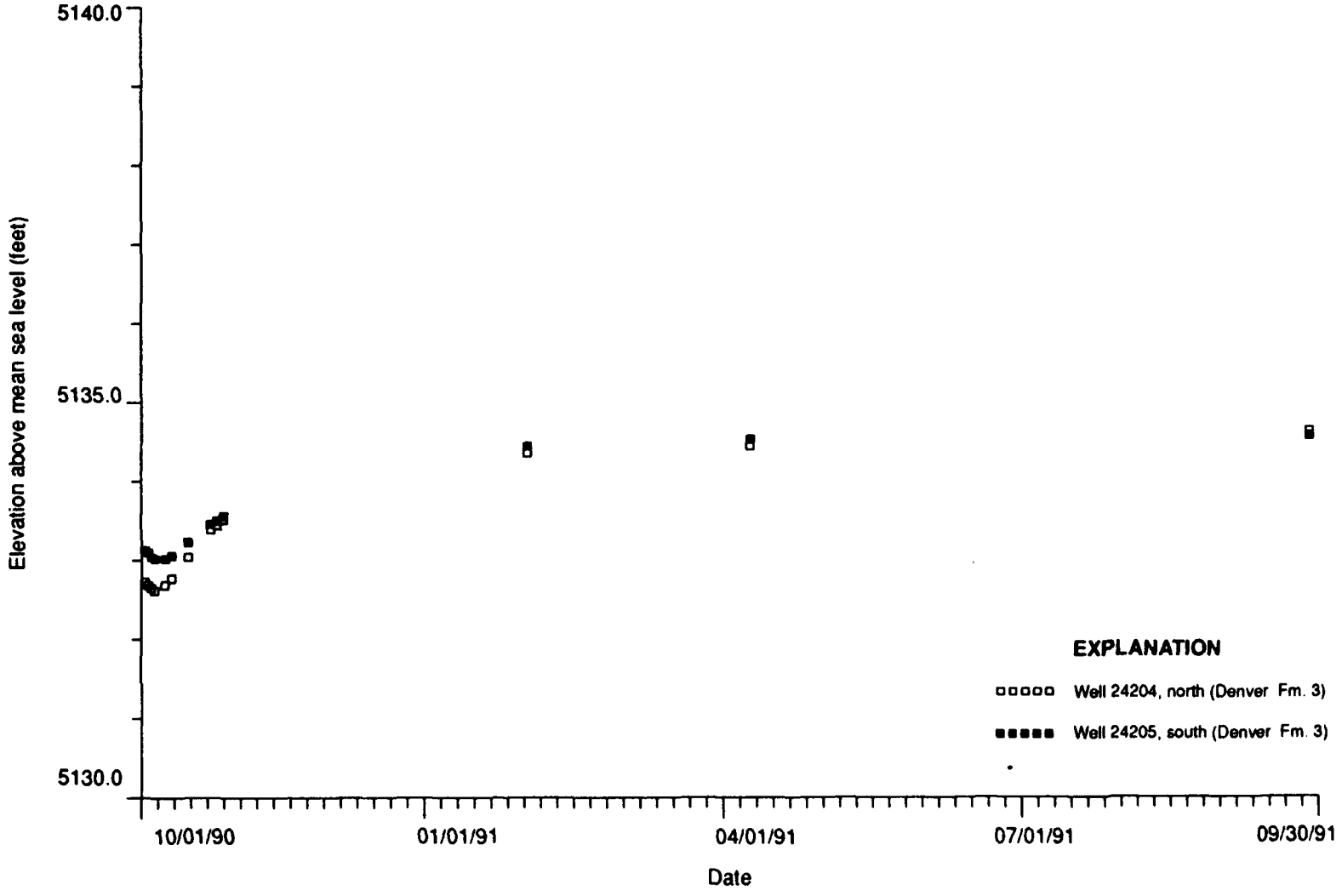
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Figure 5.19

Hydrograph of Confined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 24202 and 24203)

QWAR FY91

RMA 1076.10

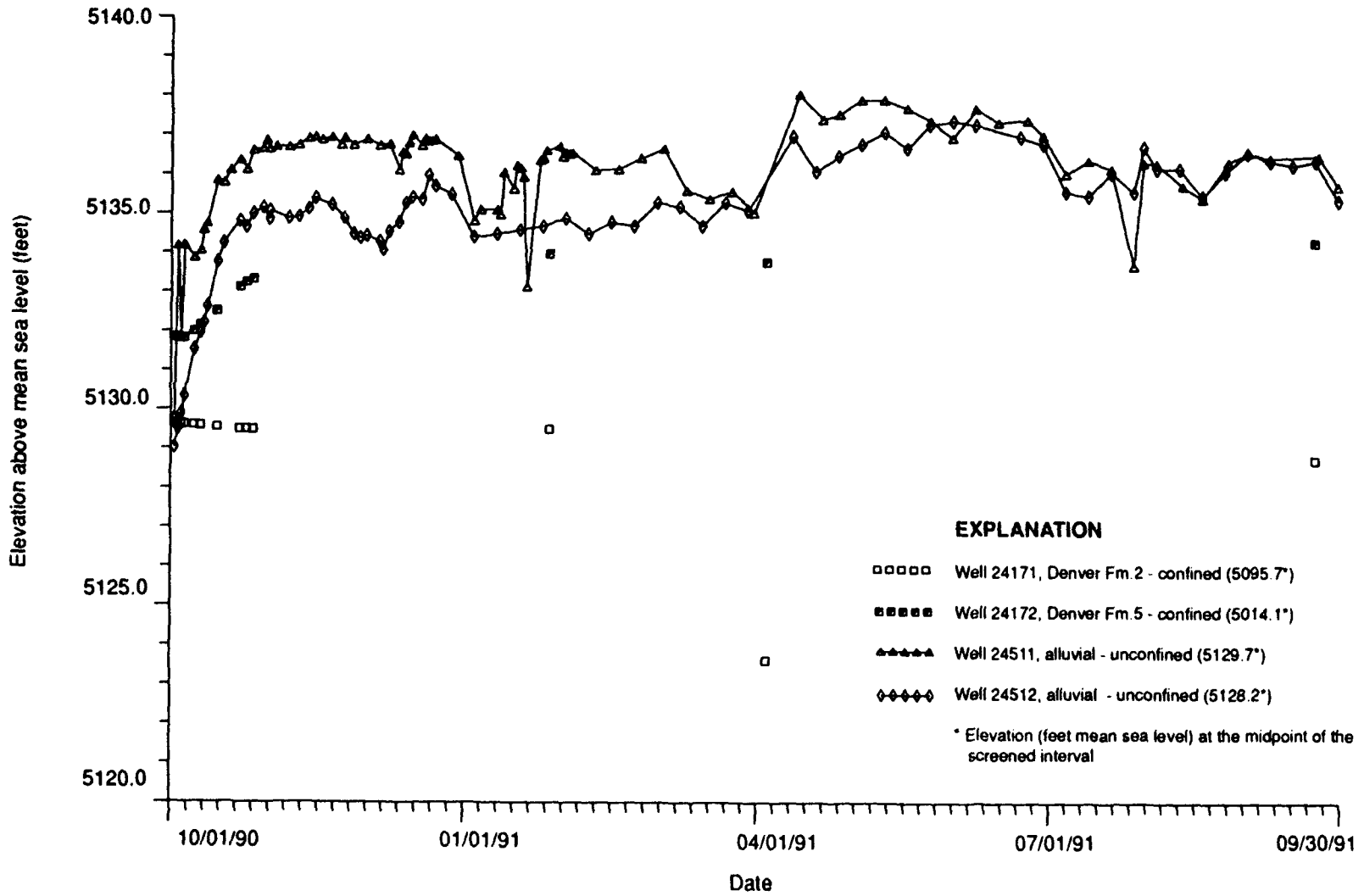


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Figure 5.20

Hydrograph of Confined Flow System Wells Across the North Boundary Containment/Treatment System Barrier Wall (wells 24204 and 24205)

RMA 1076.14



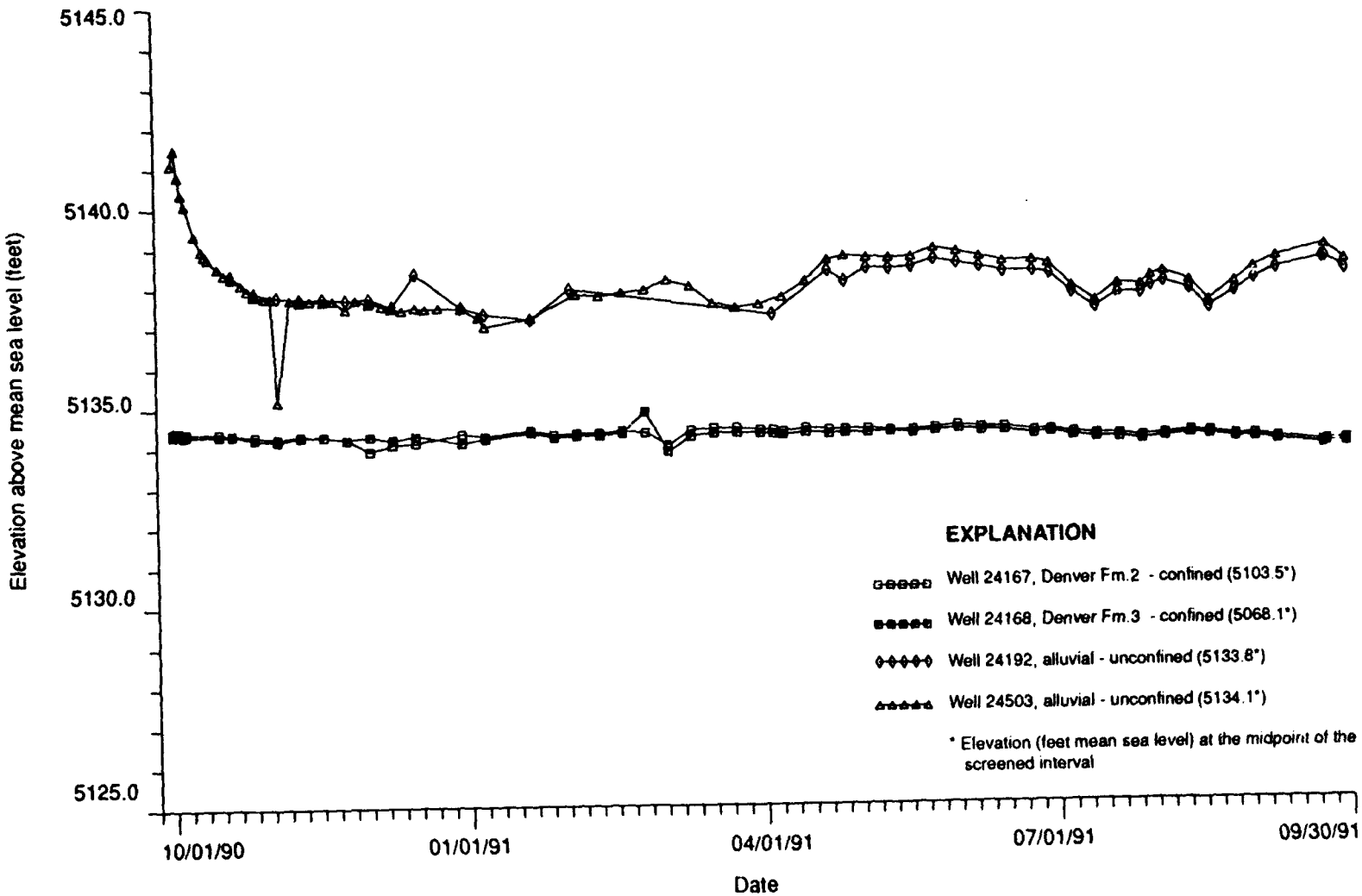
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Figure 5.21

Hydrograph of Well Cluster North of the North Boundary Containment/Treatment System Barrier Wall (wells 24171, 24172, 24511, and 24512)

RMA 1076

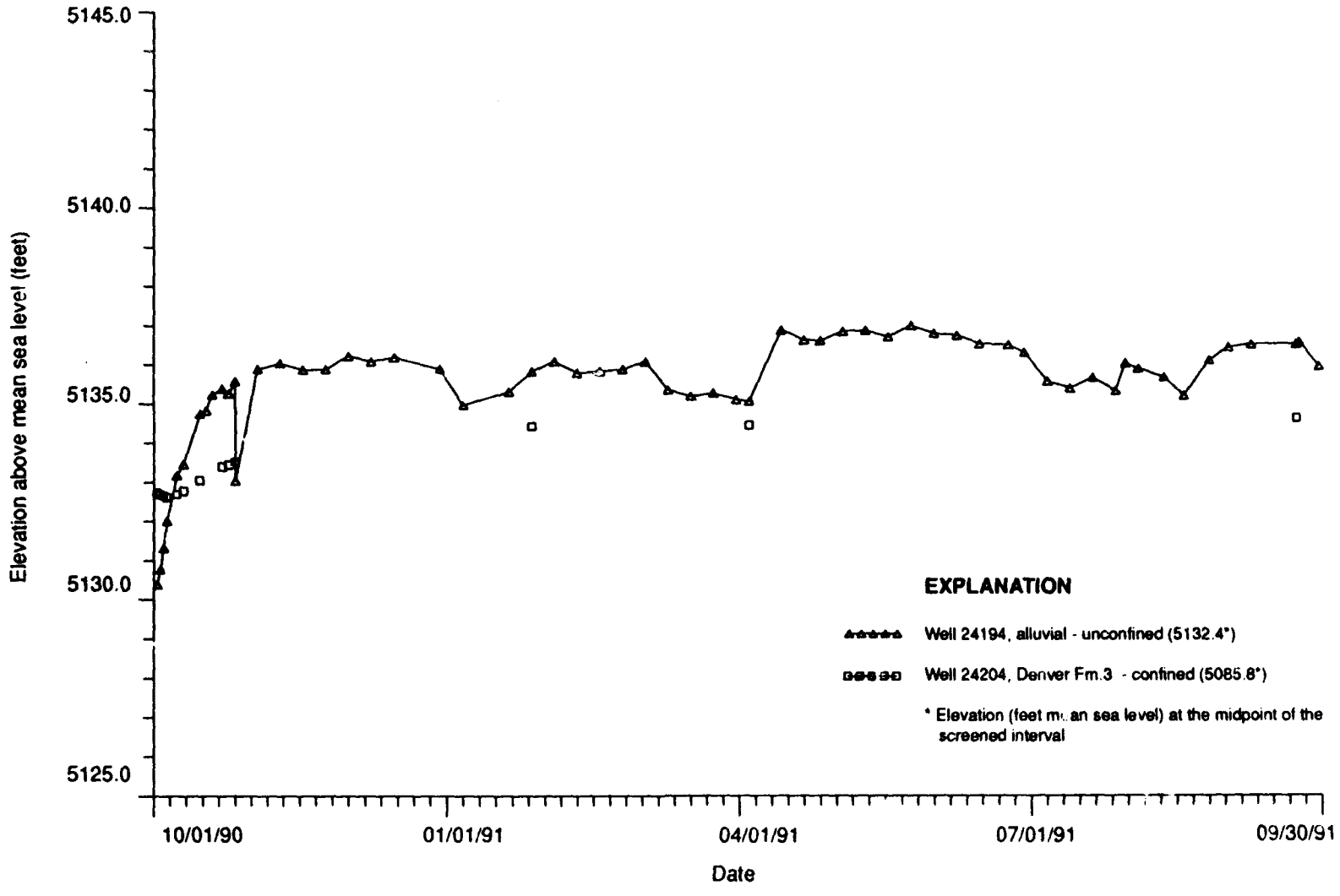


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Figure 5.22

Hydrograph of Well Cluster North of the North Boundary Containment/Treatment System Barrier Wall (wells 24167, 24168, 24192, and 24503)

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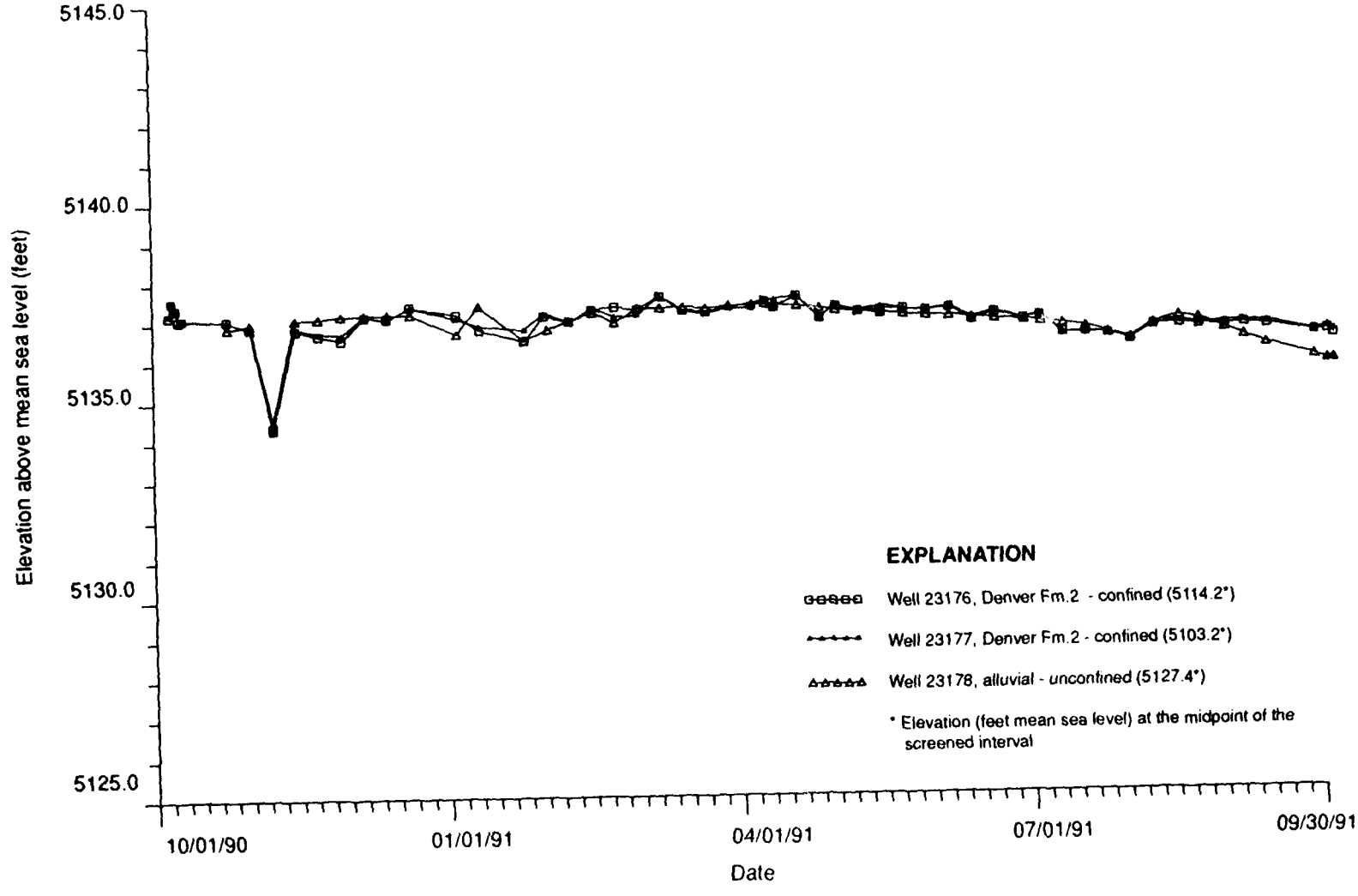
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Harding Lawson Associates

Figure 5.23

Hydrograph of Well Cluster North of the North Boundary Containment/Treatment System Barrier Wall (wells 24194 and 24204)

GWAR FY91

RMA 1076.13

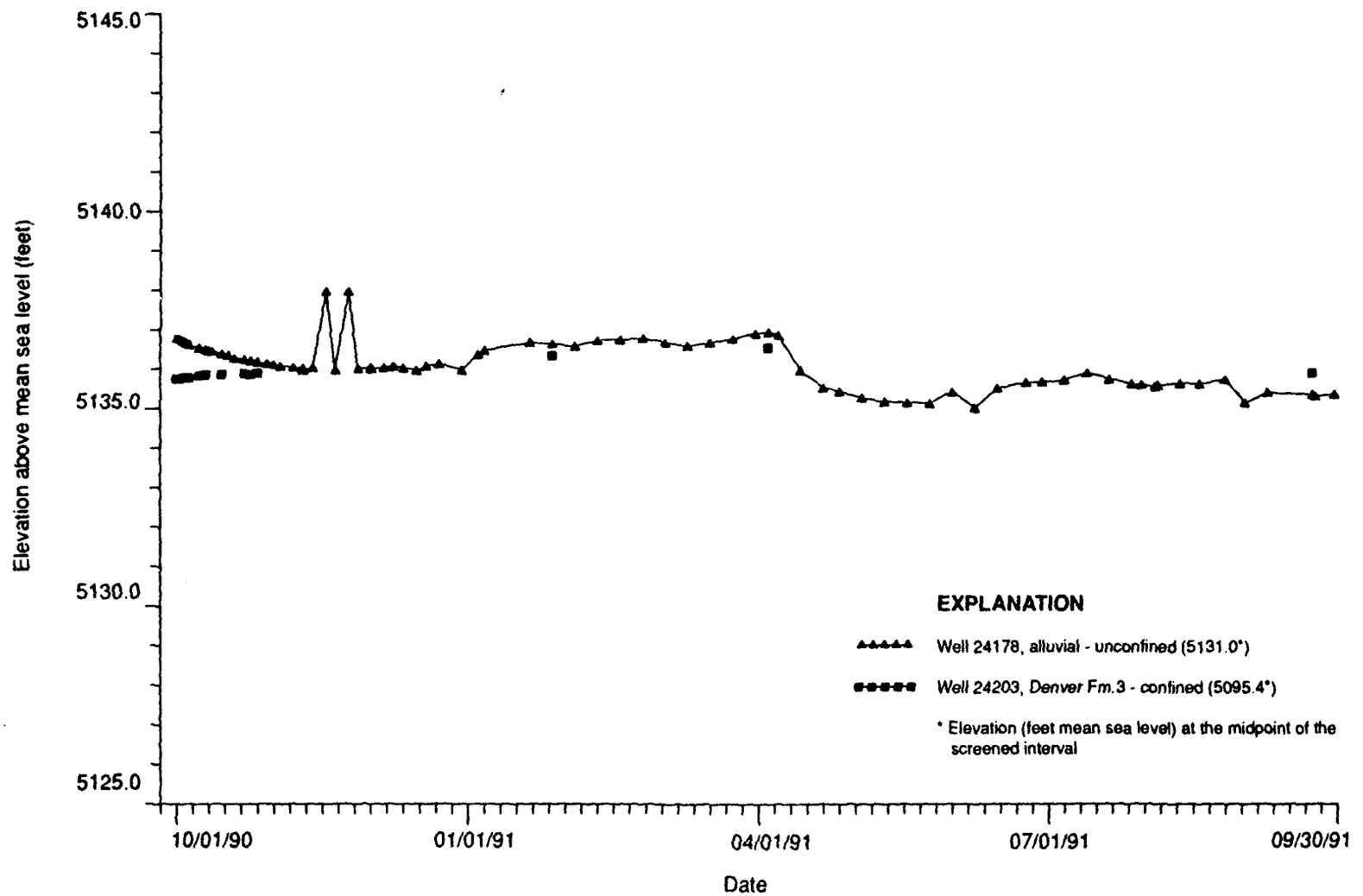


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Figure 5.24

Hydrograph of Well Cluster South of the North Boundary Containment/Treatment System Barrier Wall (wells 23176, 23177, and 23178)

RMA 1076 16

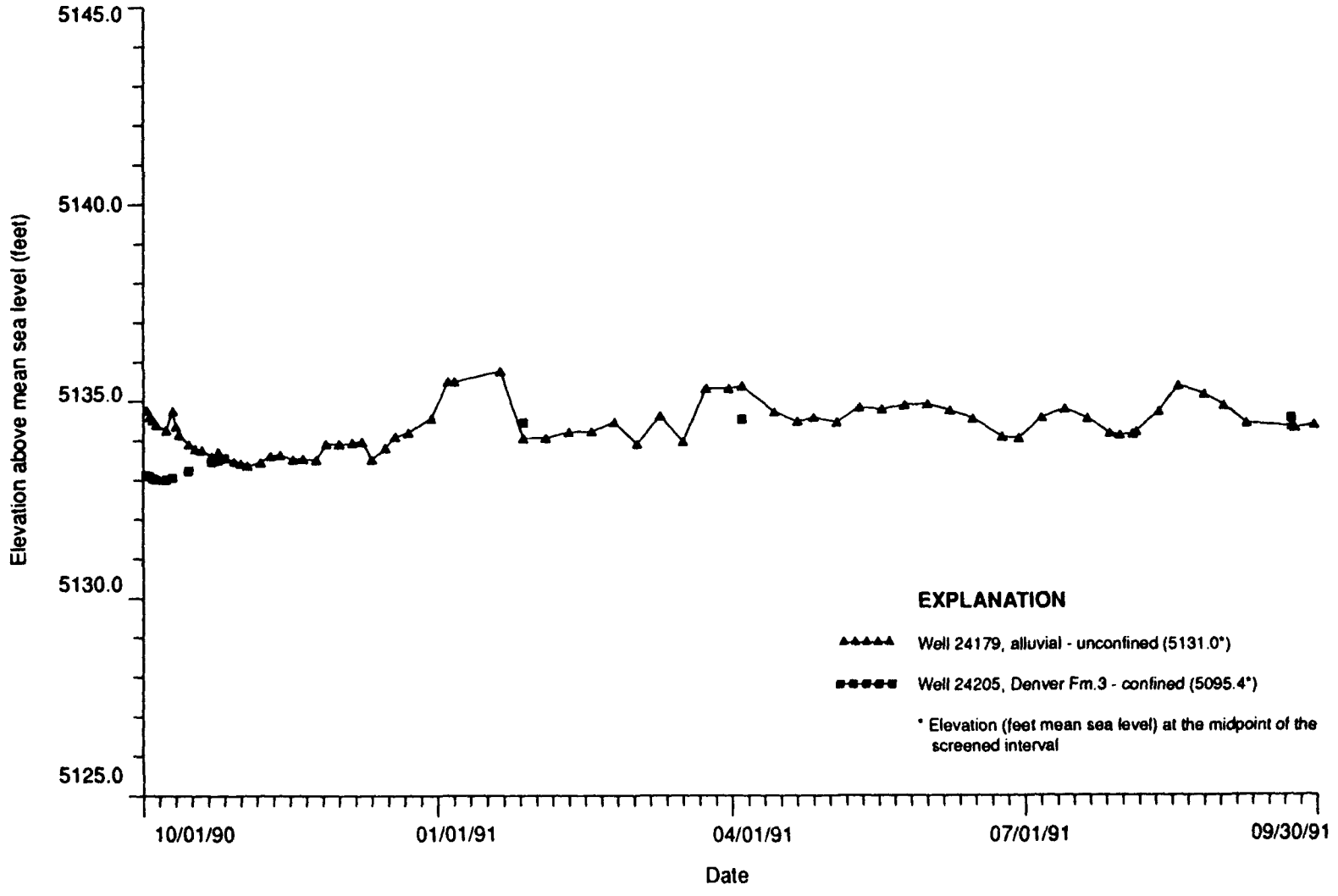


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Figure 5.25

Hydrograph of Well Cluster South of the North Boundary Containment/Treatment

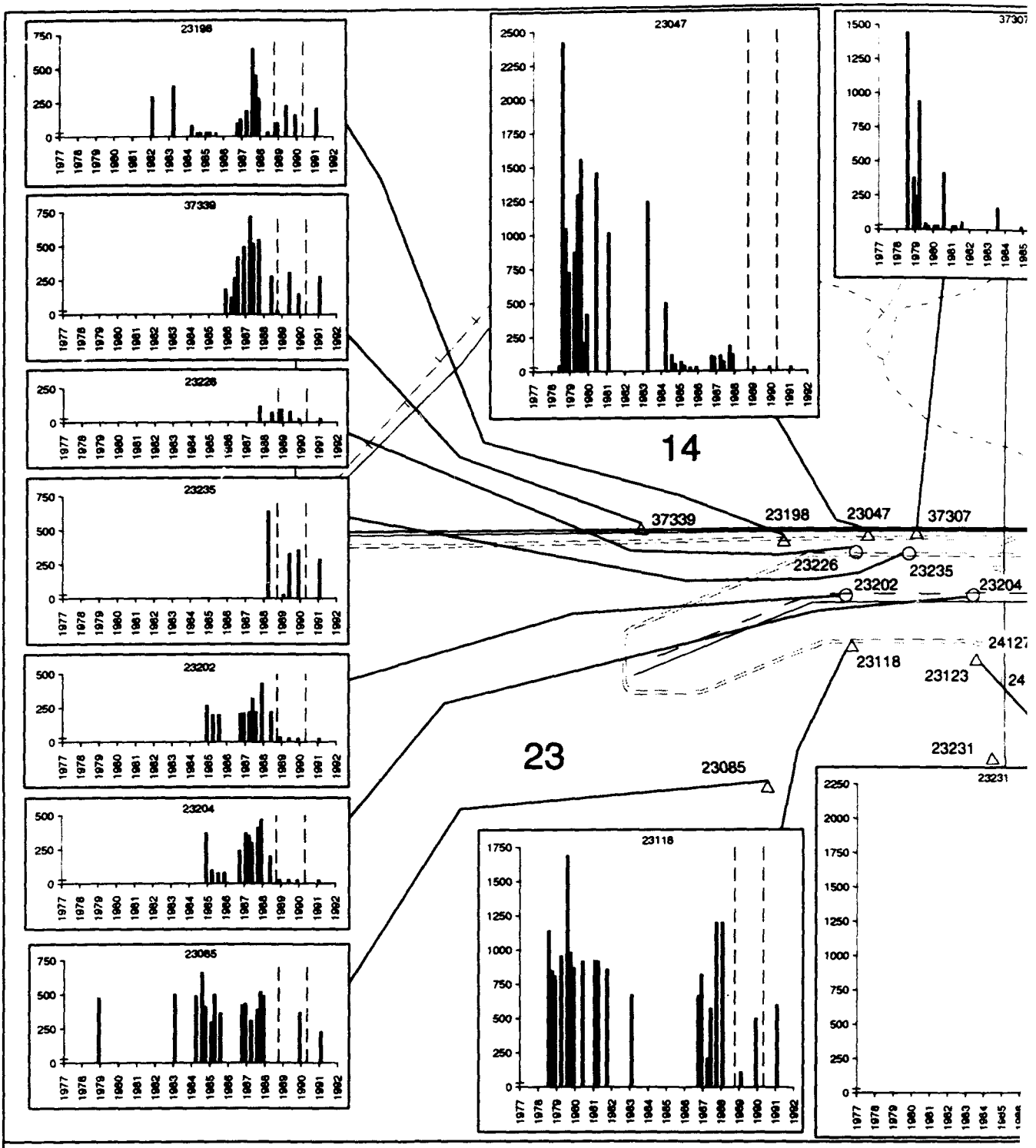
RMA 1076 17



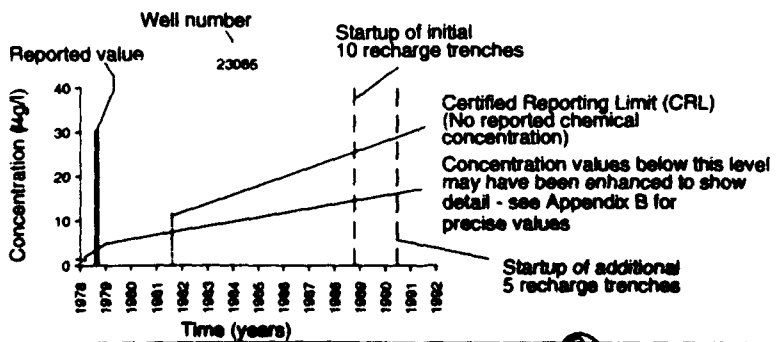
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Figure 5.26

Hydrograph of Well Cluster South of the North Boundary Containment/Treatment System Barrier Wall (wells 24179 and 24205)



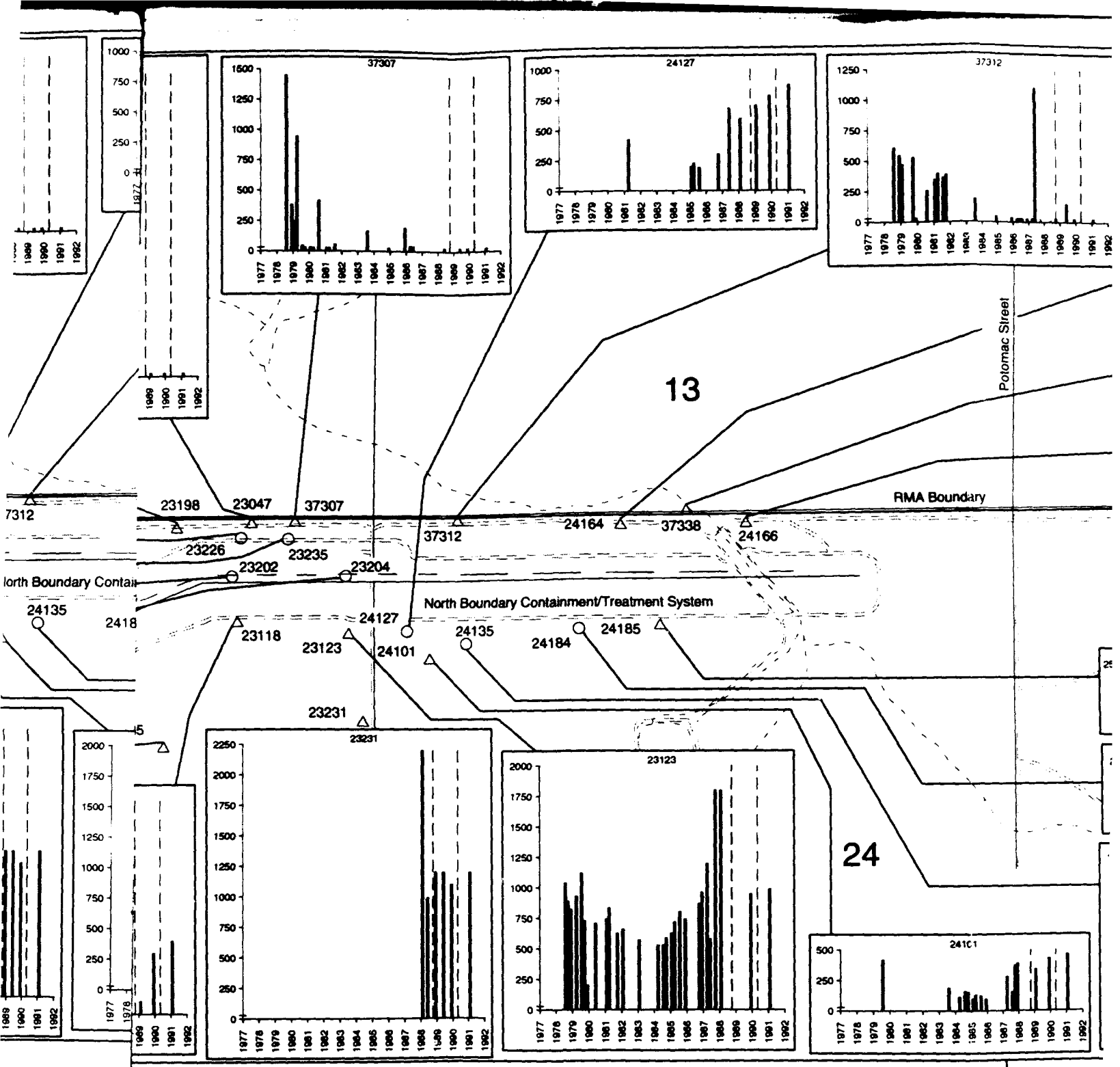
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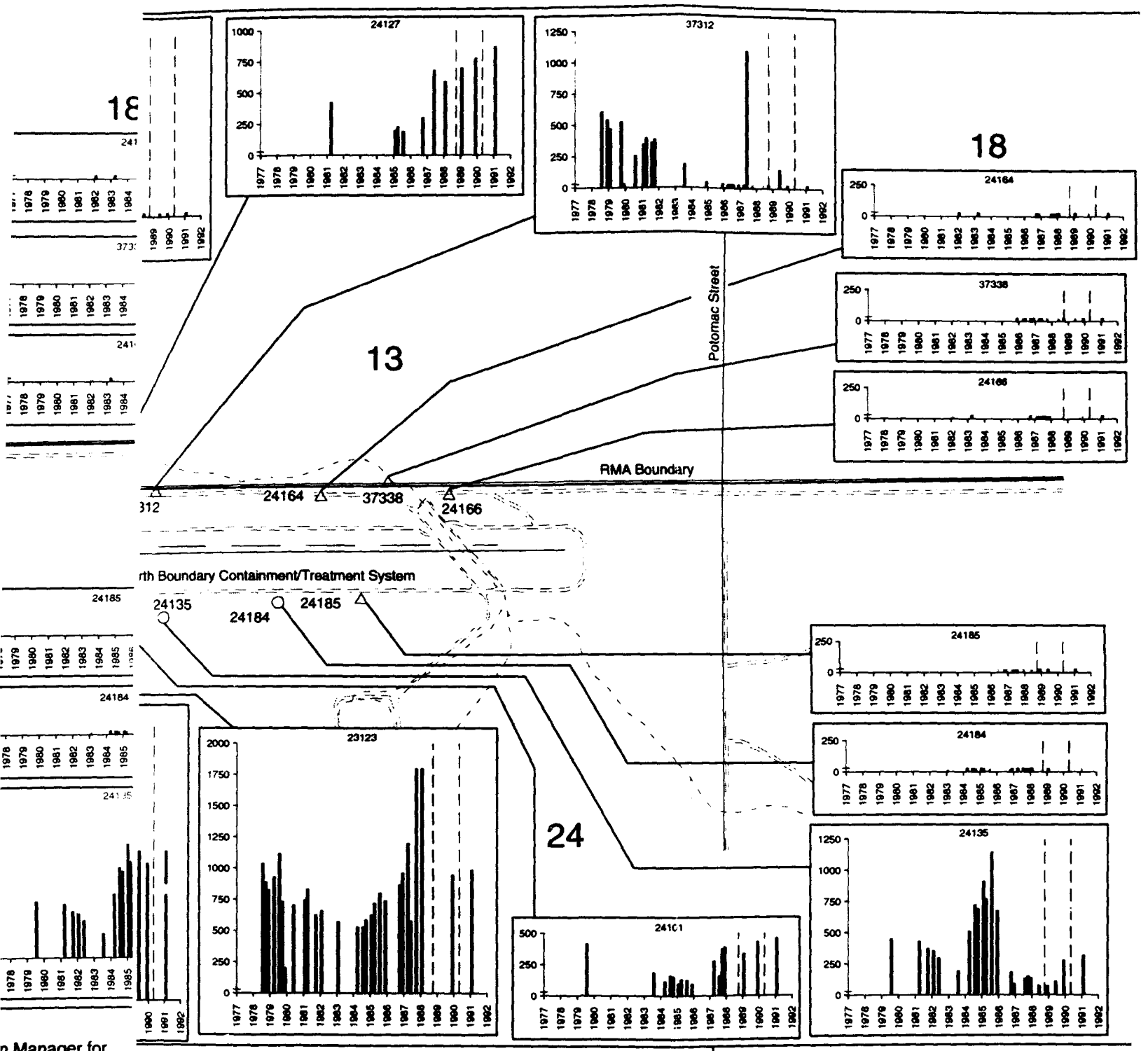
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Figure 5.

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Harding Lawson Associates

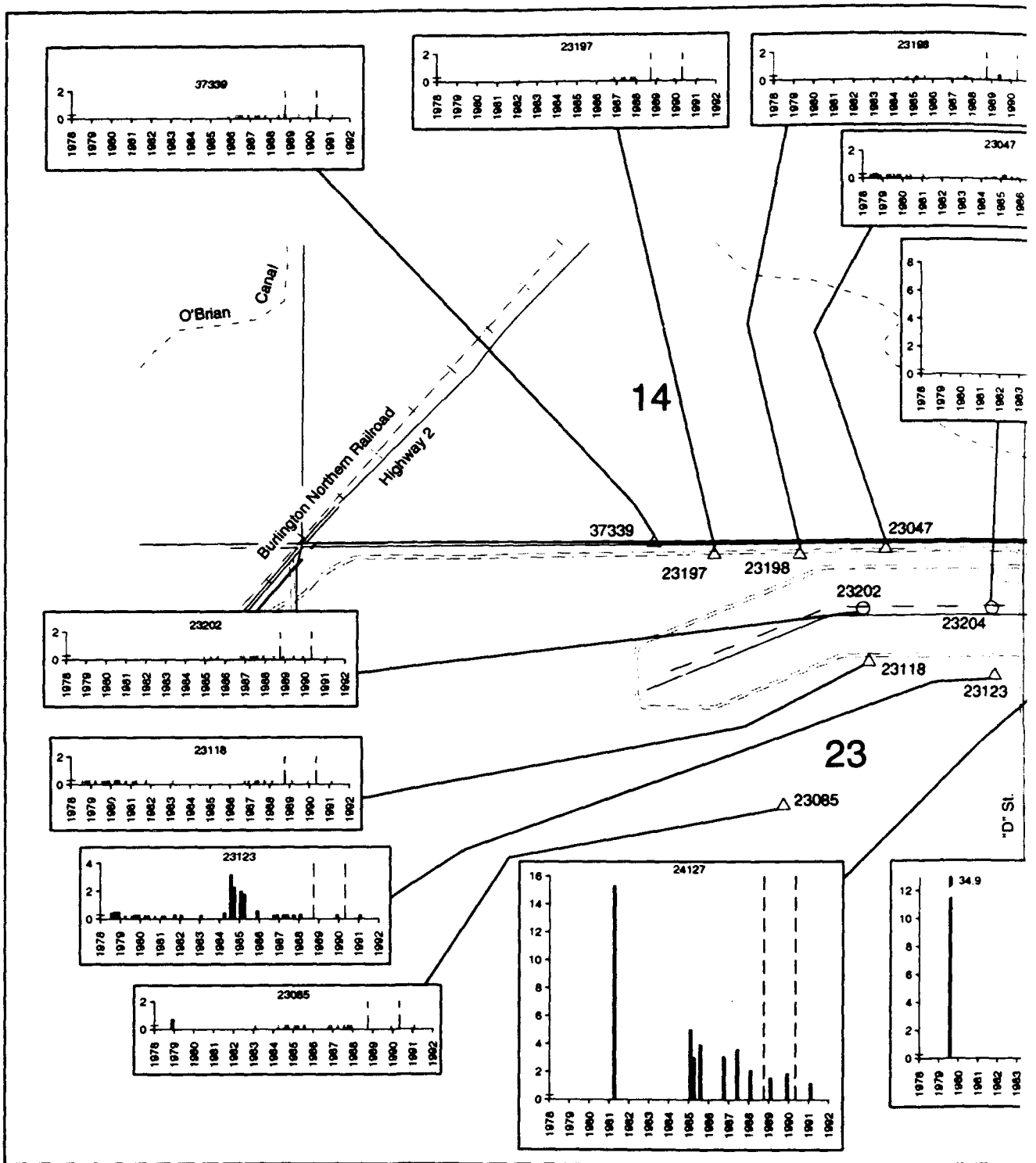
Figure 5.27

Diisopropylmethylphosphonate (DIMP)
Histograms for Wells near the North
Boundary Containment/Treatment System

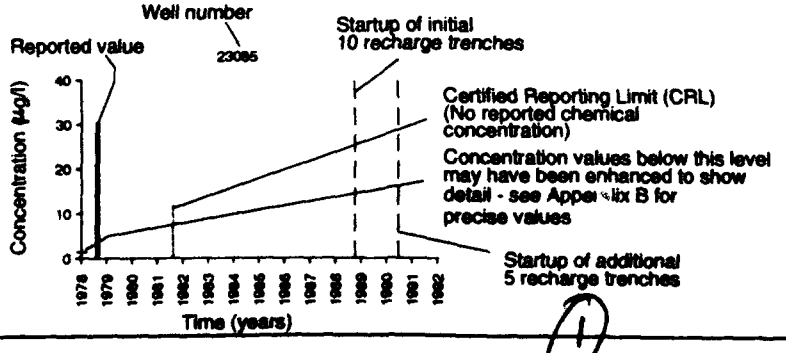
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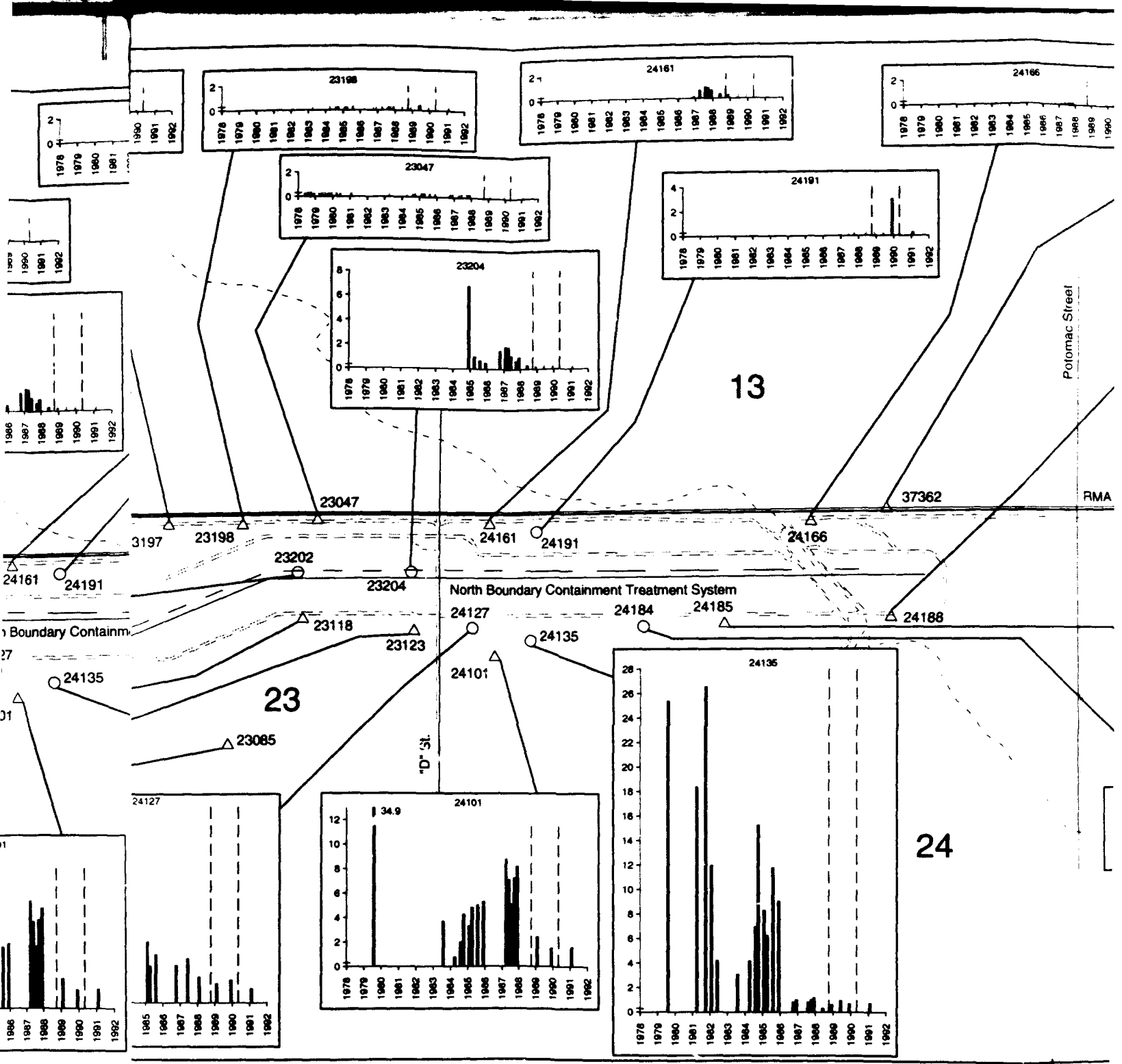
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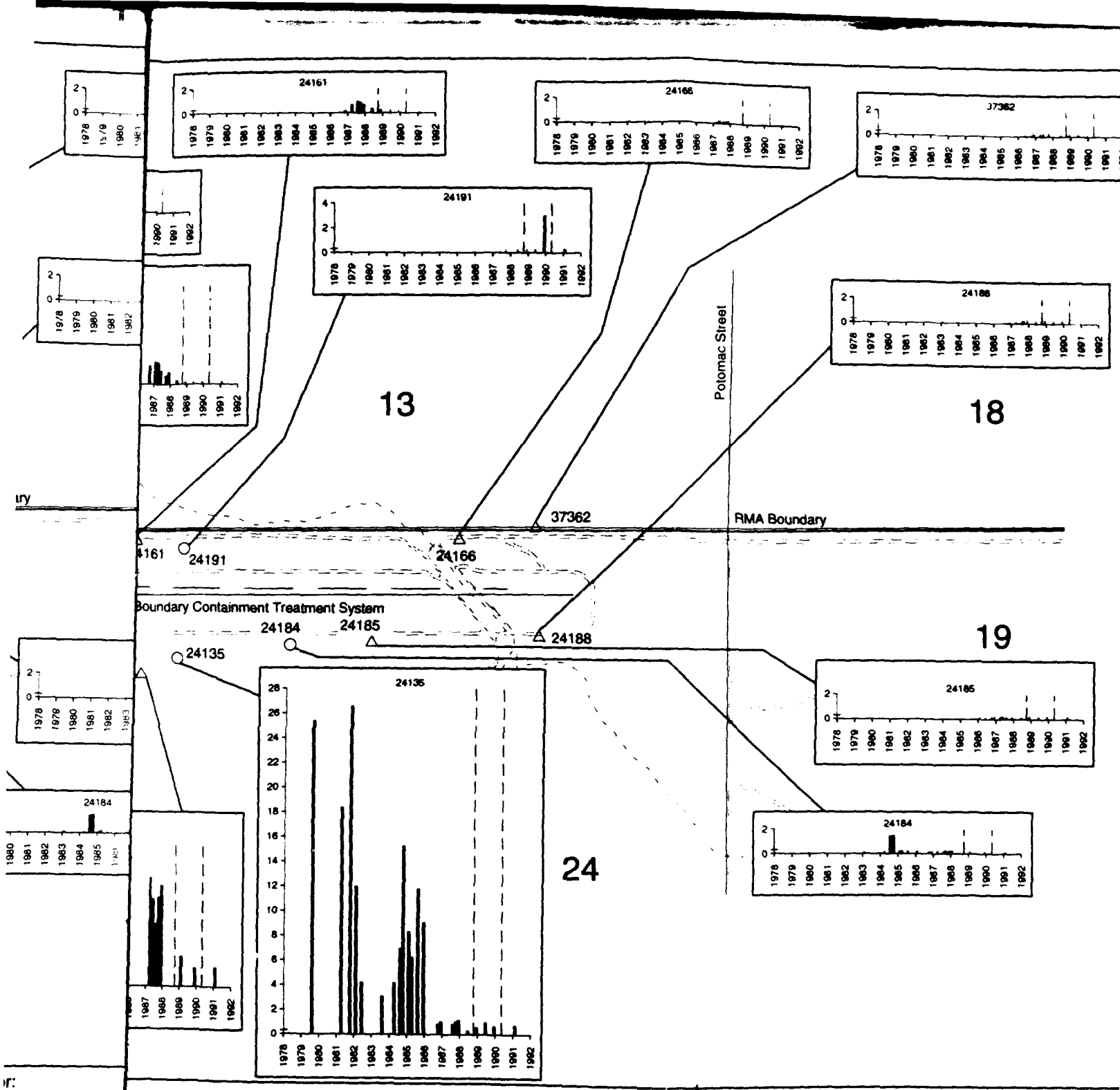


EXPLANATION



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PLANATION
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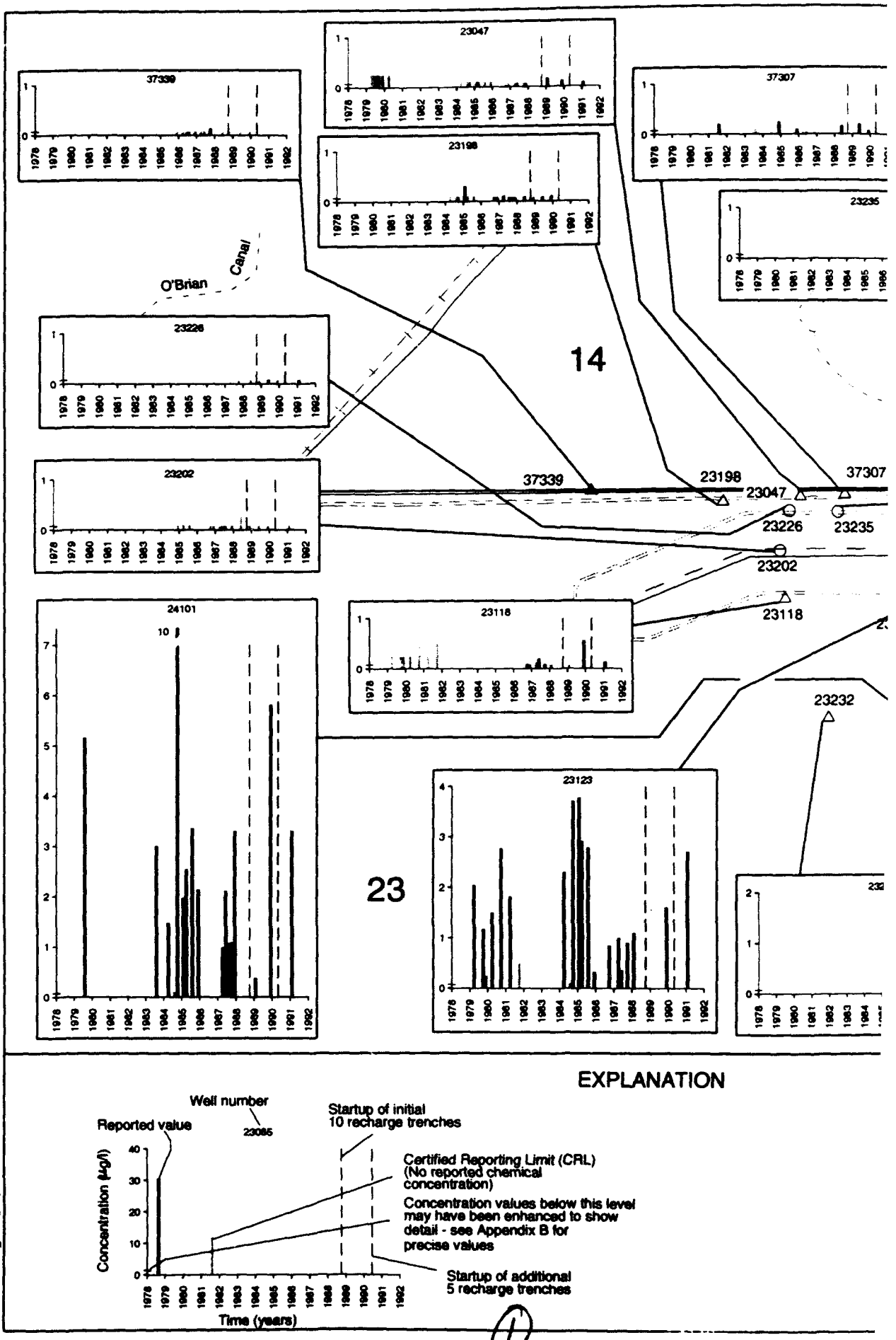


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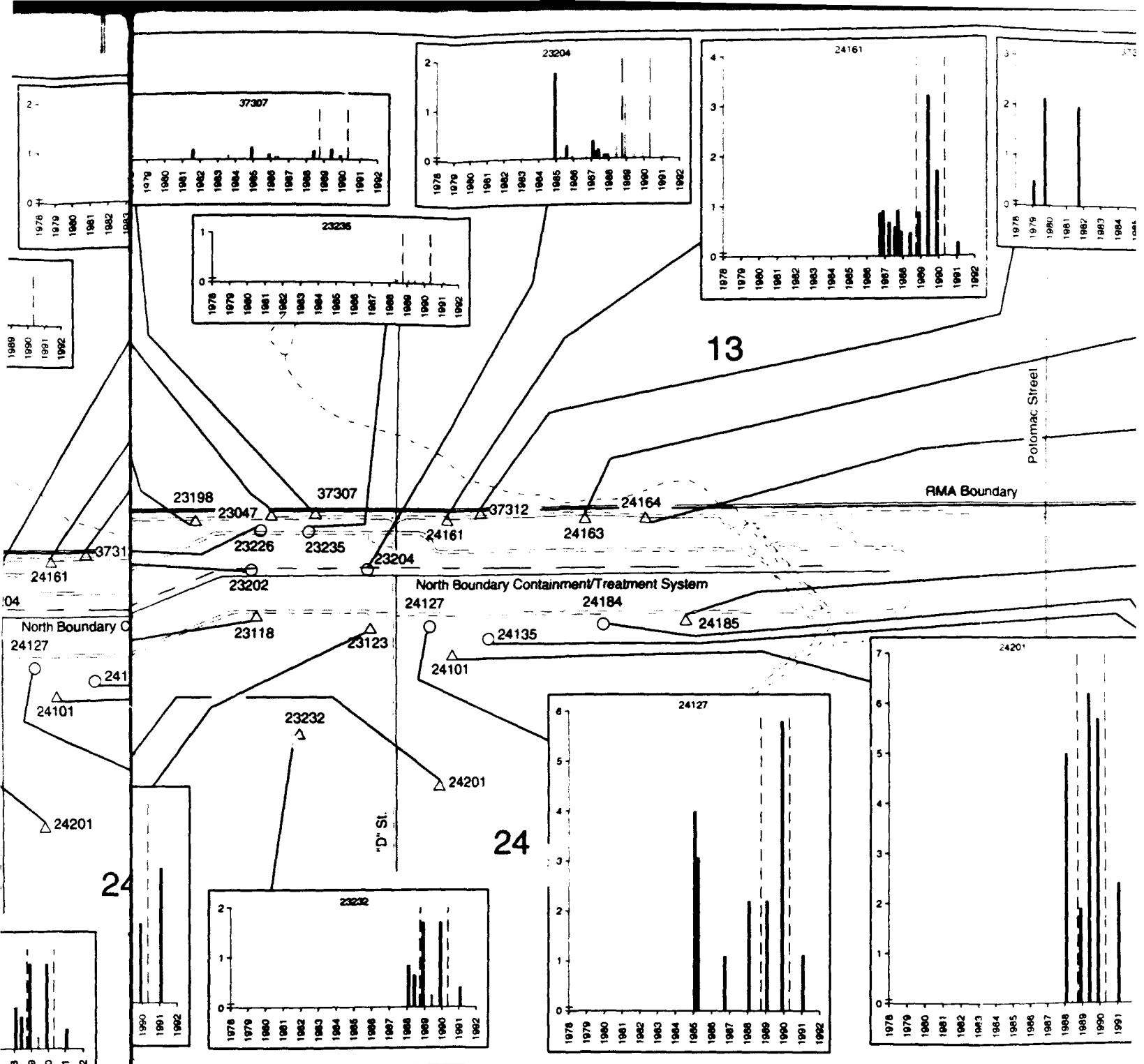
Figure 5.28

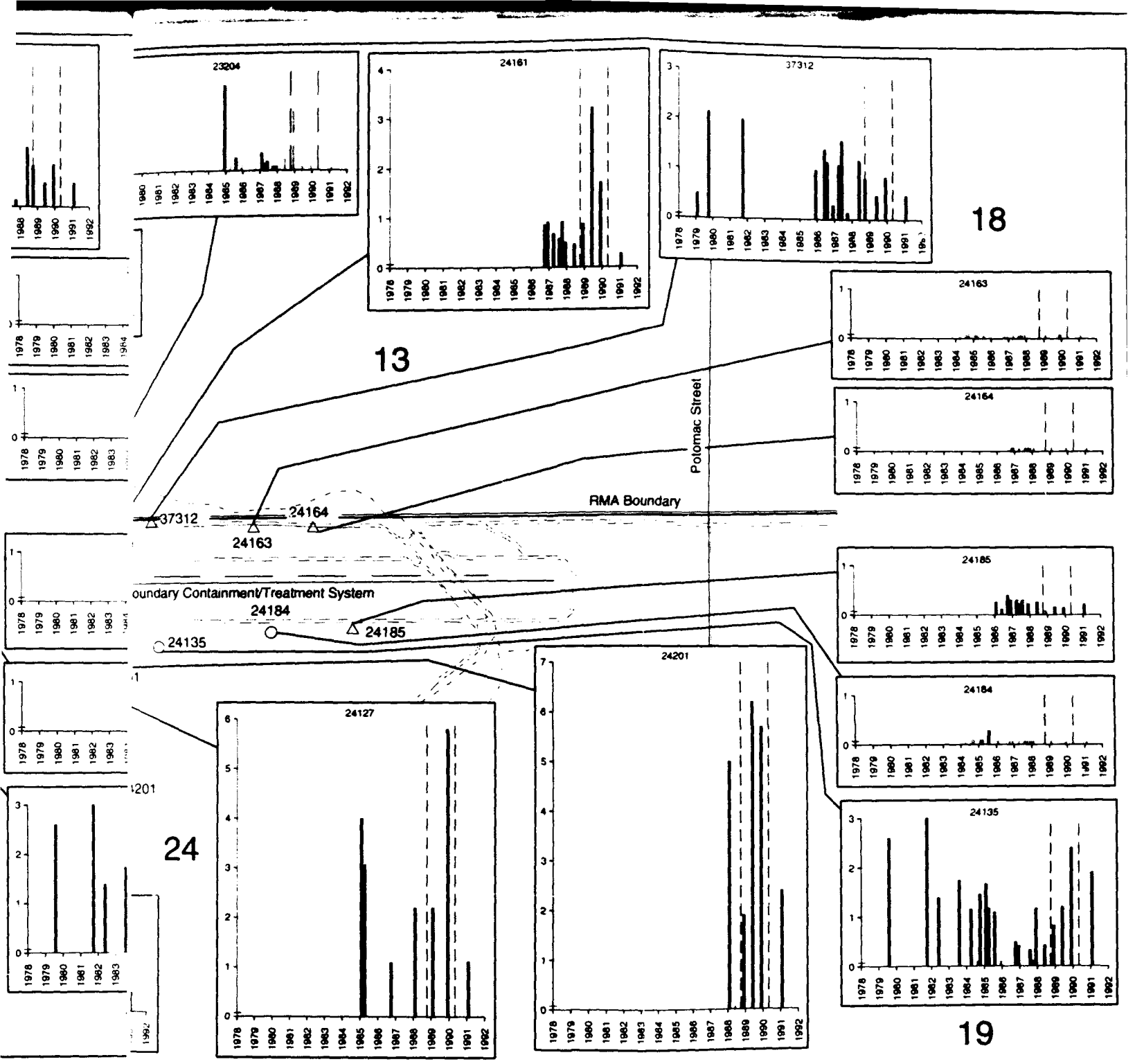
Dibromochloropropane (DBCP) Histograms for Wells near the North Boundary Containment/Treatment System

GWAR FY91



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23204
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North Boundary Containment/Treatment System
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Commerce City, Colorado
Prepared by:
Harding Lawson Associates

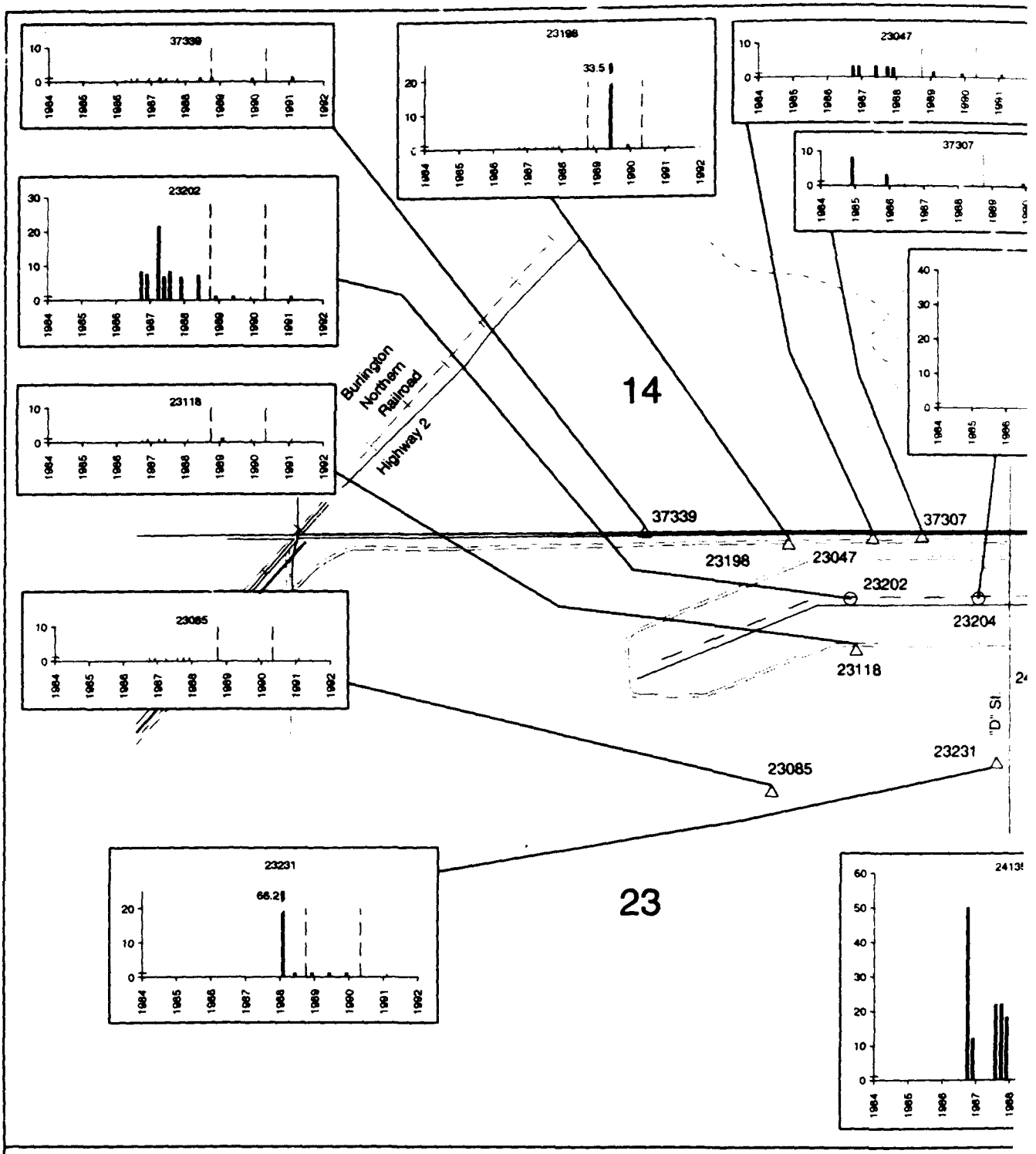
Figure 5.29

Dieldrin Histograms for Wells
Near the North Boundary
Containment/Treatment System

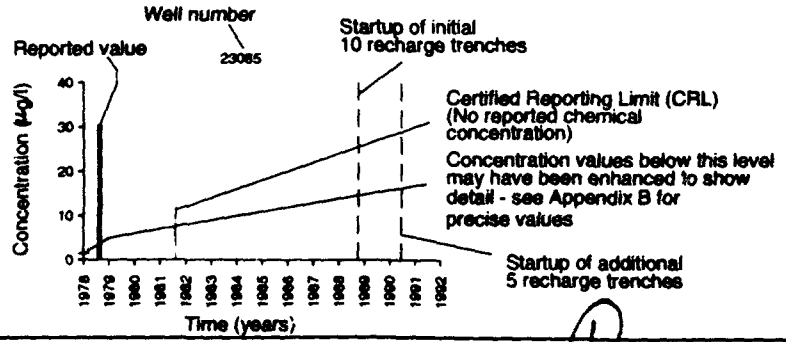
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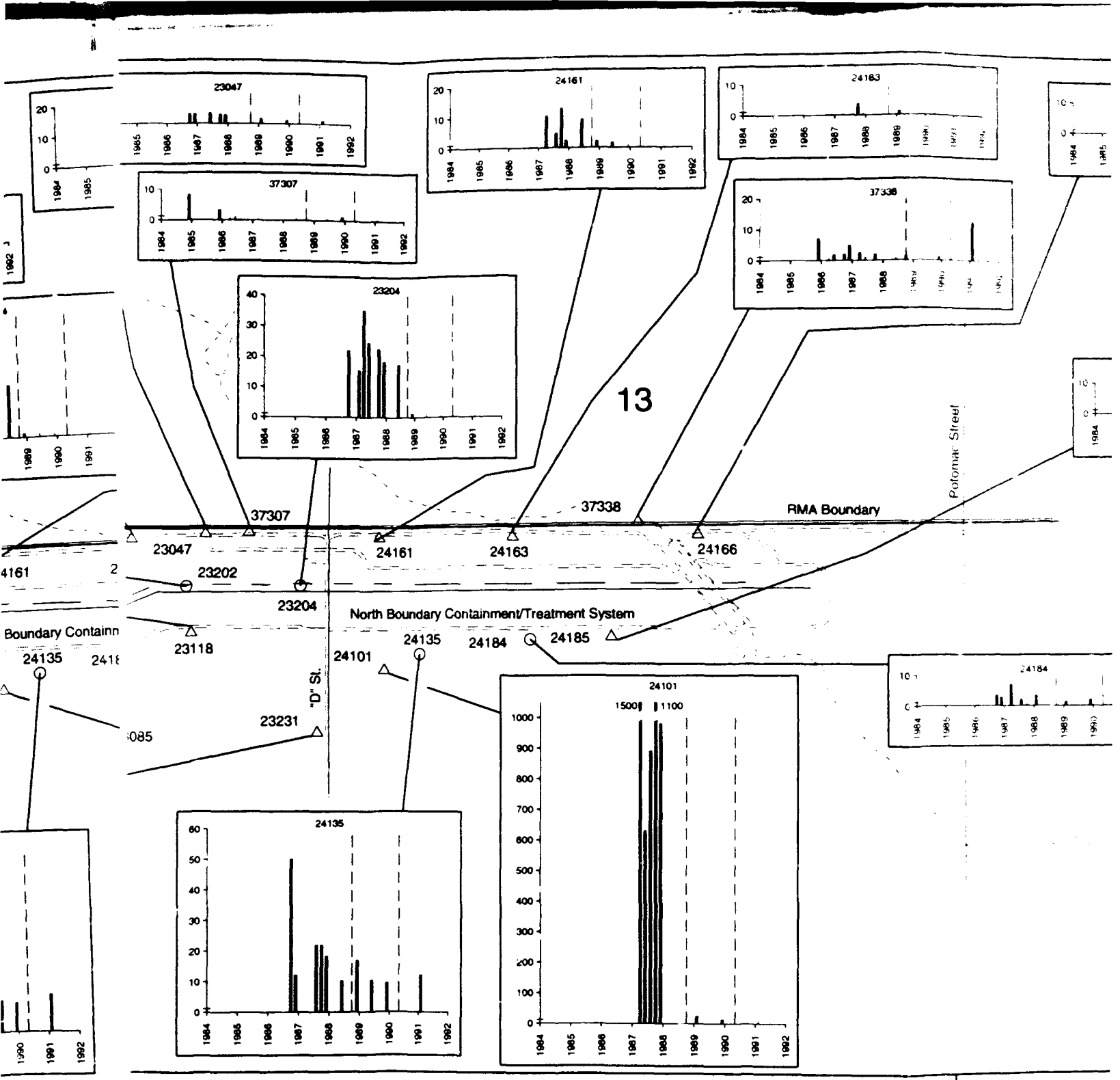
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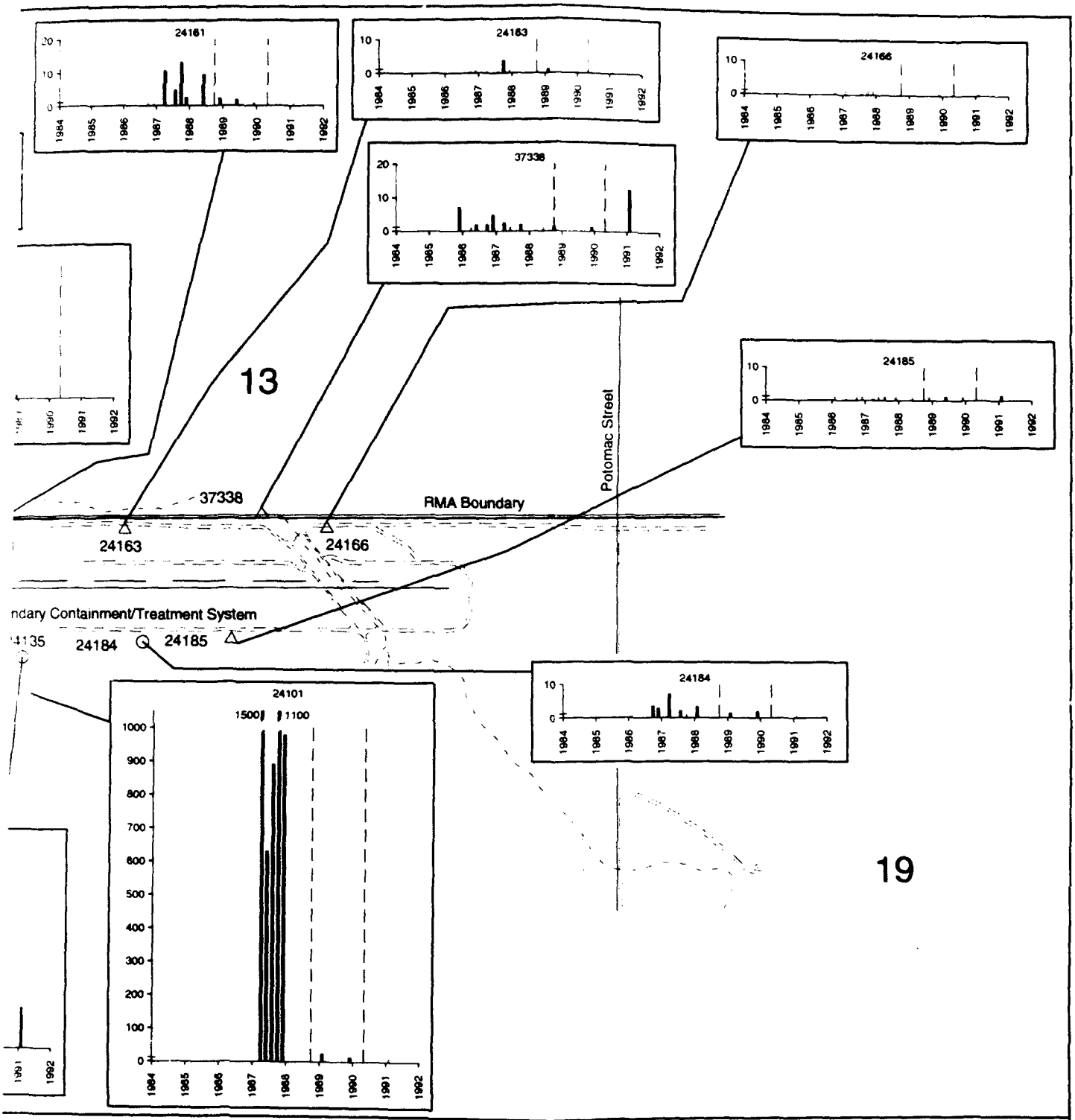


EXPLANATION



7/11/92 nb_chcl DPG


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North Boundary Containment/Treatment System
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Unconfined flow system wells
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24135 Denver well
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Figure 5.30
Chloroform Histo
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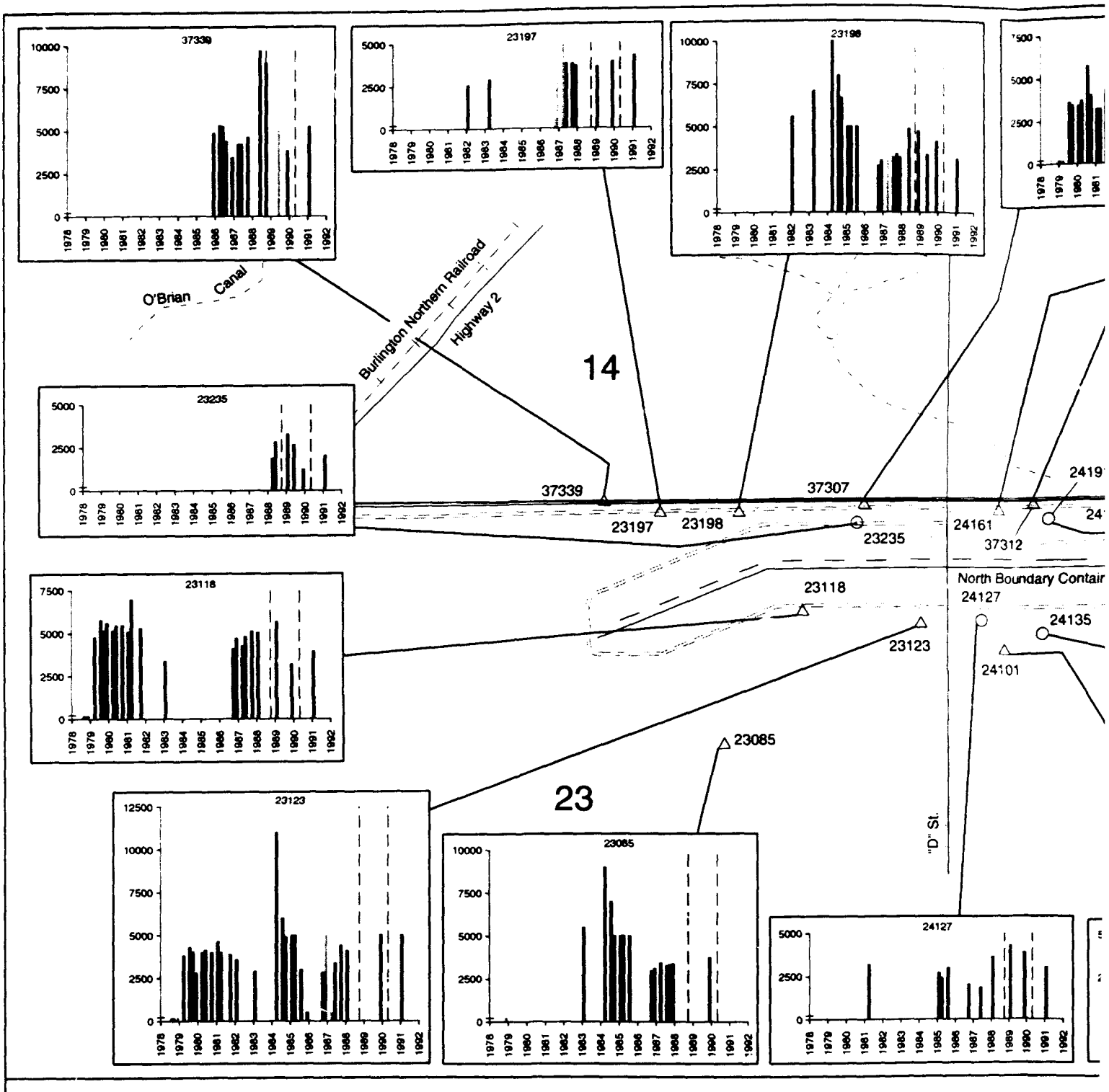
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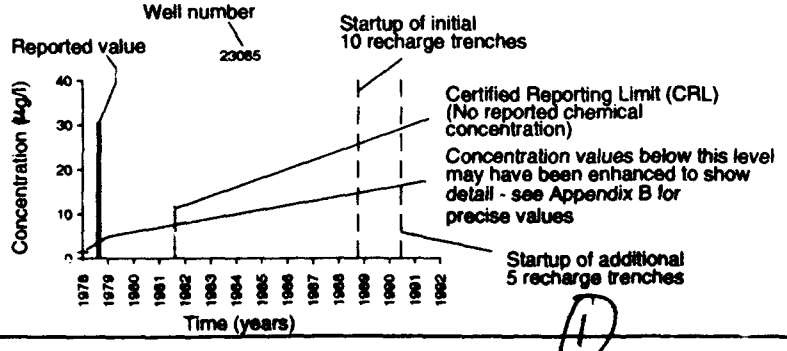
Figure 5.30

Chloroform Histograms for Wells
Near the North Boundary
Containment/Treatment System

GWAR FY91



EXPLANATION

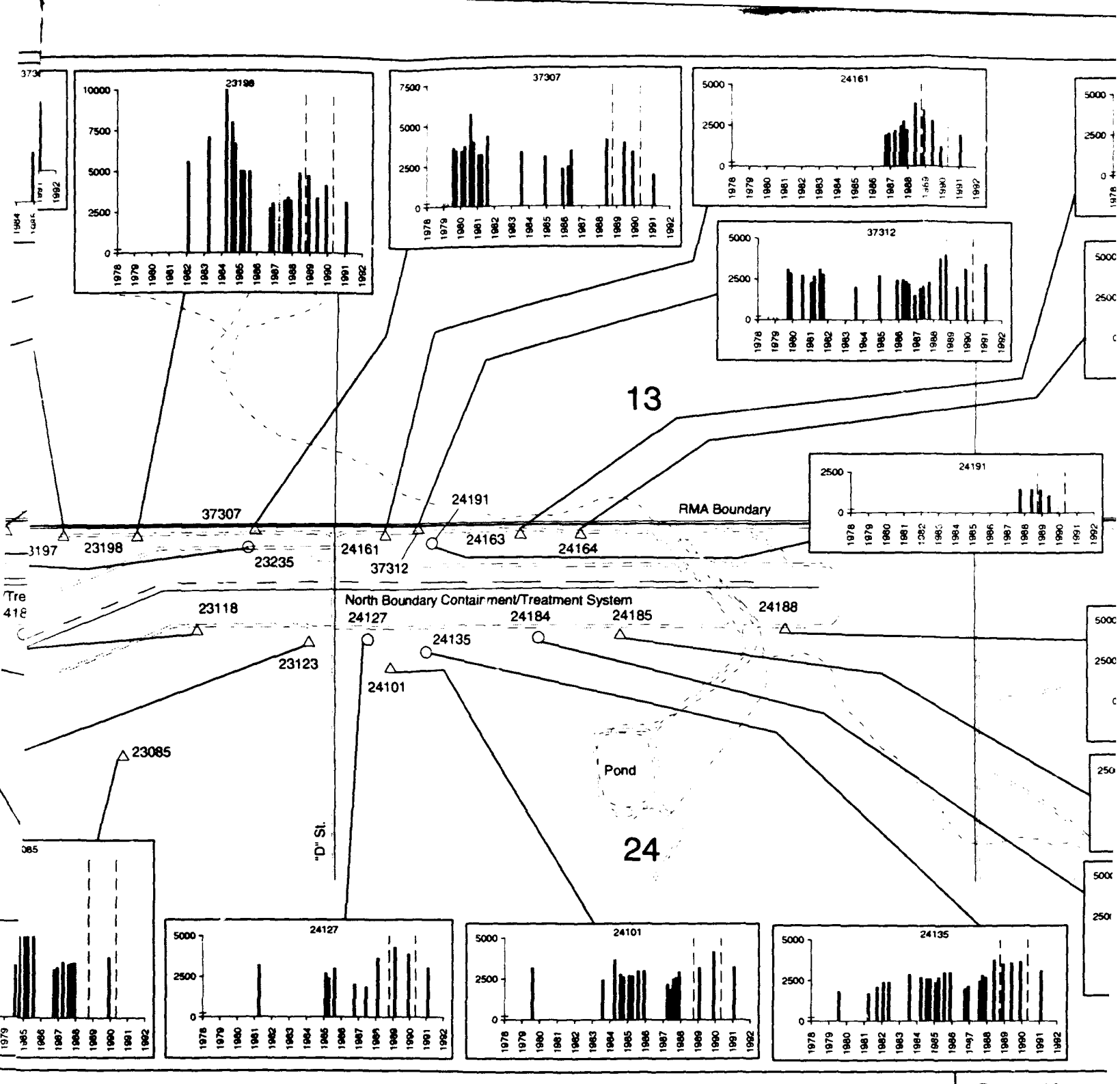


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7/11/92 rma/nb_f DPG



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Unconfined flow system wells

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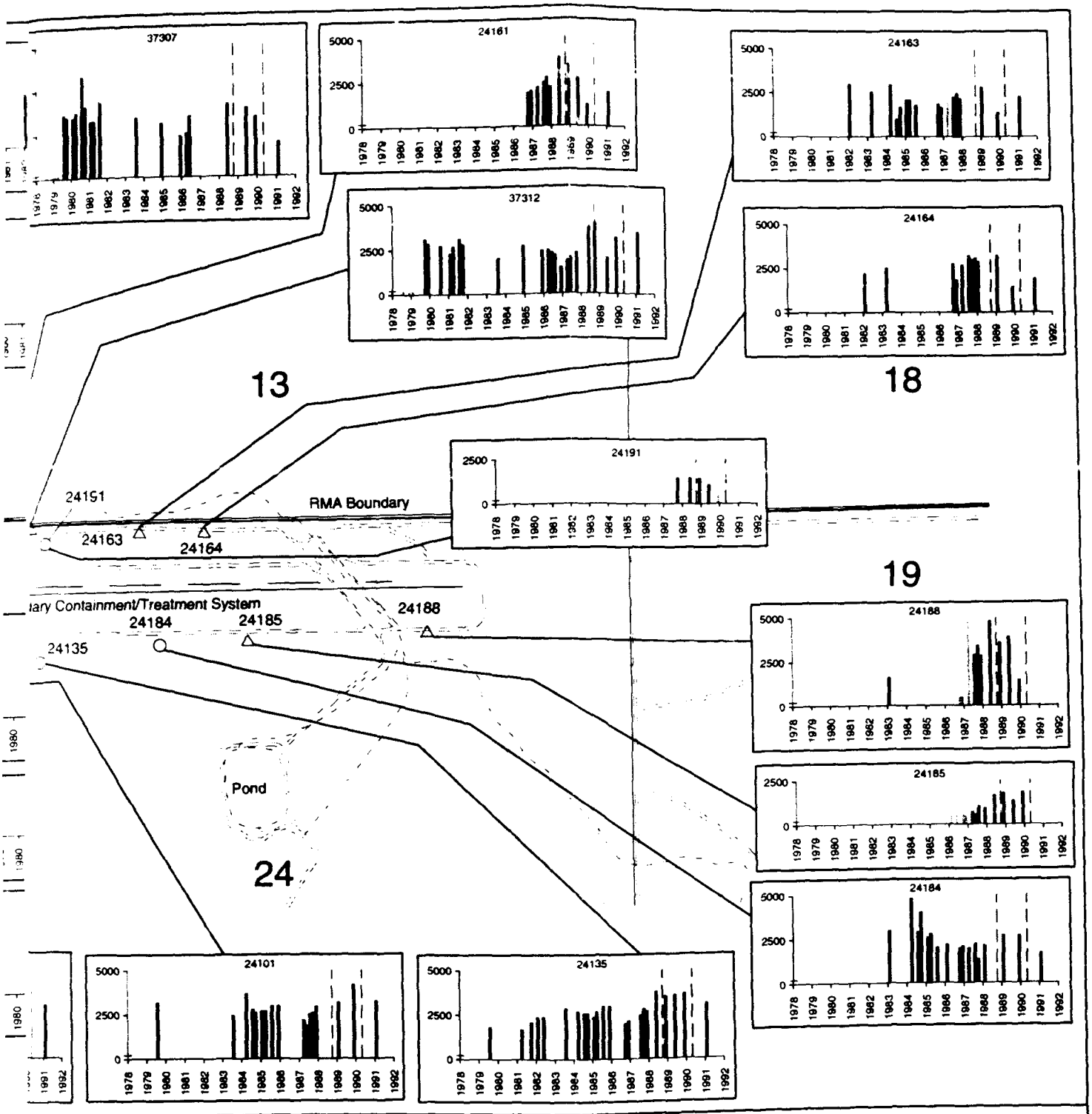
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Figure 5.31

Fluoride Histogr
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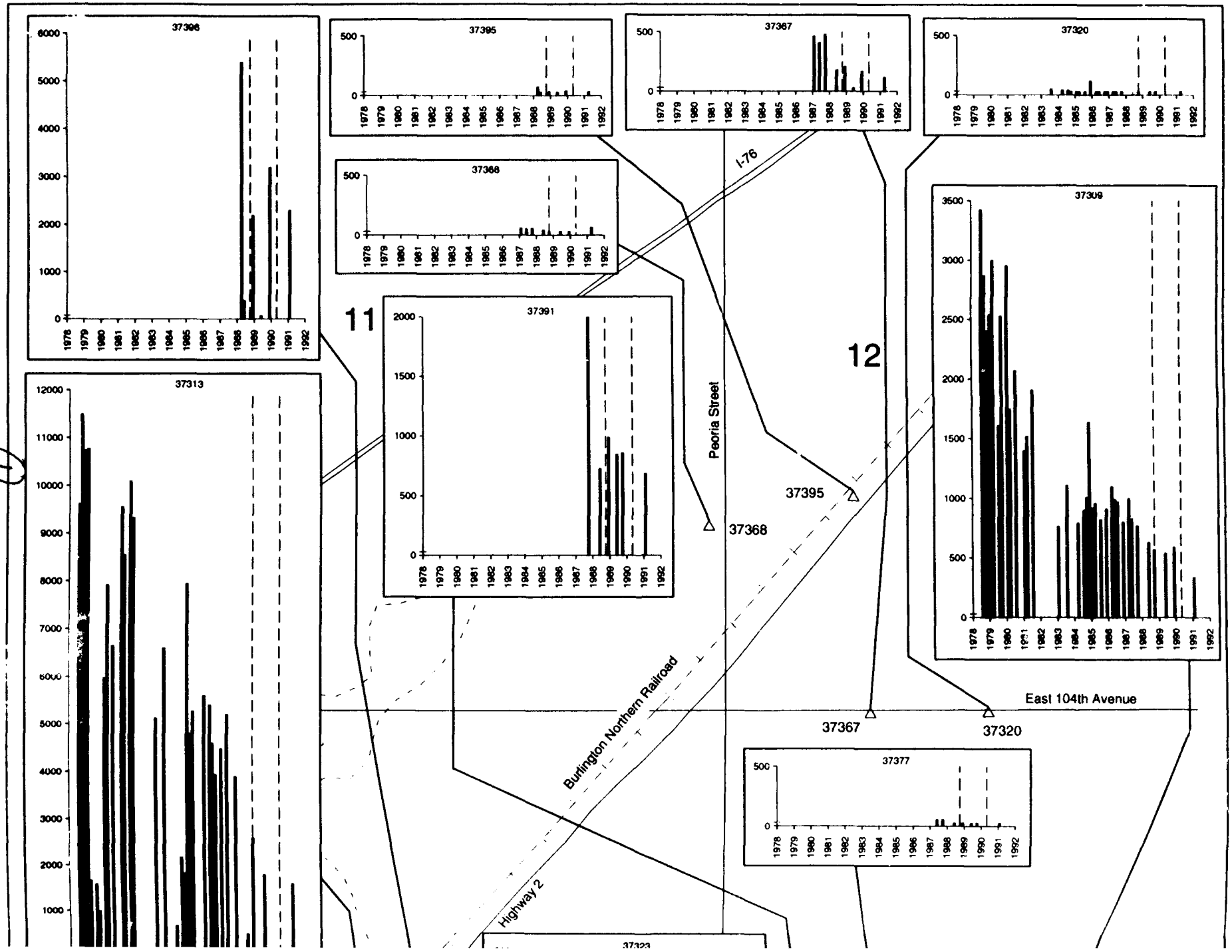
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

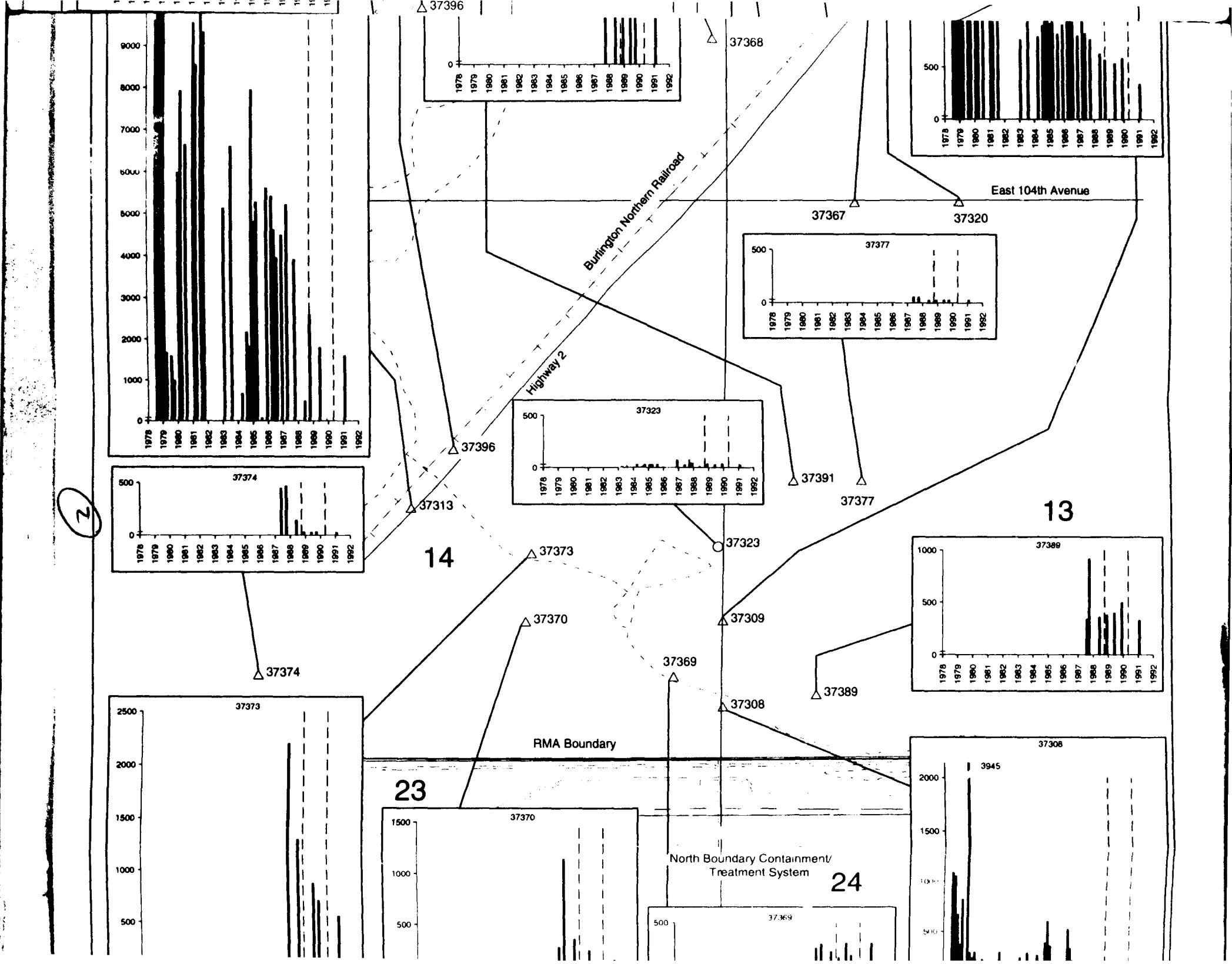
Prepared by:
Harding Lawson Associates

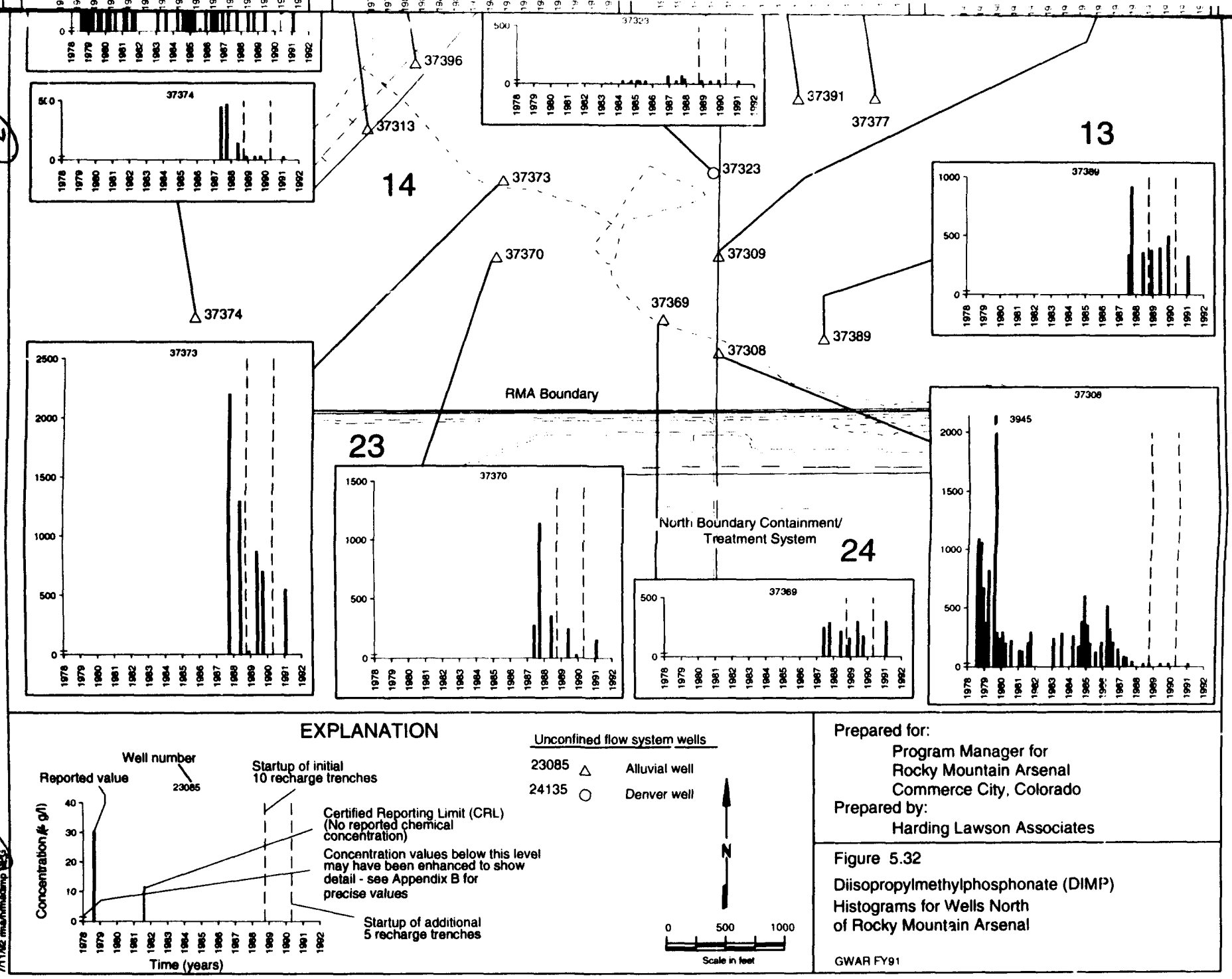
Figure 5.31

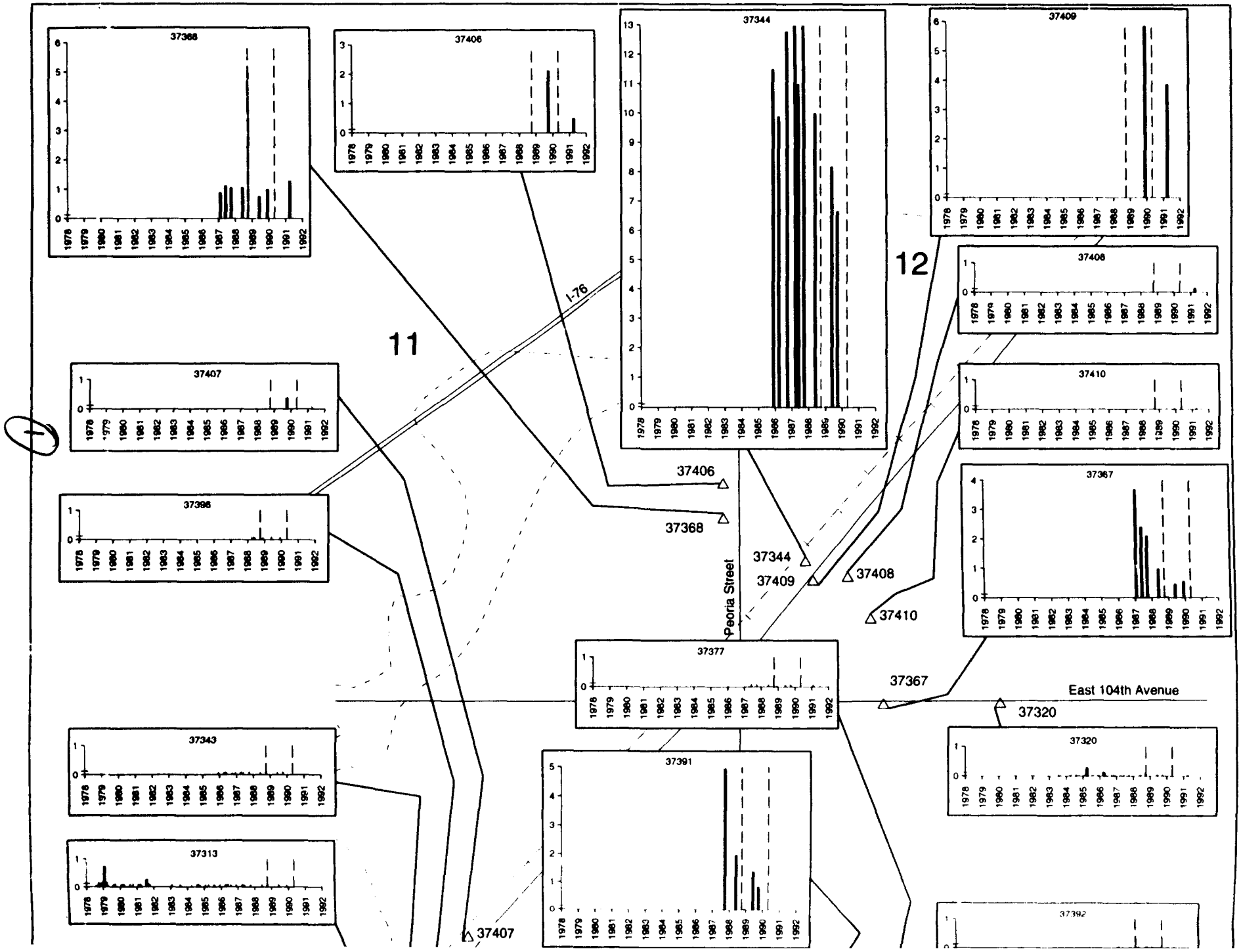
Fluoride Histograms for Wells
Near the North Boundary
Containment/Treatment System

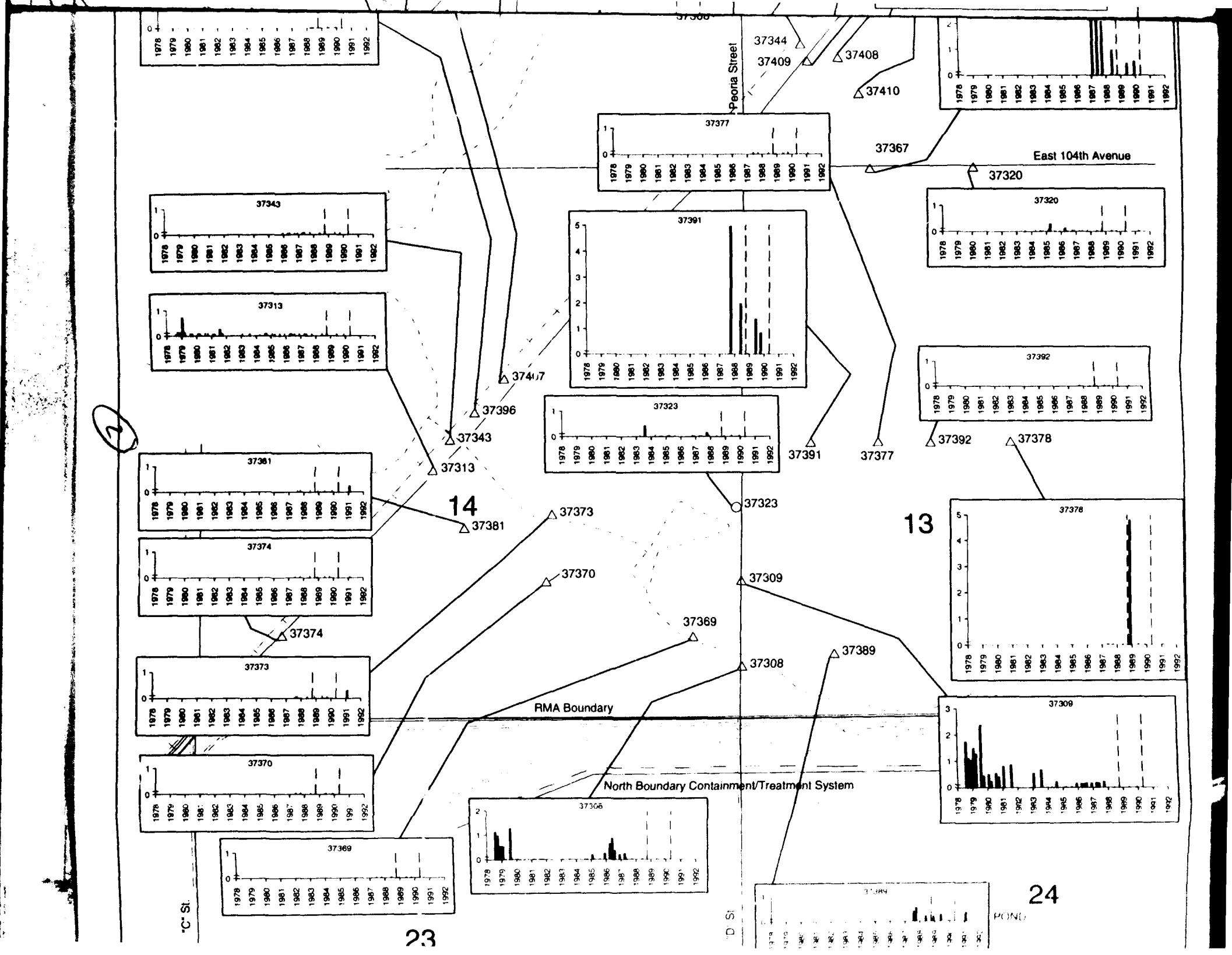
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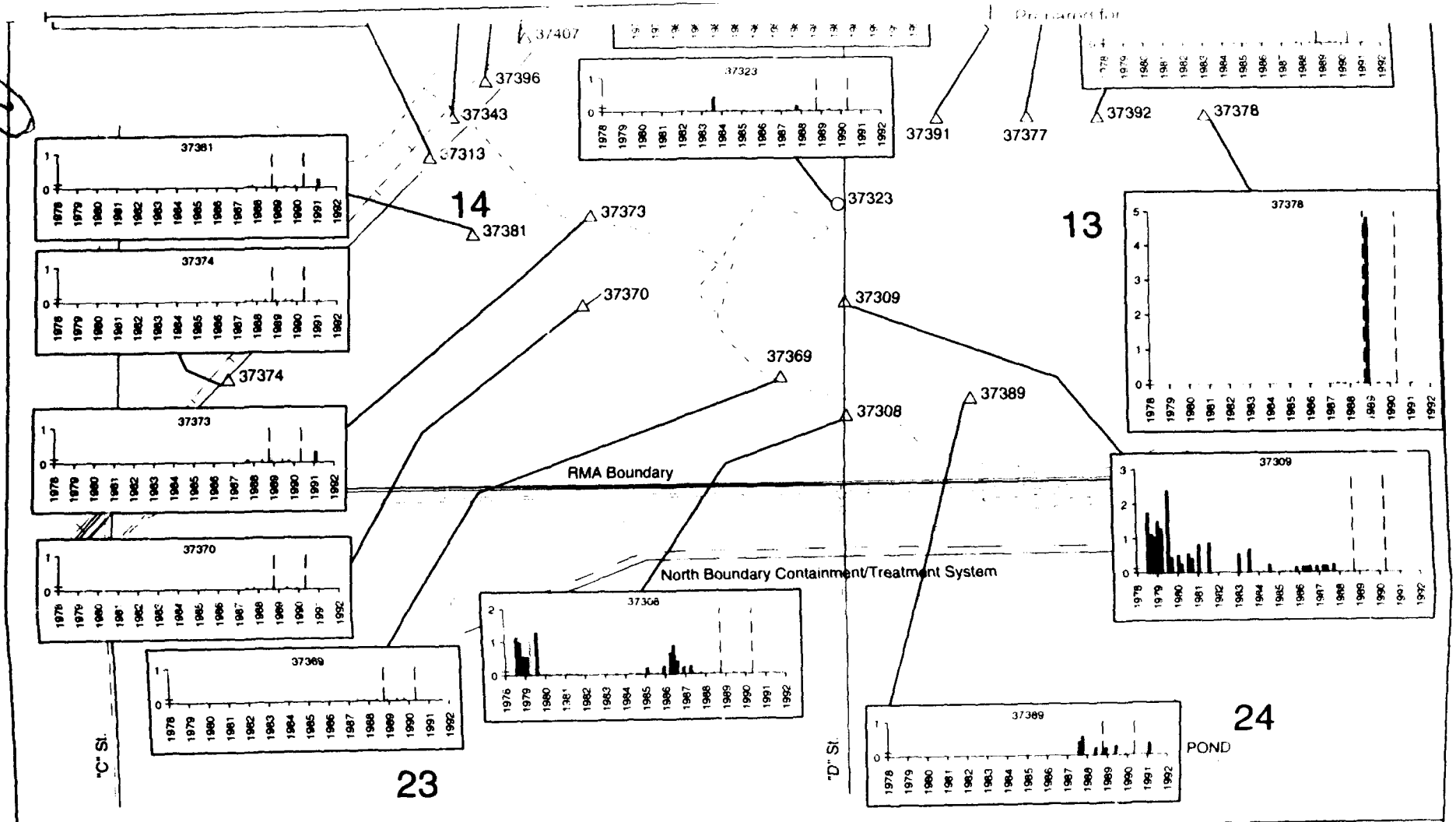

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Highway 2
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37396
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East 104th Avenue
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37320
Burlington Northern Railroad
37377
Highway 2
37323
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37313
13
37374
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37373
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37369
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37308
RMA Boundary
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23
37370
North Boundary Containment/
Treatment System
24
37369
37308
3945


37396
37313
37374
37373
37370
37369
37323
37391
37377
37309
37389
37308
14
13
23
24
RMA Boundary
North Boundary Containment/
Treatment System
37374
37373
37370
37369
37389
37308
3945
EXPLANATION
Well number
Reported value
23085
Startup of initial
10 recharge trenches
Concentration (µg/l)
Certified Reporting Limit (CRL)
(No reported chemical
concentration)
Concentration values below this level
may have been enhanced to show
detail - see Appendix B for
precise values
Startup of additional
5 recharge trenches
Time (years)
Unconfined flow system wells
23085 Alluvial well
24135 Denver well
N
0 500 1000
Scale in feet
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates
Figure 5.32
Diisopropylmethylphosphonate (DIMP)
Histograms for Wells North
of Rocky Mountain Arsenal
GWAR FY91
7/11/92 mahmsclmp


37368
37406
37344
37409
37408
37407
37410
37396
37367
37377
37343
37320
37313
37391
37392
37407
11
12
I-76
Peoria Street
East 104th Avenue
37406
37368
37344
37409
37408
37410
37367
37320
37407

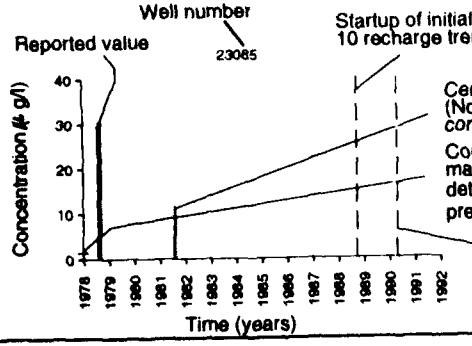

Peoria Street
East 104th Avenue
RMA Boundary
North Boundary Containment/Treatment System
"C" St.
"D" St
POND
14
13
24
23
37344
37409
37408
37410
37367
37320
37377
37391
37392
37378
37323
37396
37343
37313
37407
37381
37373
37374
37370
37369
37309
37308
37389
37366



EXPLANATION

Unconfined flow system wells

23085	△	Alluvial well
24135	○	Denver well



N

0 500 1000

Scale in feet

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

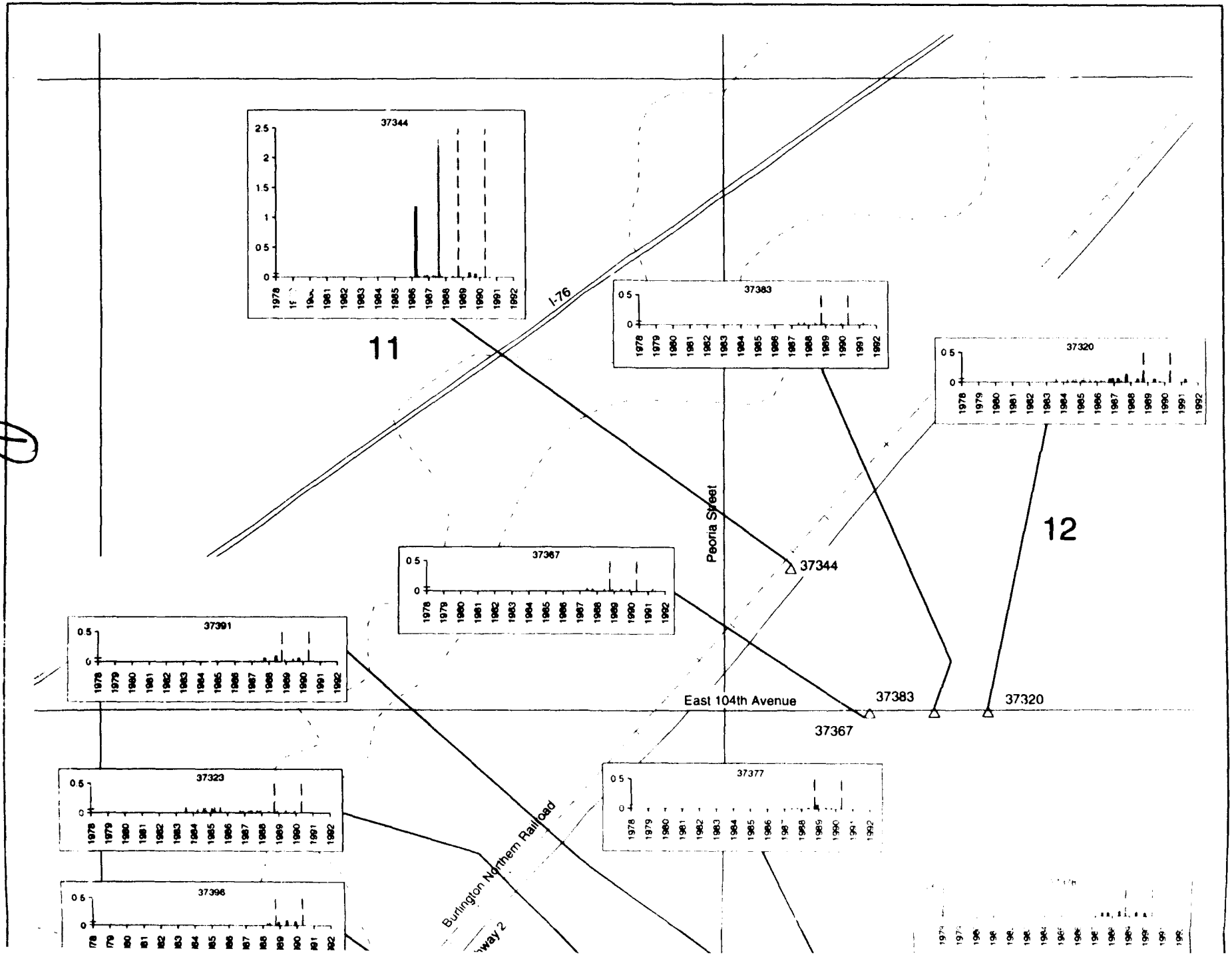
Prepared by:
Harding Lawson Associates

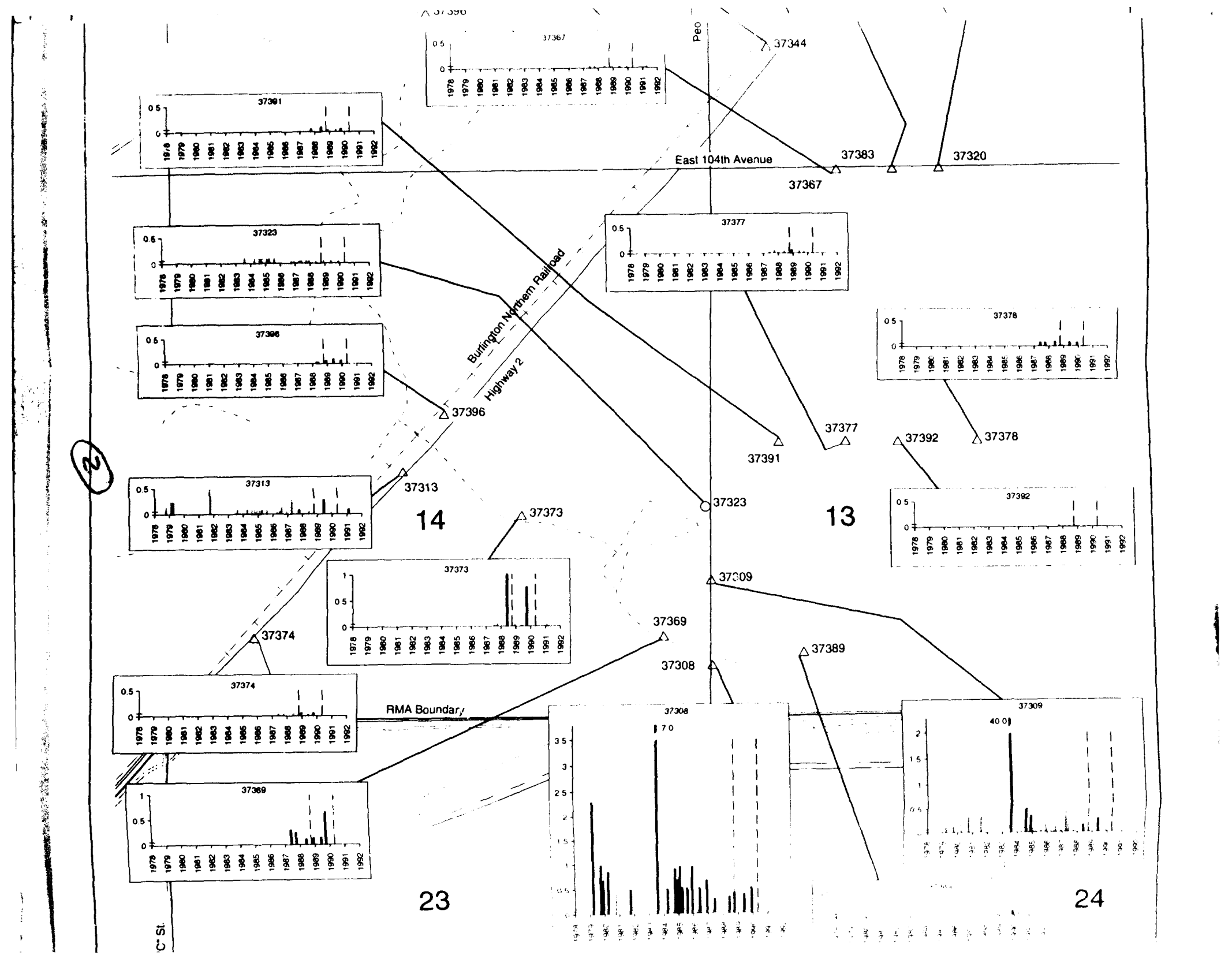
Figure 5.33

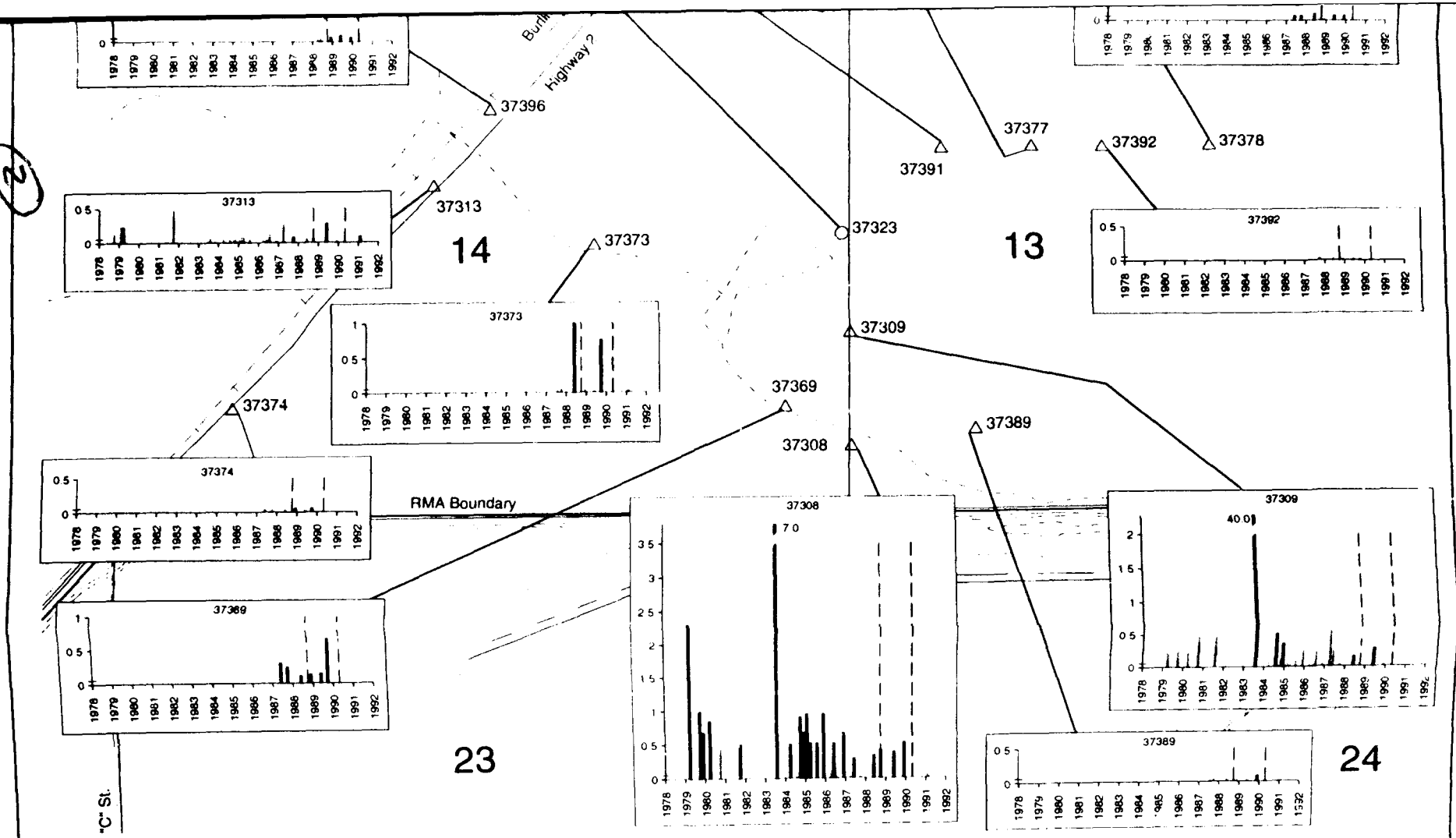
Dibromochloropropane (DBCP) Histograms for Wells North of Rocky Mountain Arsenal

GWAR FY91

7/11/92 ma/mmacdop DPG


37344
11
I-76
37383
37320
12
Peoria Street
37367
37391
East 104th Avenue
37383
37320
37367
37323
37377
37396
Burlington Northern Railroad


37396
37367
37344
37391
East 104th Avenue
37383
37320
37323
37377
Burlington Northern Railroad
Highway 2
37396
37378
37392
37377
37391
37313
37323
14
13
37373
37309
37369
37374
37308
37389
RMA Boundary
37374
37308
37309
37389
23
24
C" St.



EXPLANATION

Well number
Reported value
23085
Startup of initial 10 recharge trenches
Concentration (µg/l)
Time (years)
Certified Reporting Limit (CRL) (No reported chemical concentration)
Concentration values below this level may have been enhanced to show detail - see Appendix B for precise values
Startup of additional 5 recharge trenches

Unconfined flow system wells

23085 △ Alluvial well

24135 ○ Denver well

N

0 500 1000

Scale in feet

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

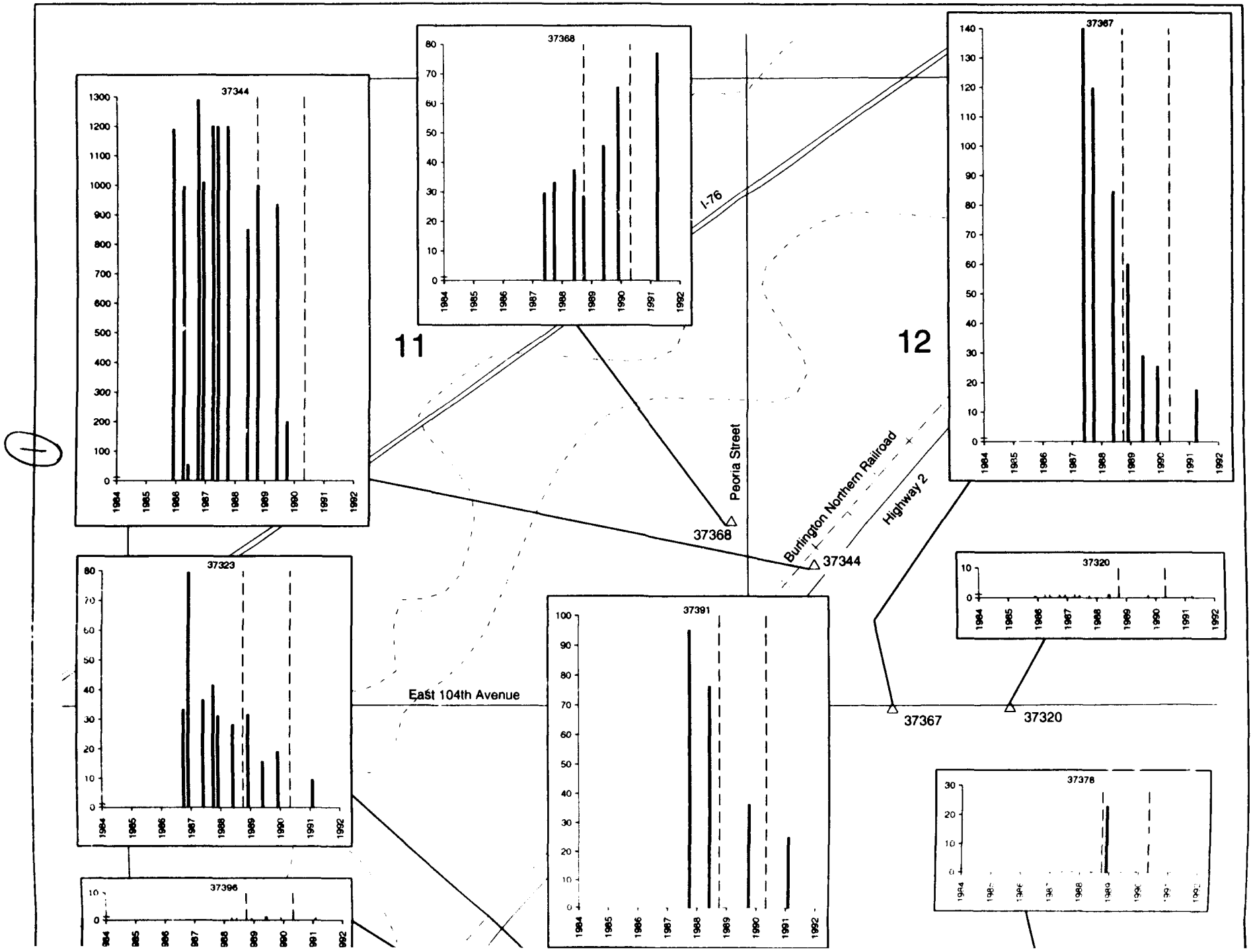
Prepared by:
Harding Lawson Associates

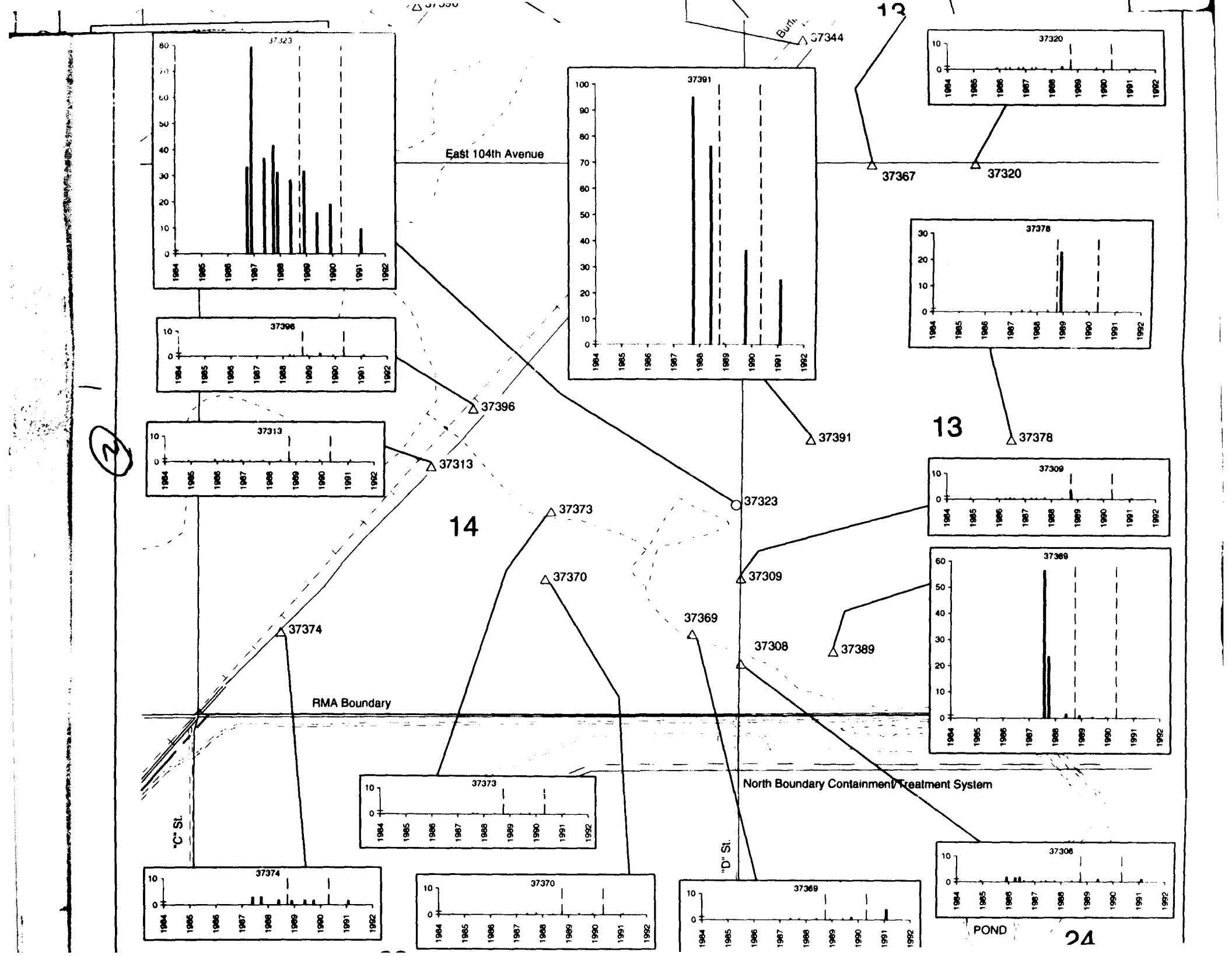
Figure 5.34

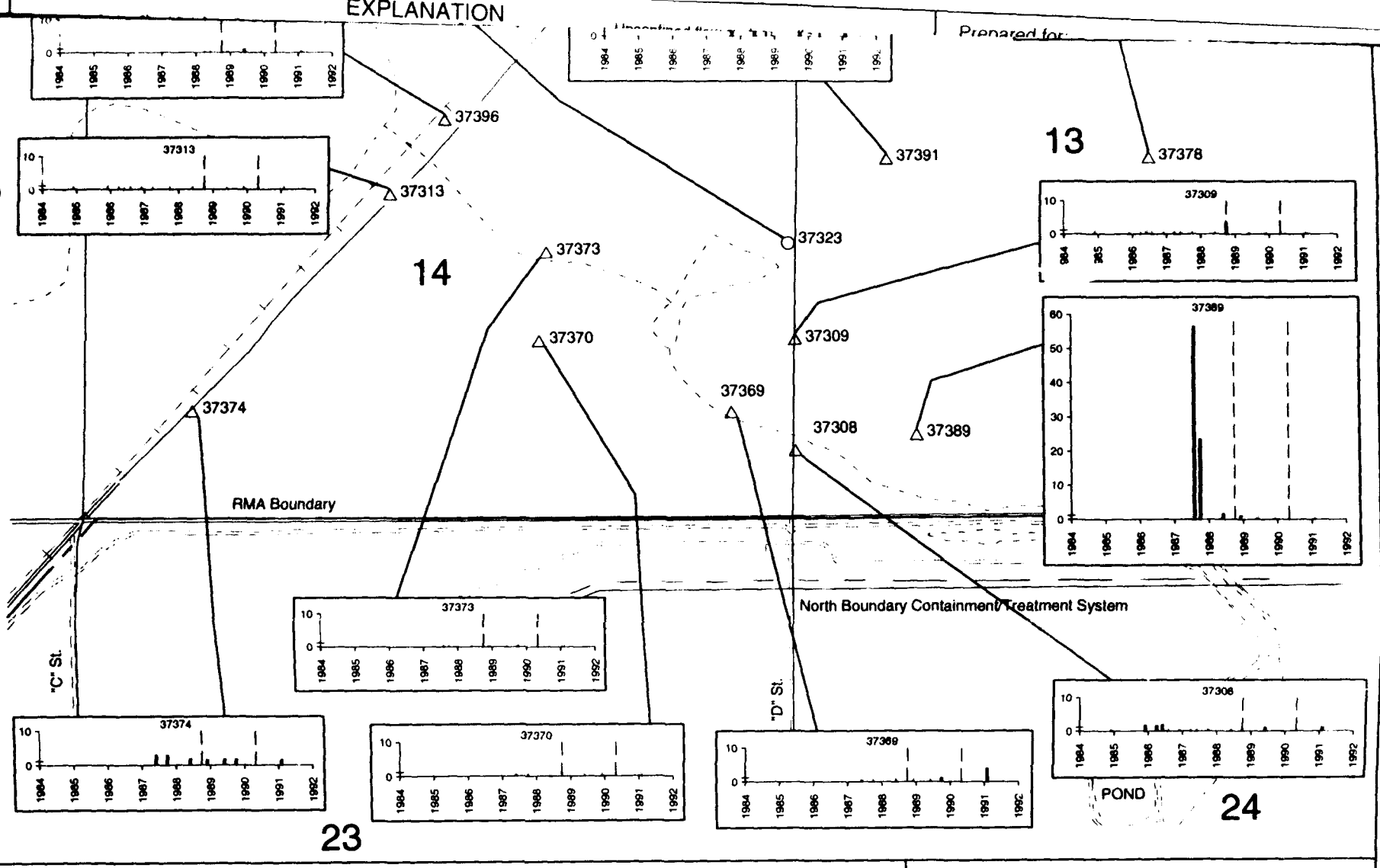
Dieldrin Histograms for Wells
North of Rocky Mountain Arsenal

GWAR FY91

7/11/92 rma/hrmaddr DPG


37344
37368
37367
37323
37391
37320
37396
37378
11
12
I-76
Peoria Street
Burlington Northern Railroad
Highway 2
East 104th Avenue
37368
37344
37367
37320


East 104th Avenue
RMA Boundary
"C" St.
"D" St.
North Boundary Containment/Treatment System
POND
13
14
24
37323
37391
37320
37367
37378
37396
37313
37373
37370
37374
37309
37369
37308
37389
37306
37344



EXPLANATION

Well number
Reported value
23085
Startup of initial 10 recharge trenches
Concentration (µg/l)
Time (years)
Certified Reporting Limit (CRL) (No reported chemical concentration)
Concentration values below this level may have been enhanced to show detail - see Appendix B for precise values
Startup of additional 5 recharge trenches

Unconfined flow system wells

23085 △ Alluvial well

24135 ○ Denver well

N

0 500 1000

Scale in feet

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

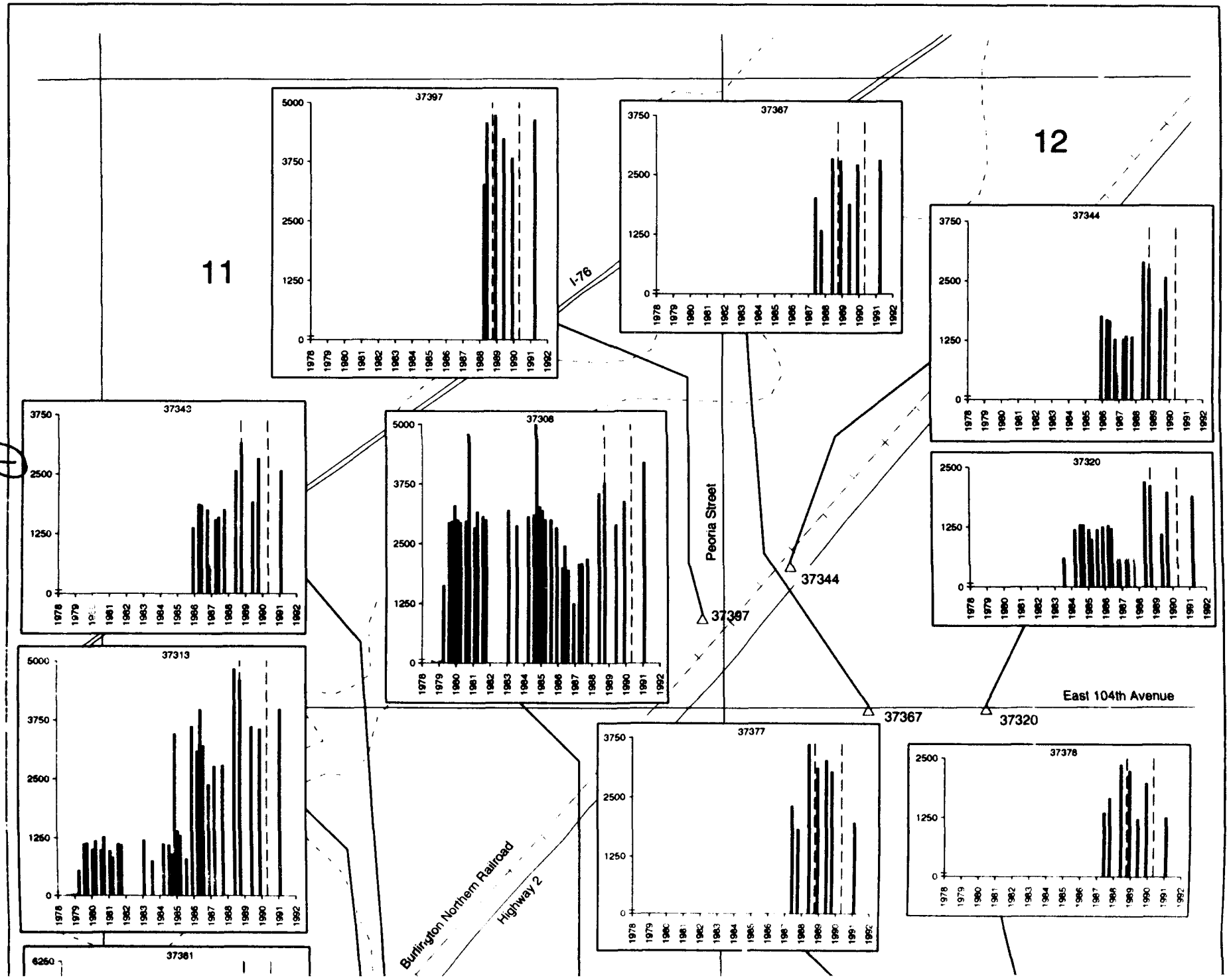
Prepared by:
Harding Lawson Associates

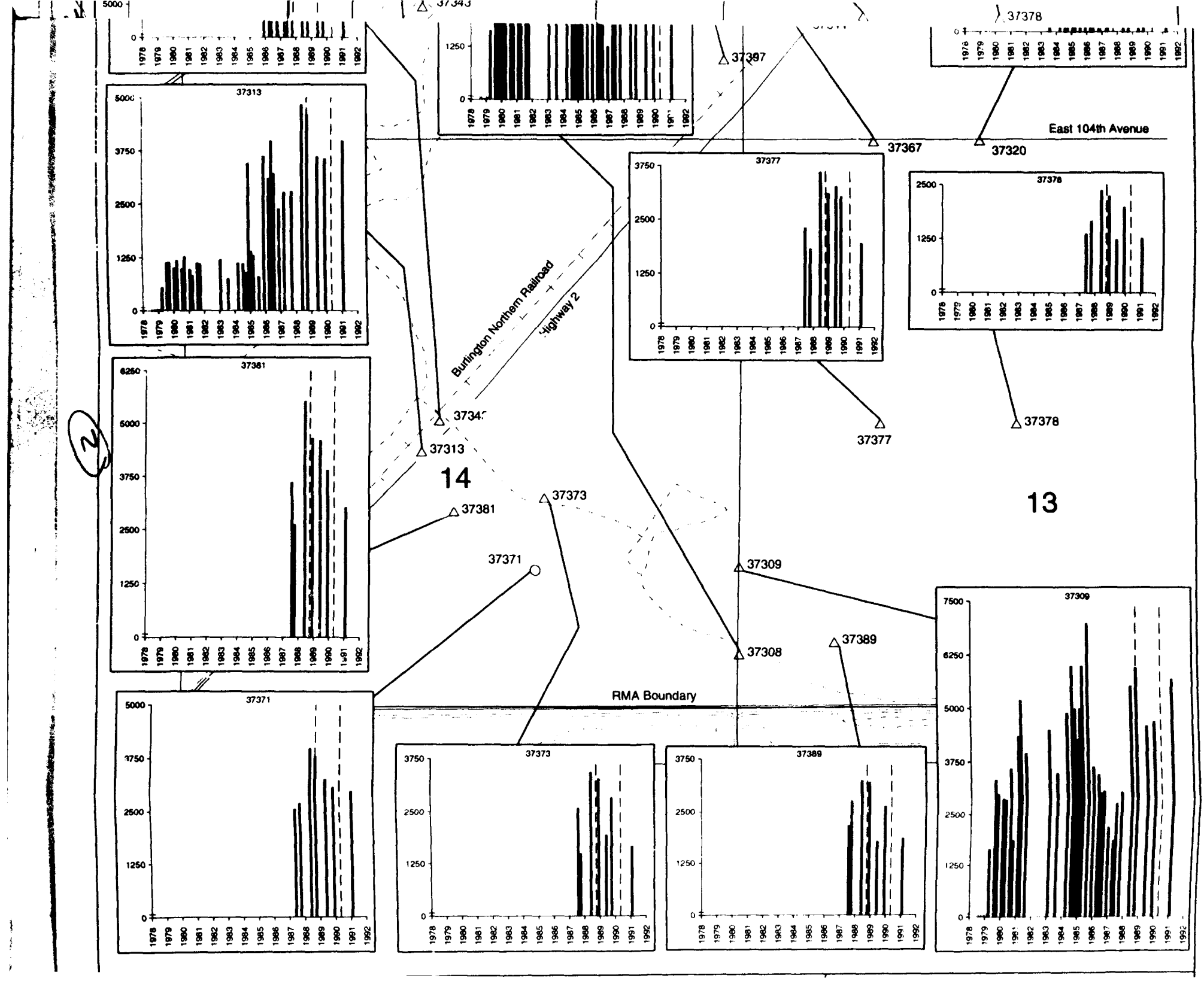
Figure 5.35

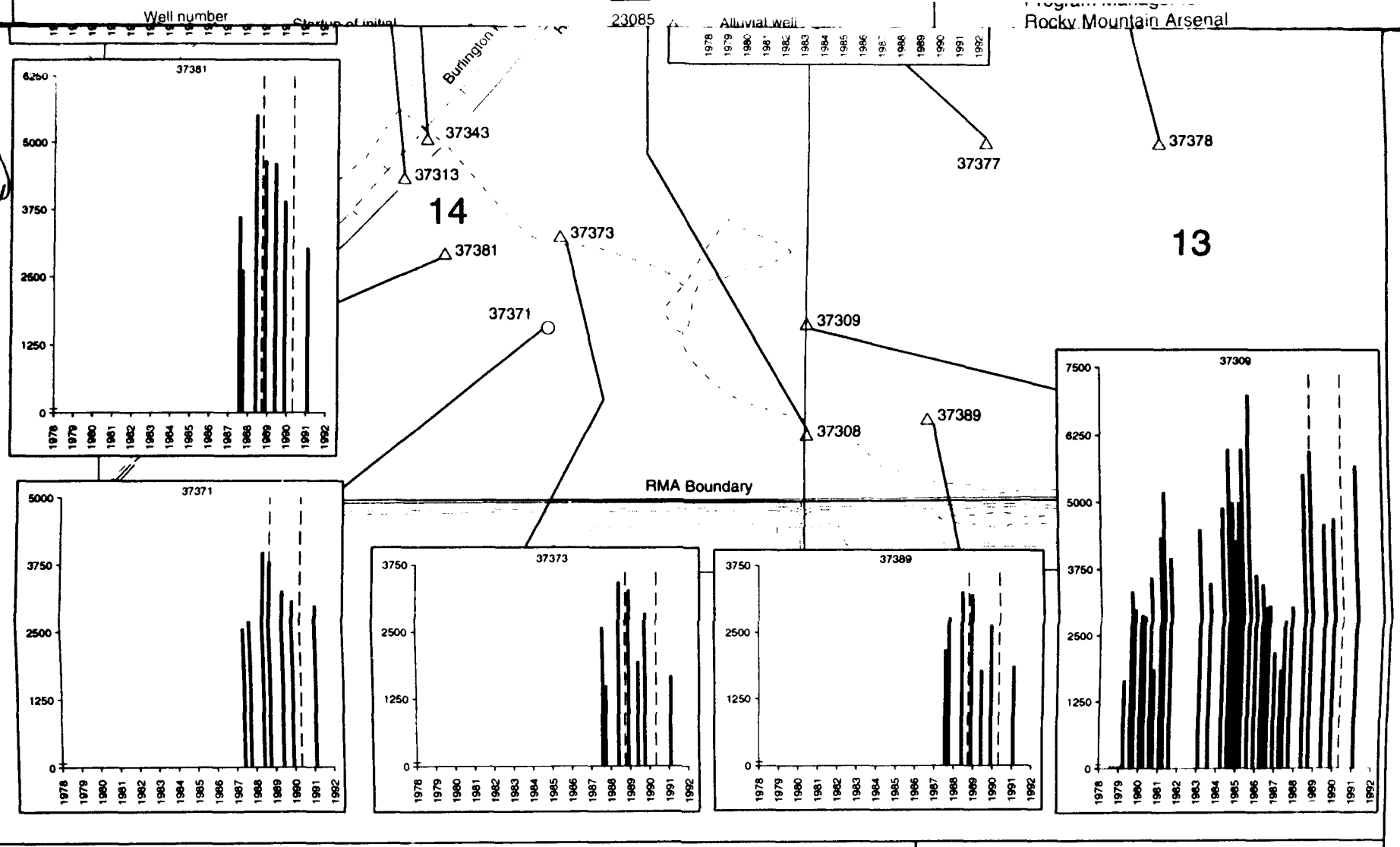
Chloroform Histograms for Wells North of Rocky Mountain Arsenal

GWAR FY91

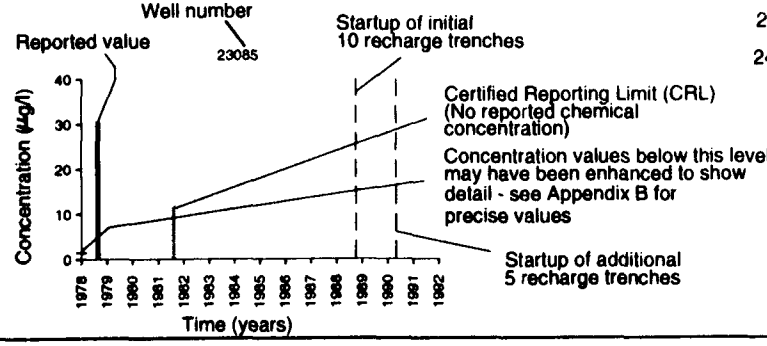
7/1/92 ms/hmischd DPG


11
12
37397
37367
37344
37343
37308
37320
37313
37377
37378
37361
I-76
Peoria Street
East 104th Avenue
Burlington Northern Railroad
Highway 2
37397
37344
37367
37320


37313
37381
37371
37373
37389
37309
37378
37377
37367
37320
East 104th Avenue
Burlington Northern Railroad
Highway 2
14
13
RMA Boundary

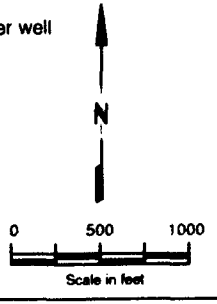


EXPLANATION



Unconfined flow system wells

23085	△	Alluvial well
24135	○	Denver well



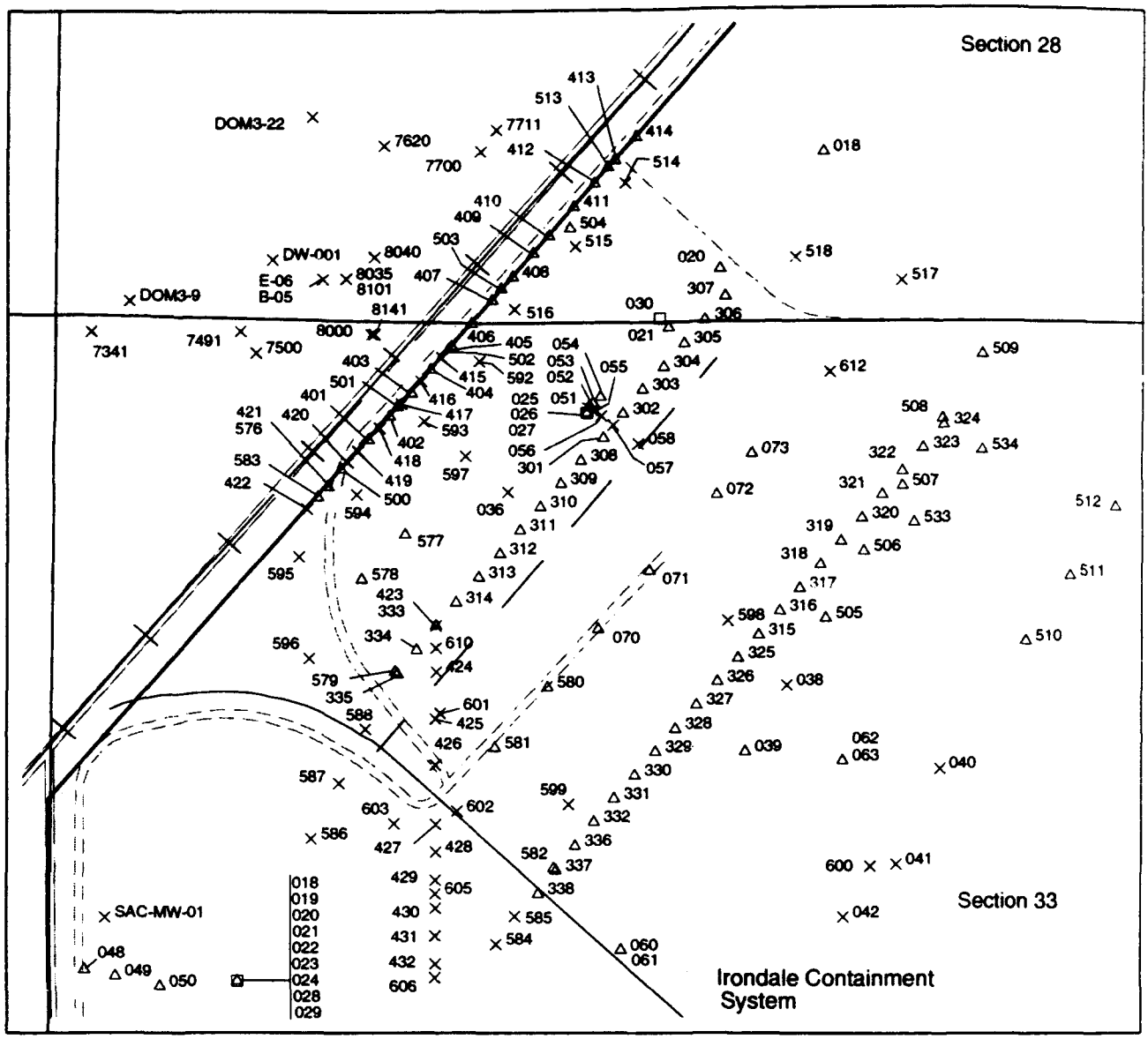
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Figure 5.36

Fluoride Histograms for Wells
North of Rocky Mountain Arsenal

GWAR FY91

7/11/92 mw/rmal DPG

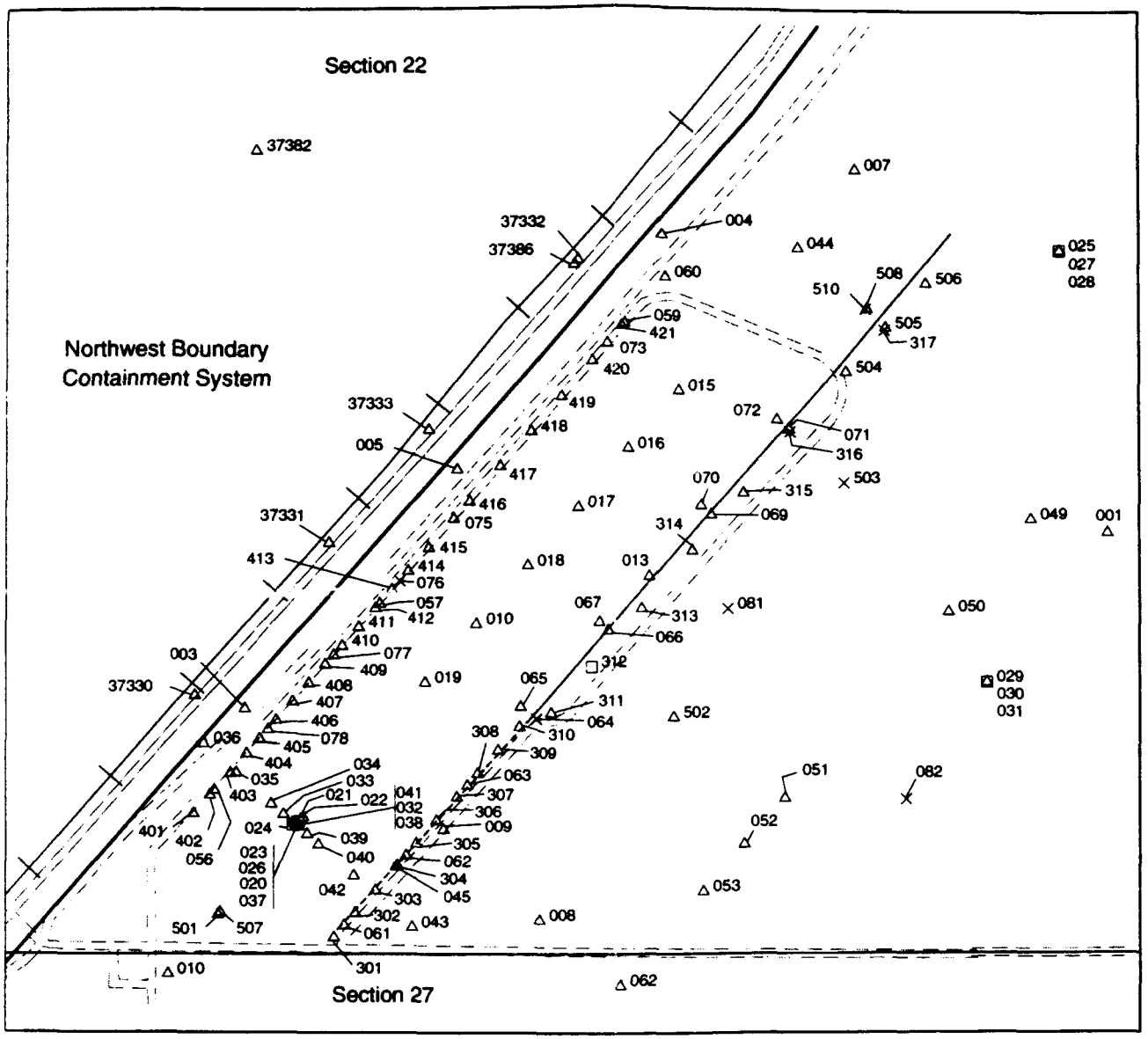


EXPLANATION

- Drainage
- Paved road
- Unpaved road
- △101 Alluvial well
- ○102 Unconfined Denver Formation well
- □103 Confined Denver Formation well
- ×104 Not classified (DP Associates, October 1991)

7/11/92 RMA/2000806.DPG

17



Containment System

Physical barrier

Hydraulic barrier

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Harding Lawson Associates

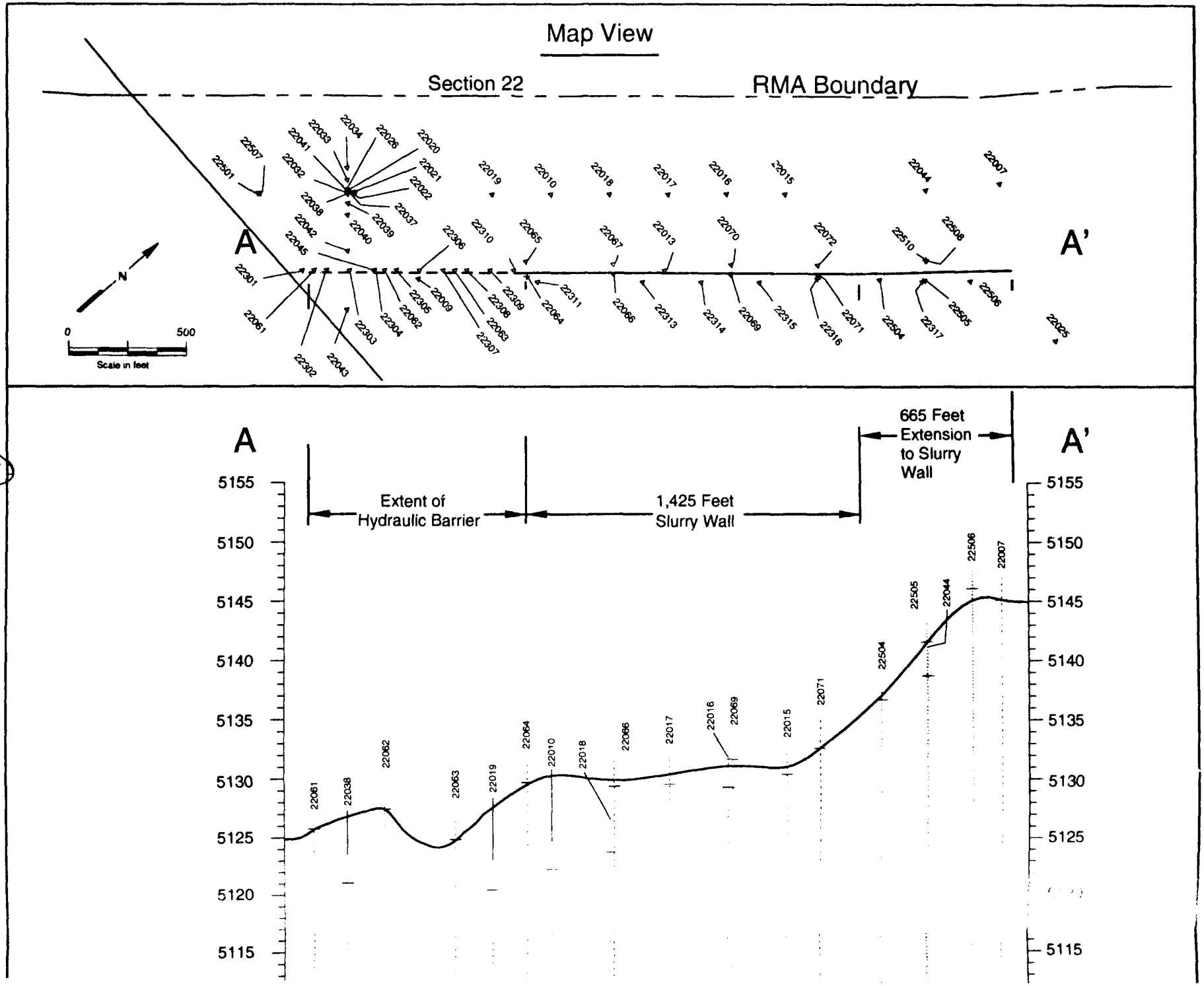
Figure 5.37

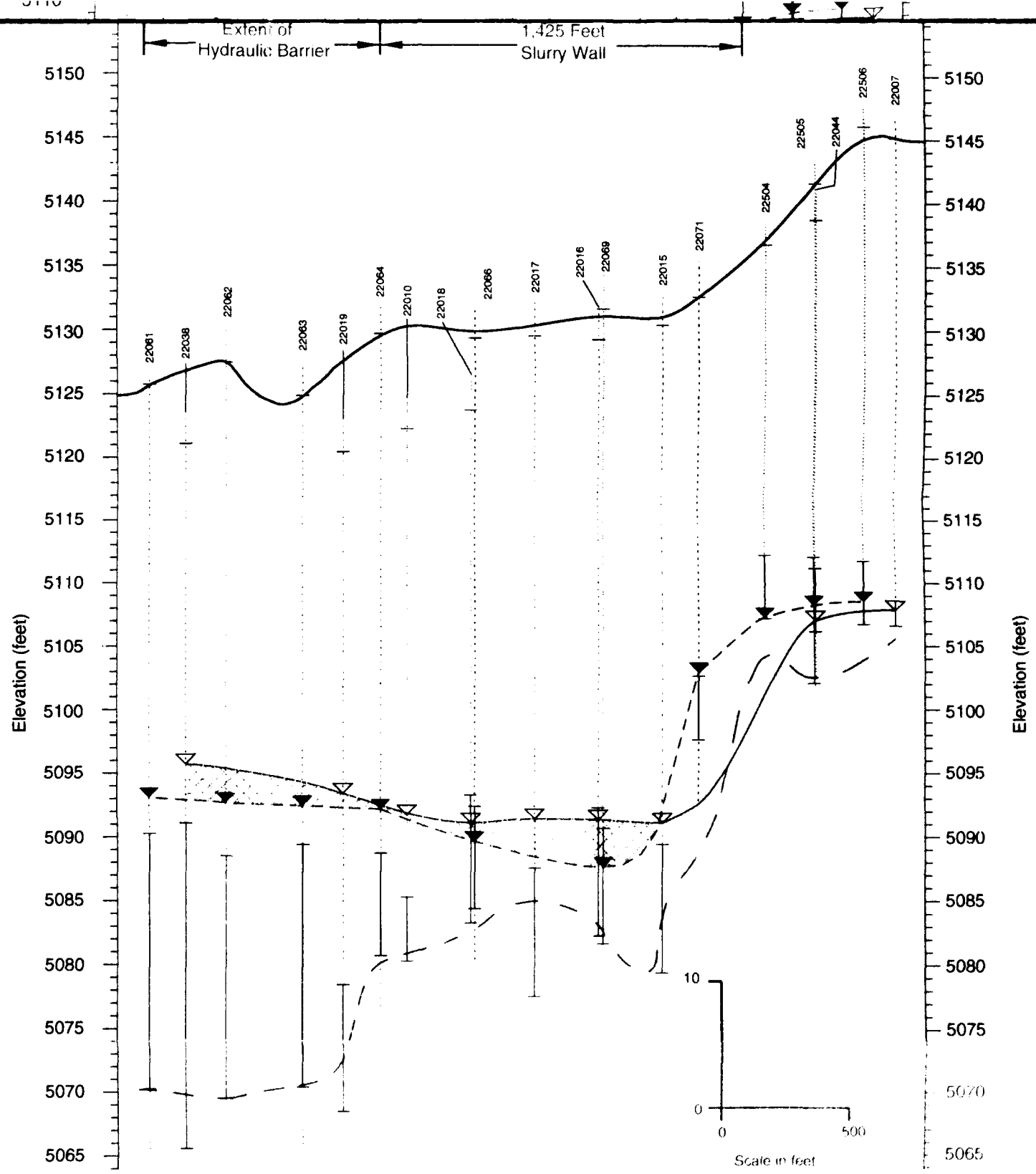
Well Location Maps for the Irondale Containment System and the Northwest Boundary Containment System

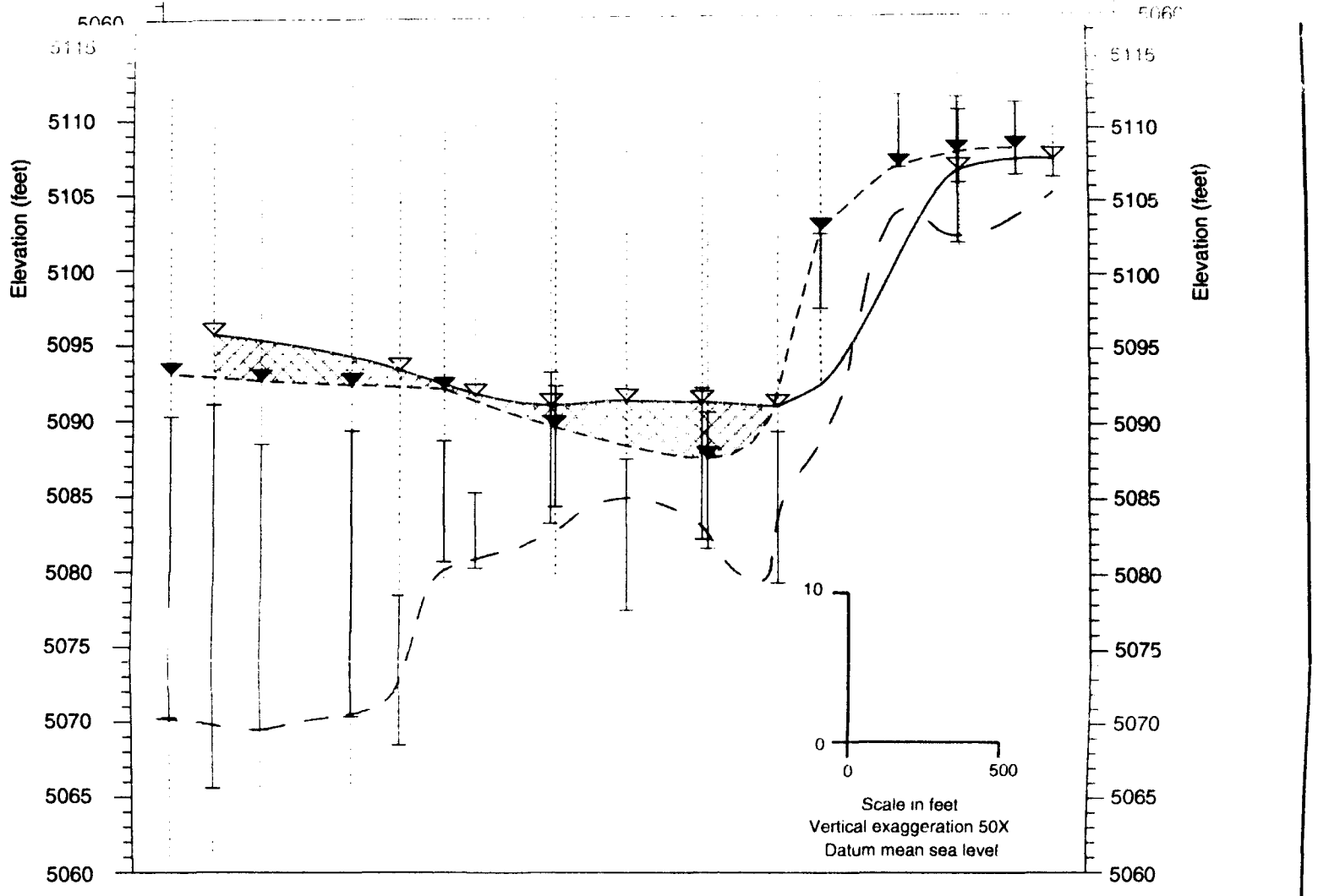
GWAR FY91

(2)

(3)


Map View
Section 22
RMA Boundary
A
A'
N
0
500
Scale in feet
22501
22507
22041
22003
22034
22026
22020
22092
22021
22022
22038
22037
22039
22040
22042
22045
22301
22061
22302
22043
22303
22304
22062
22305
22009
22306
22063
22307
22308
22310
22309
22064
22311
22065
22066
22067
22313
22013
22314
22070
22069
22315
22072
22316
22071
22504
22510
22317
22508
22505
22506
22025
22019
22010
22018
22017
22016
22015
22044
22007
665 Feet
Extension
to Slurry
Wall
Extent of
Hydraulic Barrier
1,425 Feet
Slurry Wall
5155
5150
5145
5140
5135
5130
5125
5120
5115


Extent of Hydraulic Barrier
1,425 Feet Slurry Wall
Elevation (feet)
5150
5145
5140
5135
5130
5125
5120
5115
5110
5105
5100
5095
5090
5085
5080
5075
5070
5065
22061
22038
22062
22063
22019
22064
22010
22018
22066
22017
22016
22069
22015
22071
22504
22505
22044
22506
22007
10
0
0
500
Scale in feet



EXPLANATION

- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987b, plate 1)
- Water elevation upgradient (southeast) of barrier wall
- Water elevation downgradient (northwest) of barrier wall
- Water-level elevation marker southeast of barrier wall
- Water-level elevation marker northwest of barrier wall

22062 — Well number
Ground surface (southeast side of barrier wall)
Ground surface (northwest side of barrier wall)
Cased interval
Screened interval
Cased interval
22506 Alluvial well

Containment system

Physical barrier
Hydraulic barrier

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

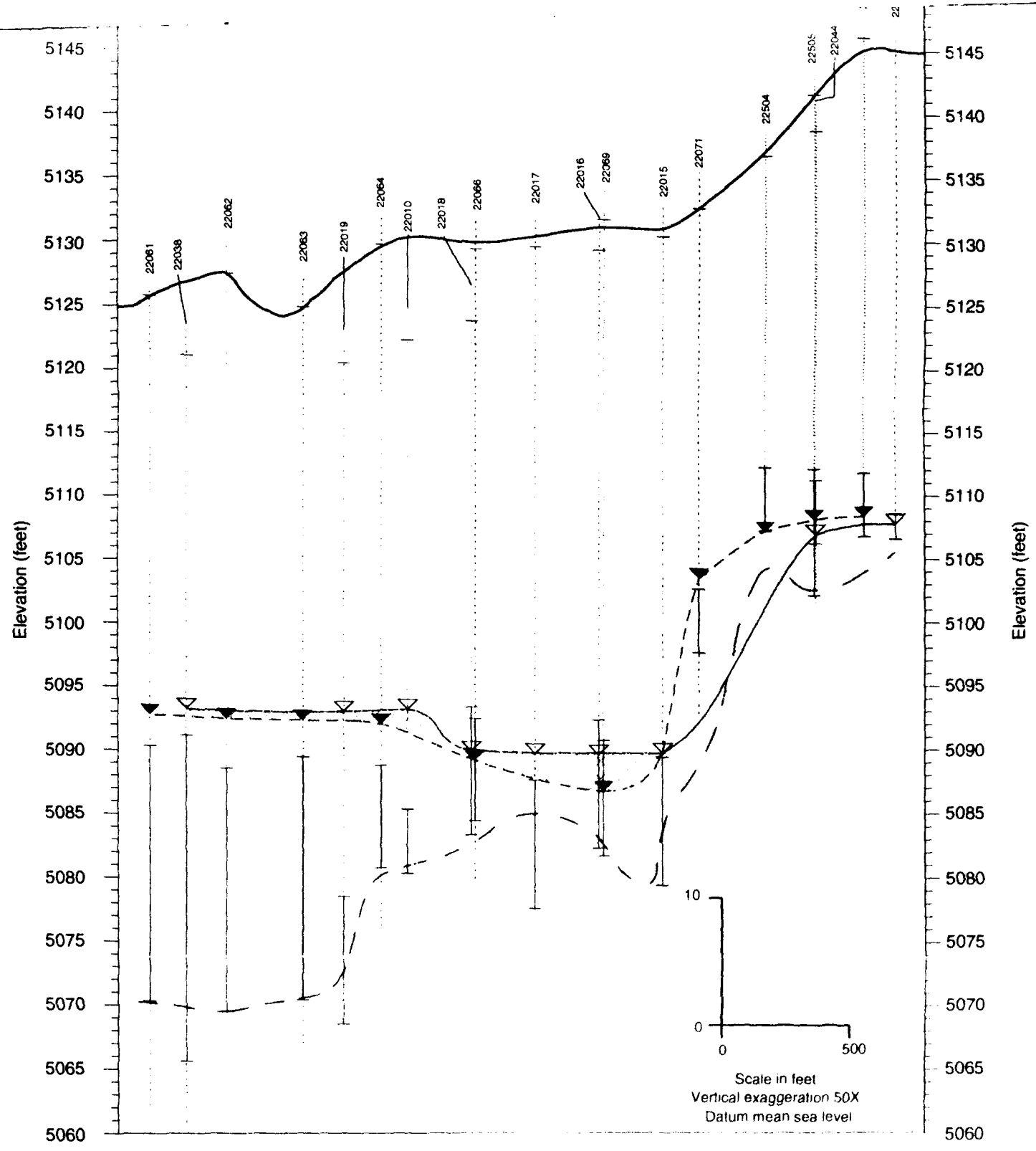
Prepared by:
Harding Lawson Associates

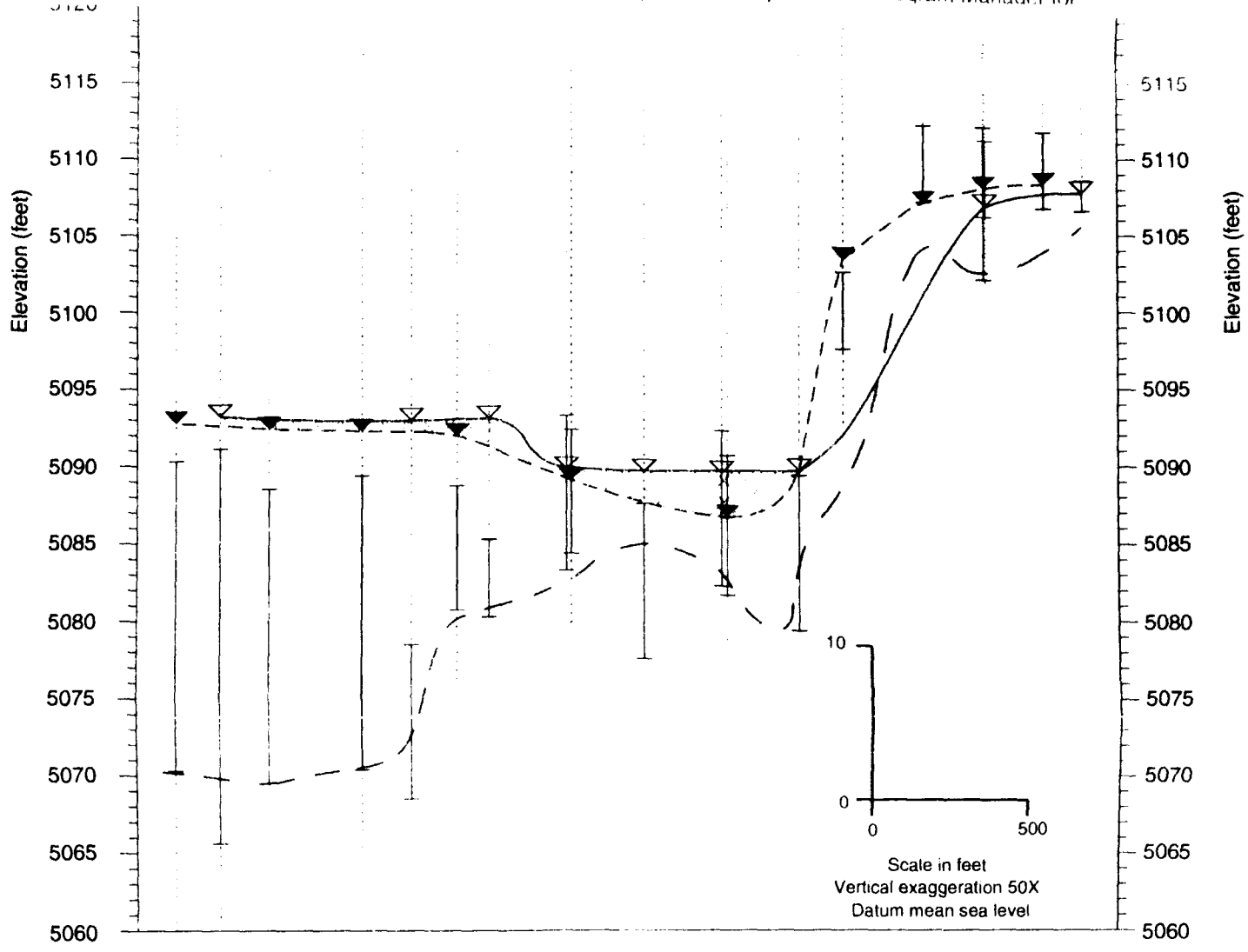
Figure 5.38

Cross Section of Approximate Water-Table Elevations at the Northwest Boundary Containment/Treatment System from October 1 to December 31, 1990

GWAR FY91

7/11/92 rma/nwsect1 DPG


Elevation (feet)
5145
5140
5135
5130
5125
5120
5115
5110
5105
5100
5095
5090
5085
5080
5075
5070
5065
5060
22061
22038
22062
22063
22019
22064
22010
22018
22066
22017
22016
22069
22015
22071
22504
22044
10
0
0
500
Scale in feet
Vertical exaggeration 50X
Datum mean sea level



EXPLANATION

- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987b, plate 1)
- Water elevation upgradient (southeast) of barrier wall
- Water elevation downgradient (northwest) of barrier wall
- Water-level elevation marker southeast of barrier wall
- Water-level elevation marker northwest of barrier wall

22062 — Well number
Ground surface (southeast side of barrier wall)
Ground surface (northwest side of barrier wall)
Cased interval
Screened interval
Cased interval
22506 Alluvial well
Containment system
Physical barrier
Hydraulic barrier

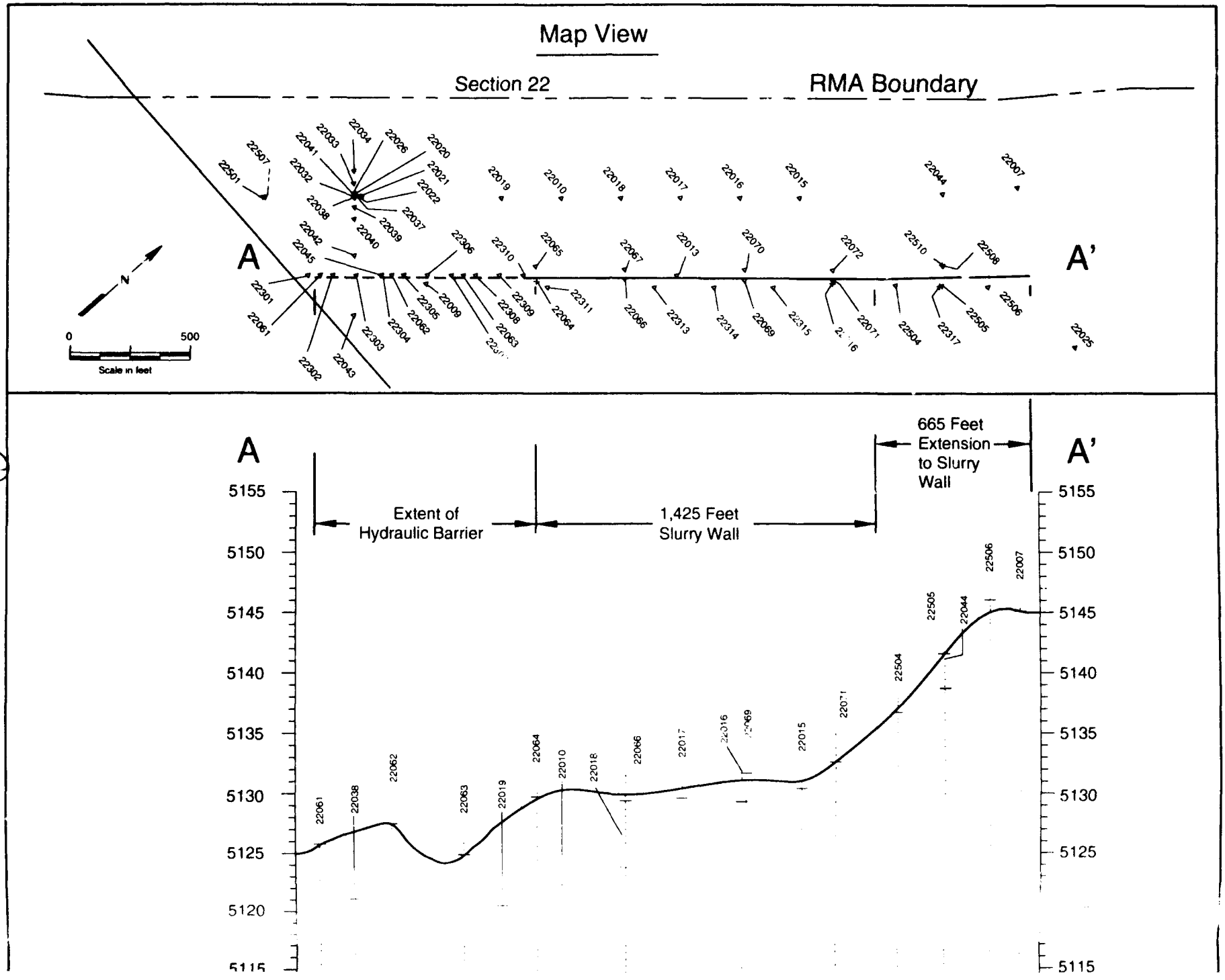
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

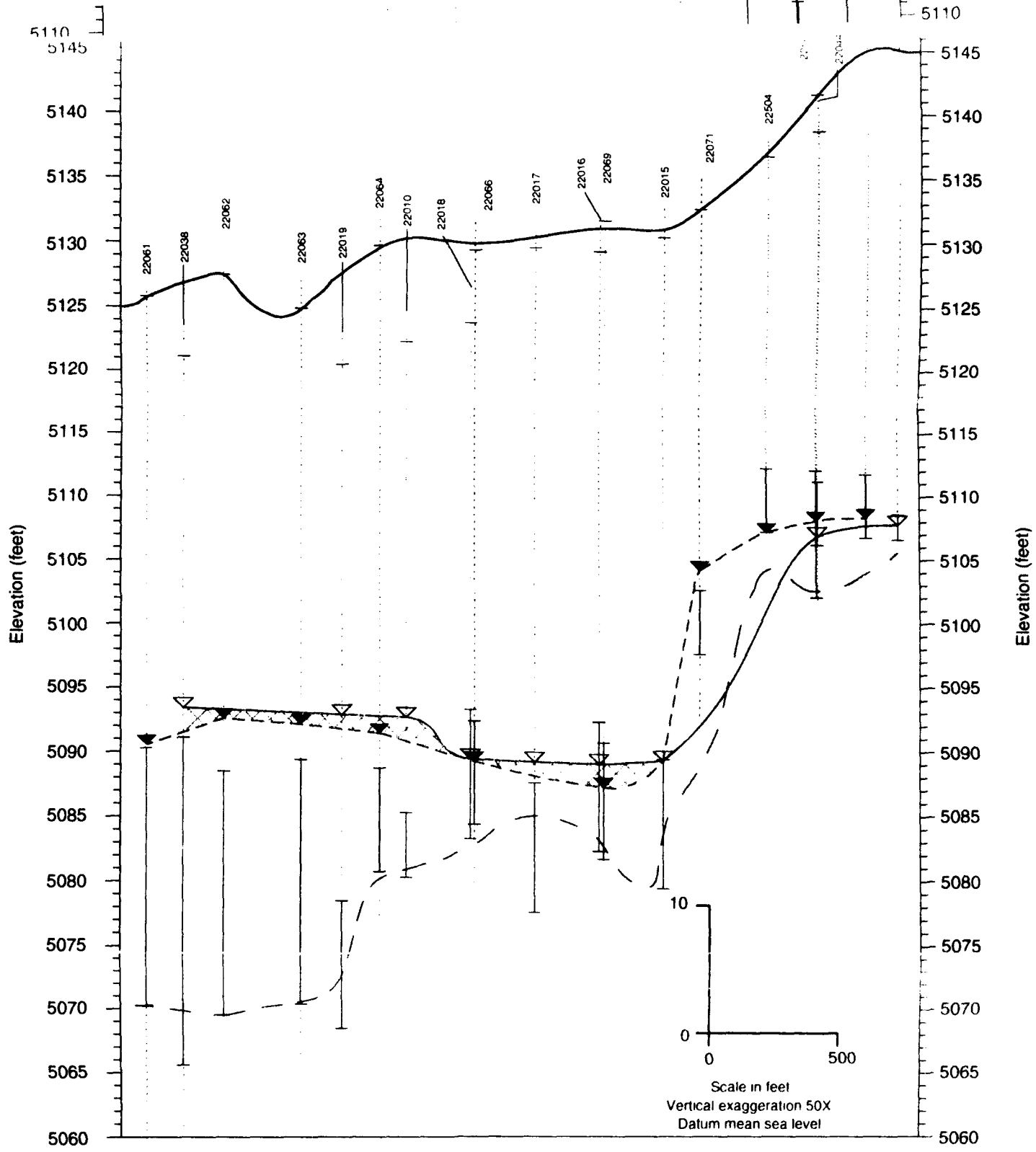
Figure 5.39

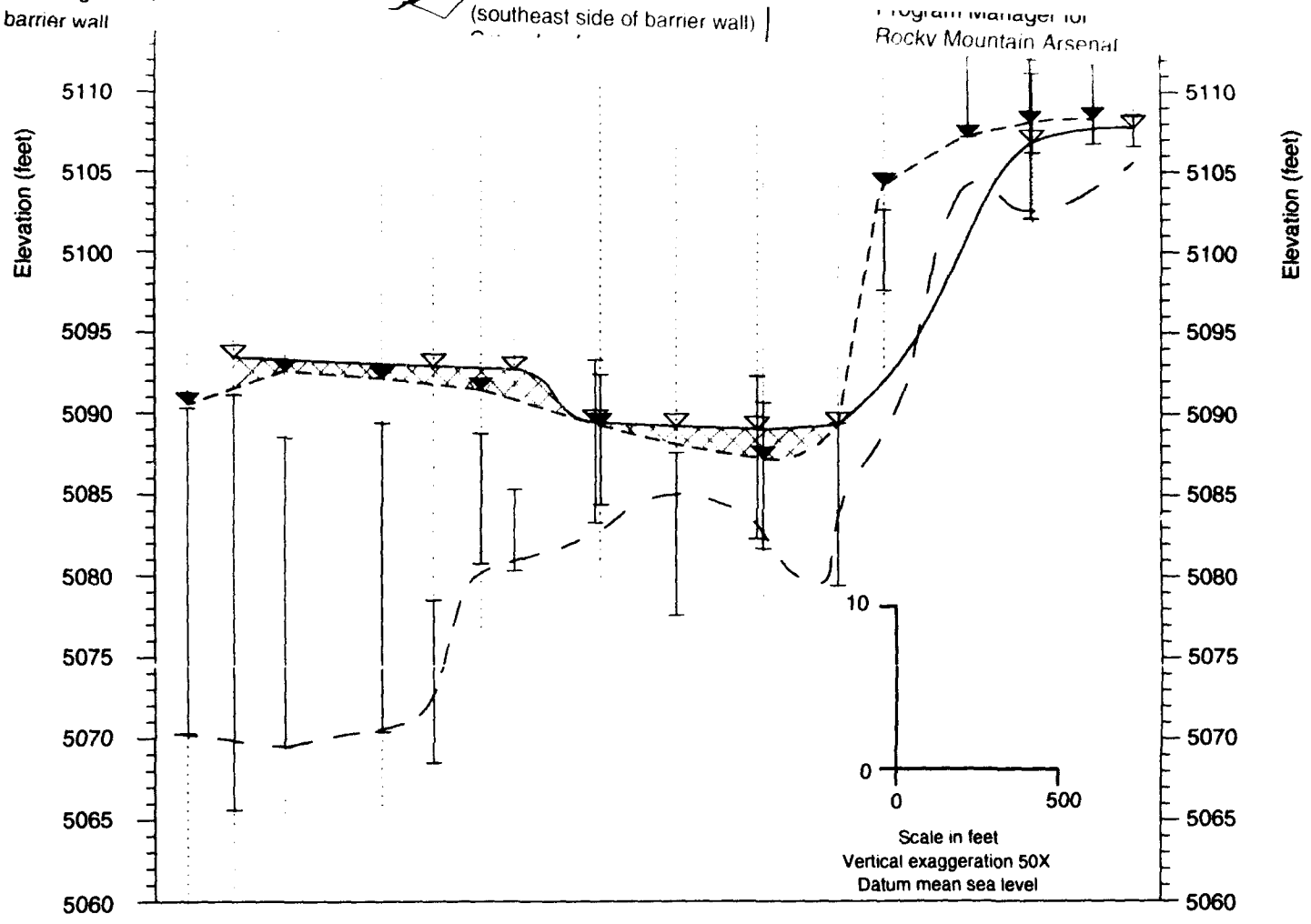
Cross Section of Approximate Water-Table Elevations at the Northwest Boundary Containment/Treatment System from January 1 to March 31, 1991

GWAR FY91

7/11/92 mw/wsect2 DPB


Map View
Section 22
RMA Boundary
A
A'
N
0
500
Scale in feet
22507
22501
22041
22033
22004
22026
22020
22032
22021
22022
22038
22037
22039
22040
22042
22045
22301
22061
22303
22304
22062
22305
22009
22306
22310
22065
22067
22013
22070
22072
22510
22508
22311
22064
22066
22313
22314
22069
22315
22071
22504
22317
22505
22506
22025
22302
22043
22063
22308
22309
22019
22010
22018
22017
22016
22015
22044
22007
665 Feet
Extension
to Slurry
Wall
Extent of
Hydraulic Barrier
1,425 Feet
Slurry Wall
5155
5150
5145
5140
5135
5130
5125
5120
5115


5110
5145
5140
5135
5130
5125
5120
5115
5110
5105
5100
5095
5090
5085
5080
5075
5070
5065
5060
Elevation (feet)
22061
22038
22062
22063
22019
22064
22010
22018
22066
22017
22016
22069
22015
22071
22504
10
0
0
500
Scale in feet
Vertical exaggeration 50X
Datum mean sea level



EXPLANATION

- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987b, plate 1)
- Water elevation upgradient (southeast) of barrier wall
- Water elevation downgradient (northwest) of barrier wall
- Water-level elevation marker southeast of barrier wall
- Water-level elevation marker northwest of barrier wall

22062 — Well number

- Ground surface (southeast side of barrier wall)
- Ground surface (northwest side of barrier wall)
- Cased interval
- Screened interval
- Cased interval

22506 Alluvial well

Containment system

- Physical barrier
- Hydraulic barrier

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

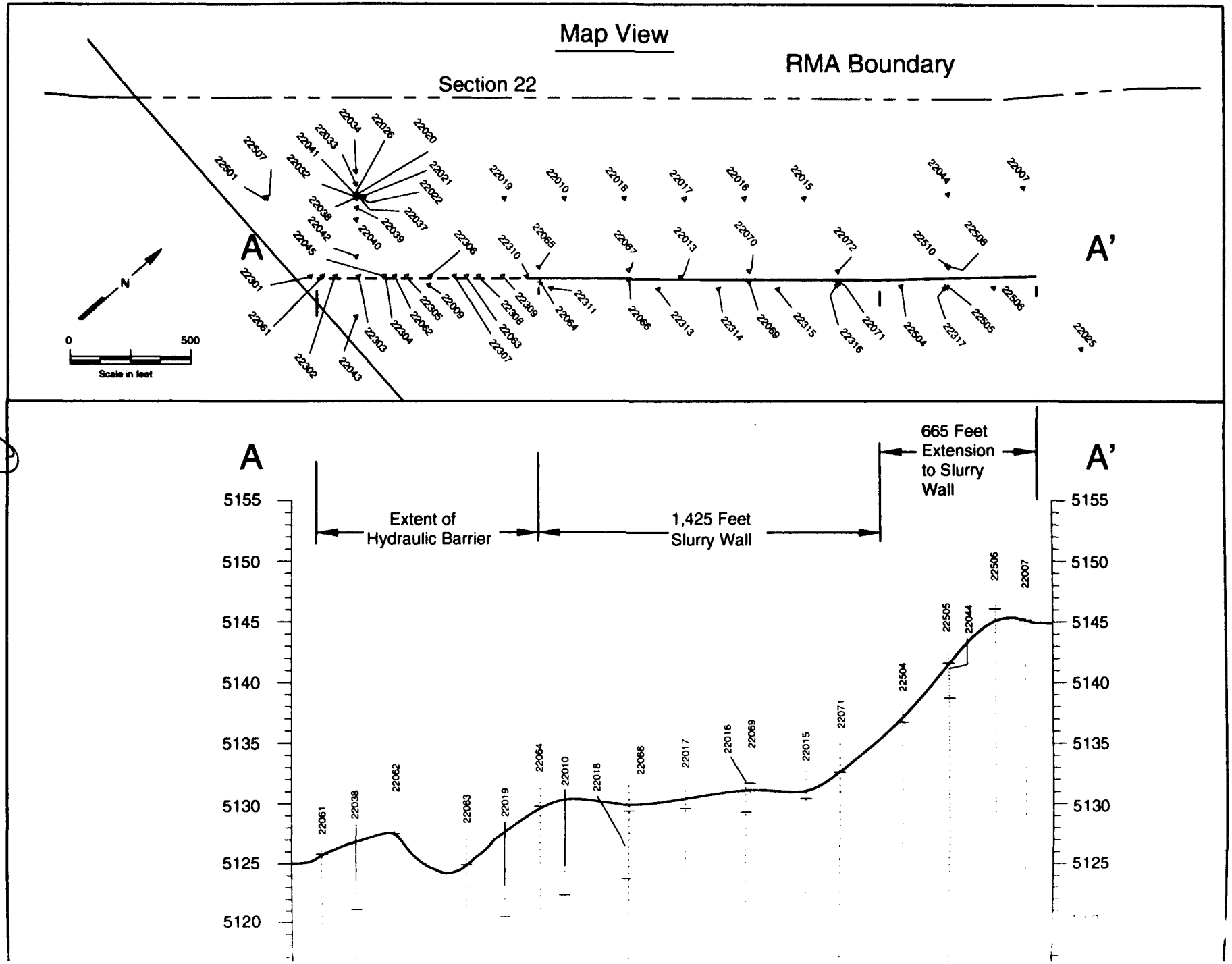
Harding Lawson Associates

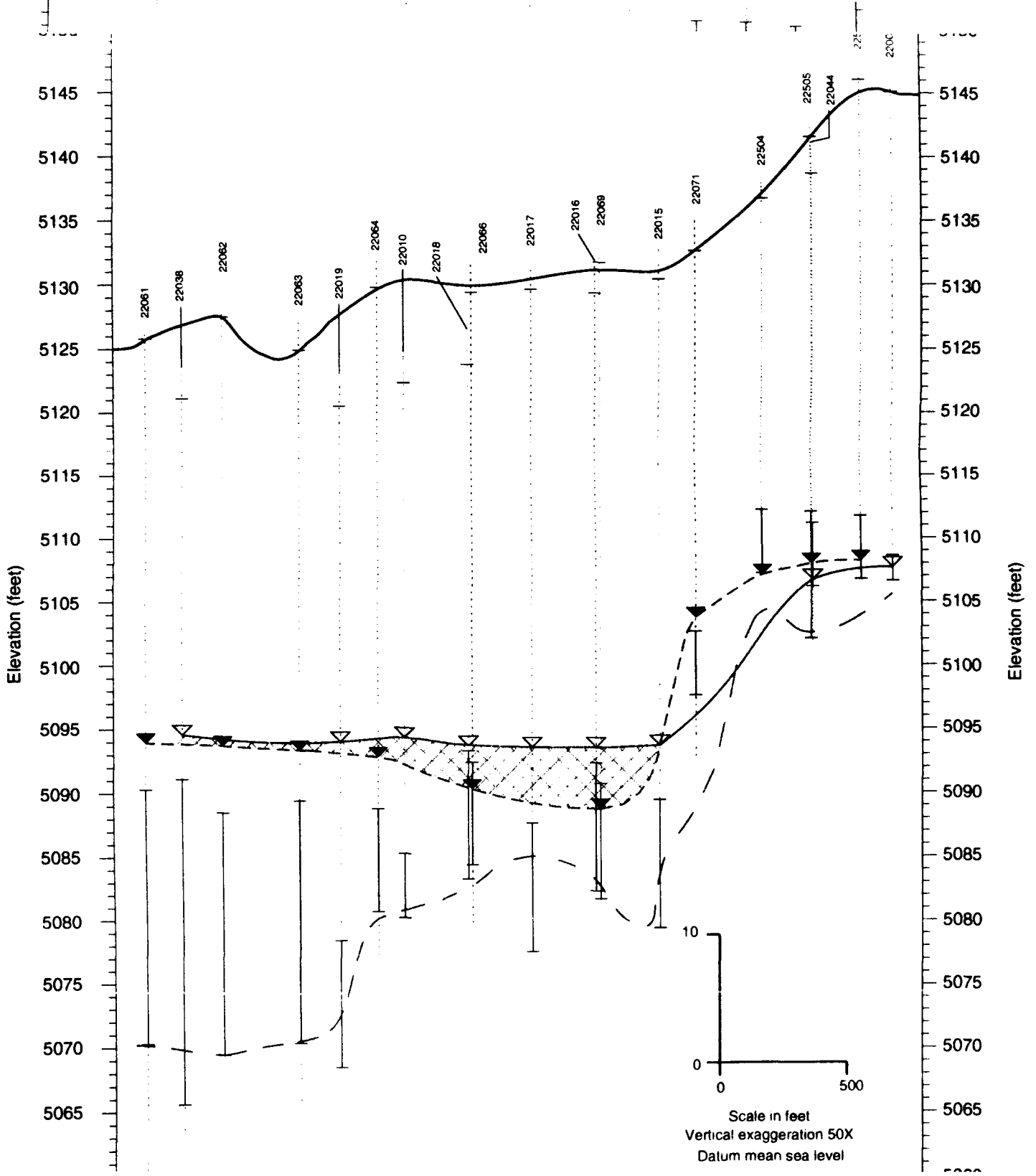
Figure 5.40

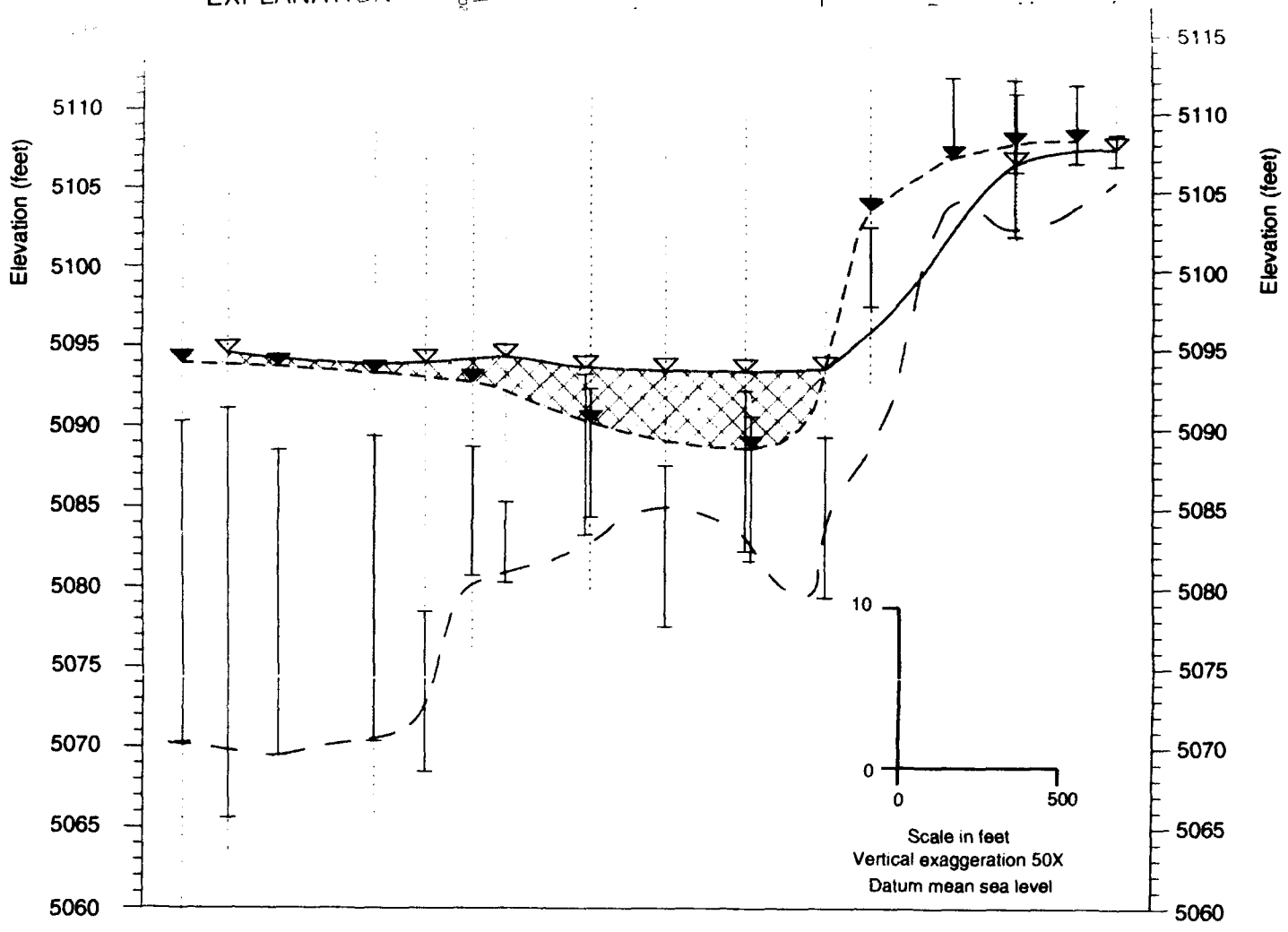
Cross Section of Approximate Water-Table Elevations at the Northwest Boundary Containment/Treatment System from April 1 to June 30, 1991

GWAR FY91

7/11/92 ms/nwsect3 DRG


Map View
RMA Boundary
Section 22
A
A'
N
0
500
Scale in feet
22507
22501
22034
22026
22020
22033
22041
22032
22021
22022
22038
22037
22039
22040
22042
22045
22019
22010
22018
22017
22016
22015
22044
22007
22306
22310
22065
22067
22013
22070
22072
22510
22508
22301
22061
22302
22303
22304
22062
22305
22009
22308
22063
22307
22309
22064
22311
22066
22313
22314
22069
22315
22316
22071
22504
22317
22505
22506
22043
22025
665 Feet
Extension
to Slurry
Wall
Extent of
Hydraulic Barrier
1,425 Feet
Slurry Wall
5155
5150
5145
5140
5135
5130
5125
5120
22061
22038
22062
22063
22019
22064
22010
22018
22066
22017
22016
22069
22015
22071
22504
22505
22044
22506
22007


Elevation (feet)
5145
5140
5135
5130
5125
5120
5115
5110
5105
5100
5095
5090
5085
5080
5075
5070
5065
22061
22038
22062
22063
22019
22064
22010
22018
22066
22017
22016
22069
22015
22071
22504
22505
22044
10
0
0
500
Scale in feet
Vertical exaggeration 50X
Datum mean sea level



EXPLANATION

- Area of reversed hydraulic gradient
- Bedrock surface at barrier wall (Source: Waterways Experiment Station, 1987b, plate 1)
- Water elevation upgradient (southeast) of barrier wall
- Water elevation downgradient (northwest) of barrier wall
- Water-level elevation marker southeast of barrier wall
- Water-level elevation marker northwest of barrier wall

22062 — Well number

Ground surface (southeast side of barrier wall)

Ground surface (northwest side of barrier wall)

Cased interval

Screened interval

Cased interval

22506 Alluvial well

Containment system

Physical barrier

Hydraulic barrier

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

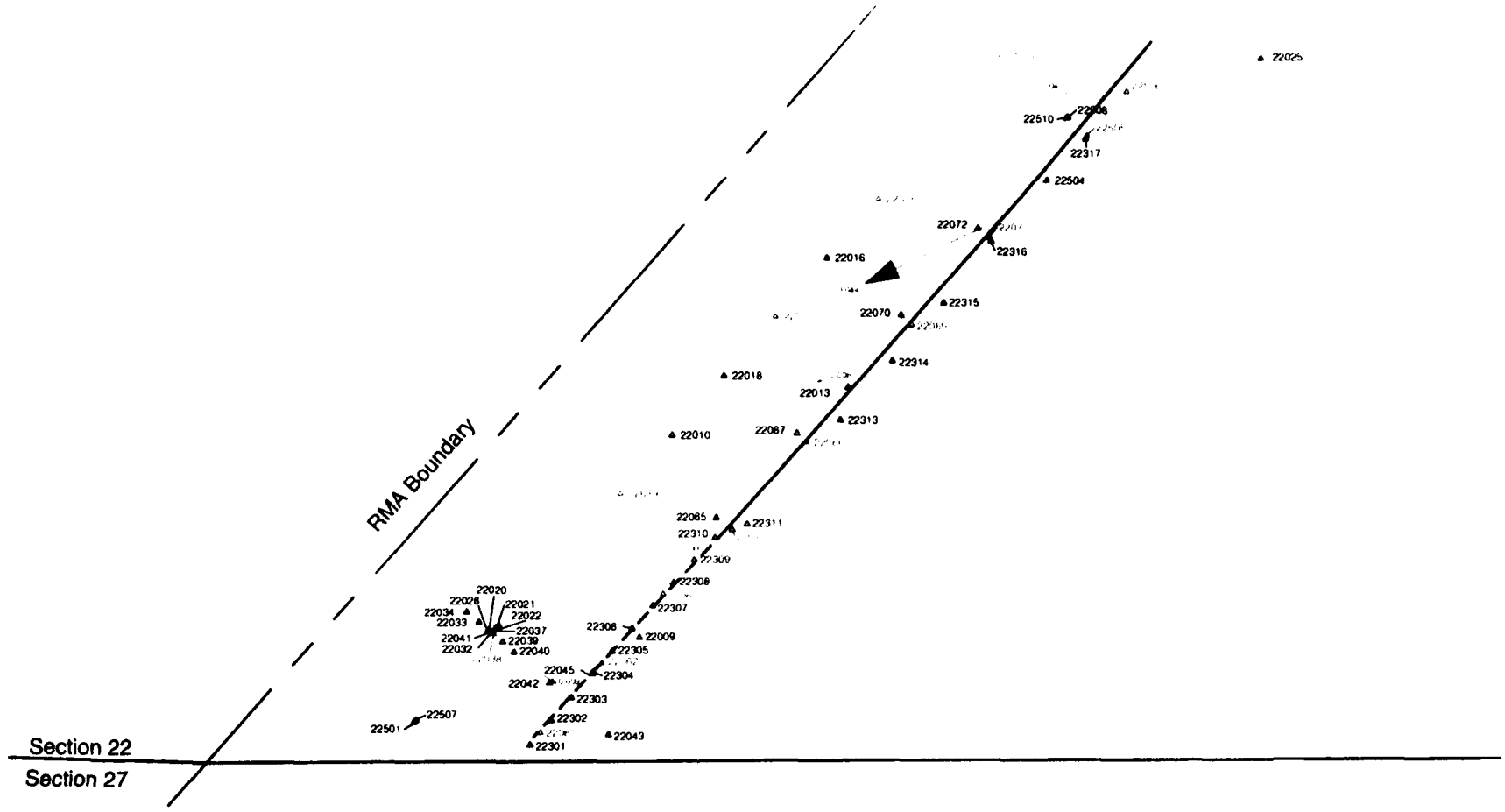
Harding Lawson Associates

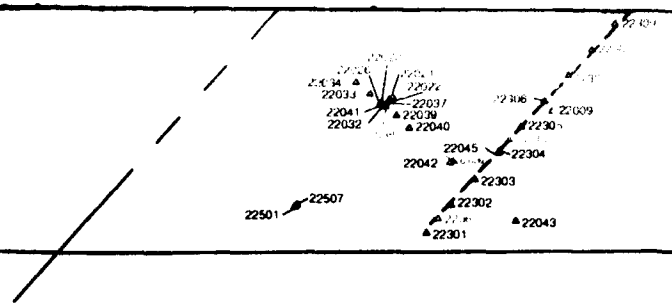
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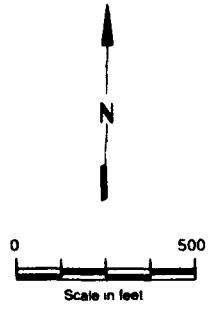
Cross Section of Approximate Water-Table Elevations at the Northwest Boundary Containment/Treatment System from July 1 to September 30, 1991

GWAR FY91

7/11/92 mw/wsec14.DRG


RMA Boundary
Section 22
Section 27
22025
22510
22317
22504
22072
22316
22016
22315
22070
22314
22018
22013
22313
22010
22087
22085
22310
22311
22309
22308
22307
22306
22009
22305
22045
22304
22042
22303
22302
22501
22507
22301
22043
22020
22026
22021
22034
22022
22033
22037
22041
22039
22032
22040
N
0
500
Scale in feet





EXPLANATION

▲ 22101 Alluvial well

Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Containment system

Physical barrier

Hydraulic barrier

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

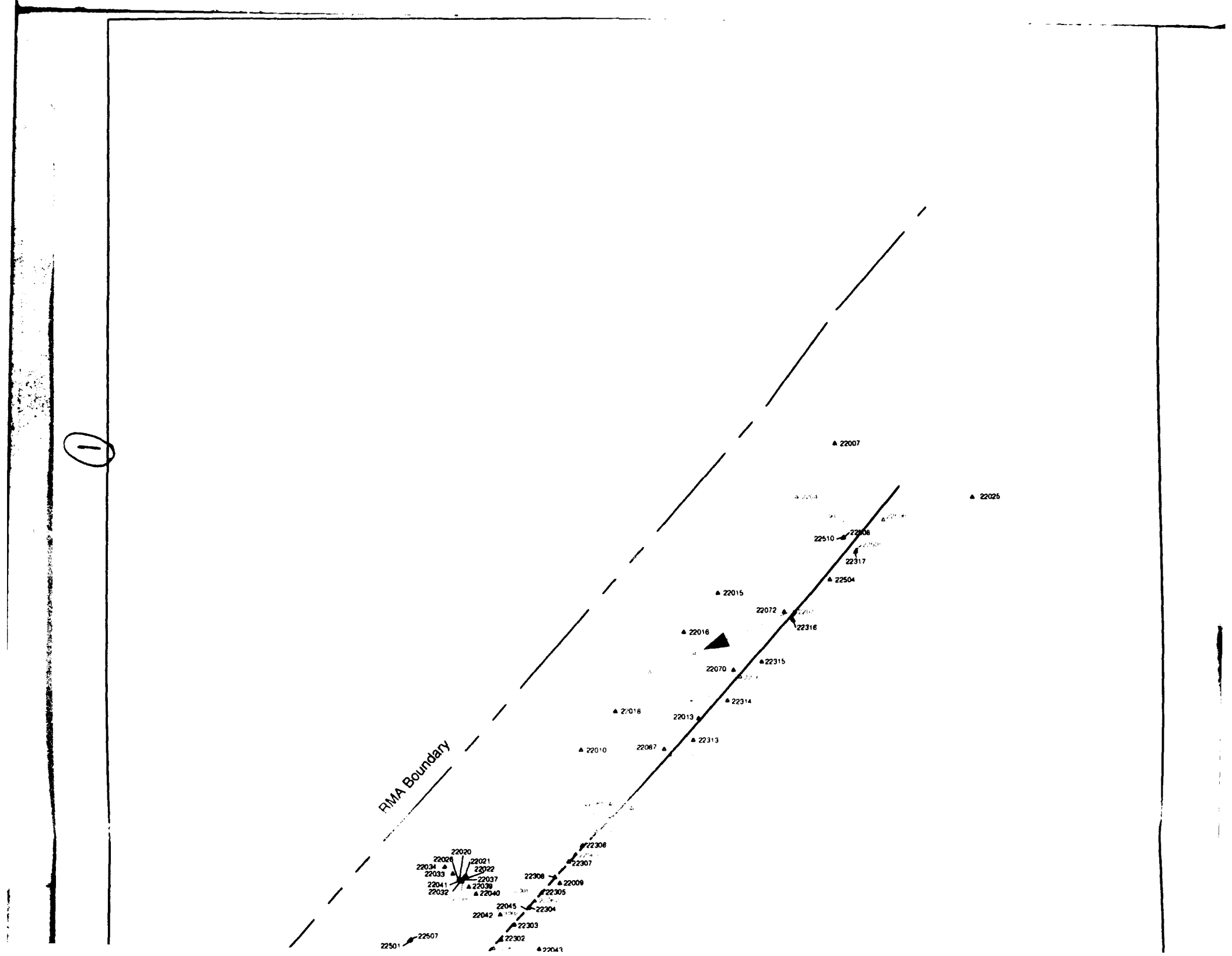
Prepared by:
Harding Lawson Associates

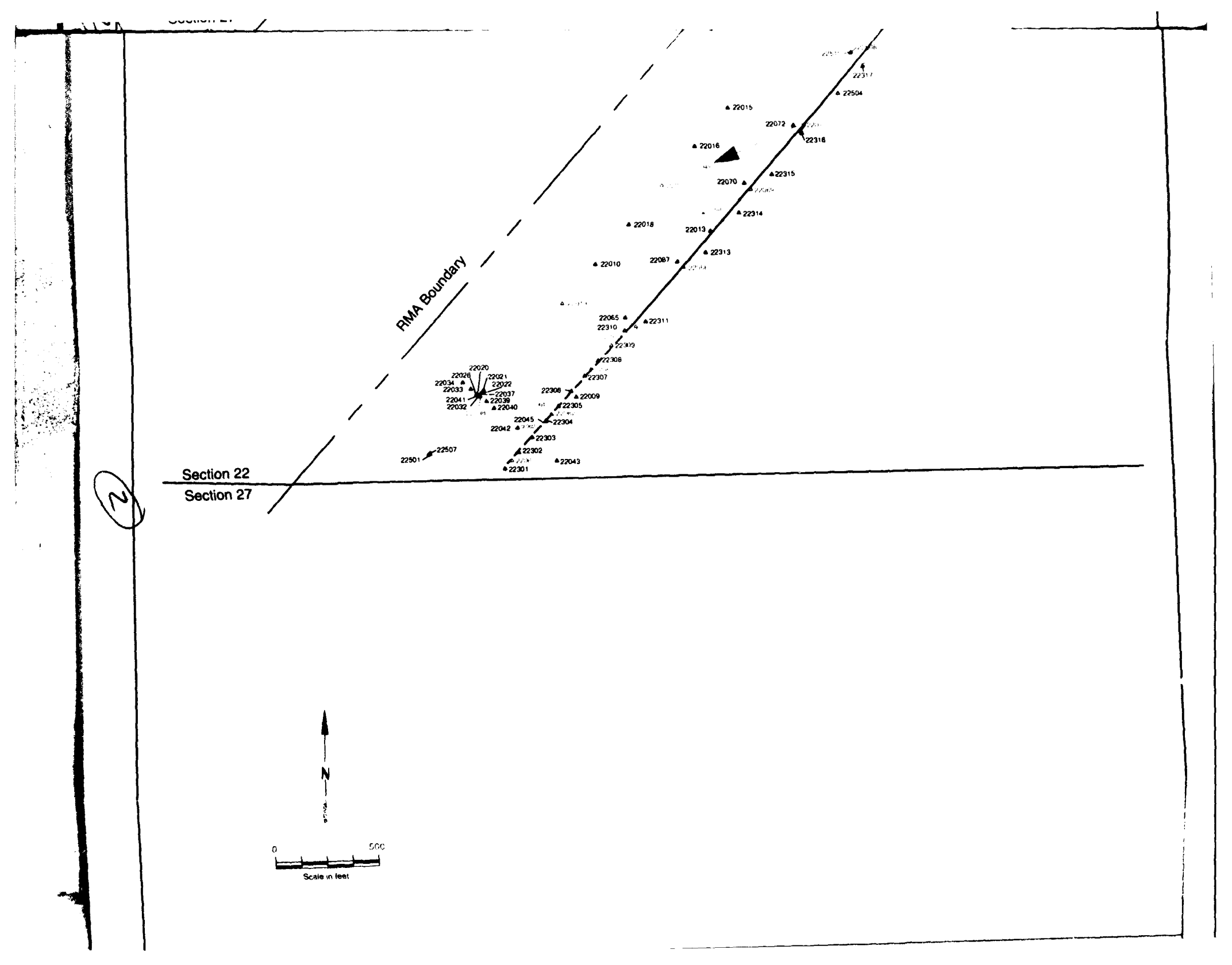
Figure 5.42

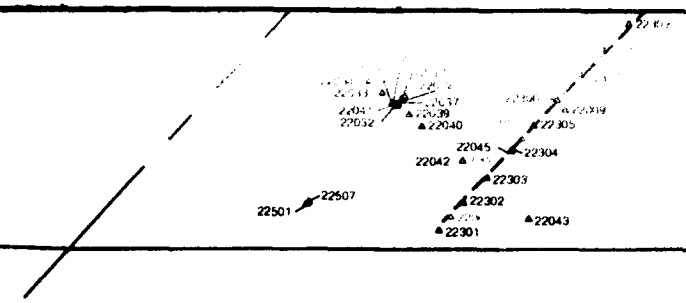
Direction and Magnitude of Water-Table Gradients in the Vicinity of the Northwest Boundary Containment/Treatment System Barrier Wall from October 1 to December 31, 1990

GWAR FY91

8/27/92 rma/mw3pq1r.JWC

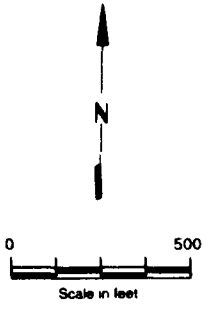

RMA Boundary
22007
22025
22510
22308
22317
22504
22015
22072
22316
22016
22315
22070
22314
22018
22013
22313
22010
22067
22308
22307
22308
22009
22305
22045
22304
22042
22303
22302
22501
22507
22043
22020
22026
22021
22034
22022
22033
22037
22041
22039
22032
22040


RMA Boundary
Section 22
Section 27
22317
22504
22015
22072
22316
22016
22315
22070
22314
22018
22013
22313
22010
22087
22065
22310
22311
22309
22308
22307
22020
22026
22021
22034
22033
22022
22037
22041
22039
22032
22040
22306
22009
22305
22045
22304
22042
22303
22302
22507
22501
22043
22301
N
0
500
Scale in feet



Section 22

Section 27



EXPLANATION

▲22101 Alluvial well

Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Containment system

Physical barrier

Hydraulic barrier

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

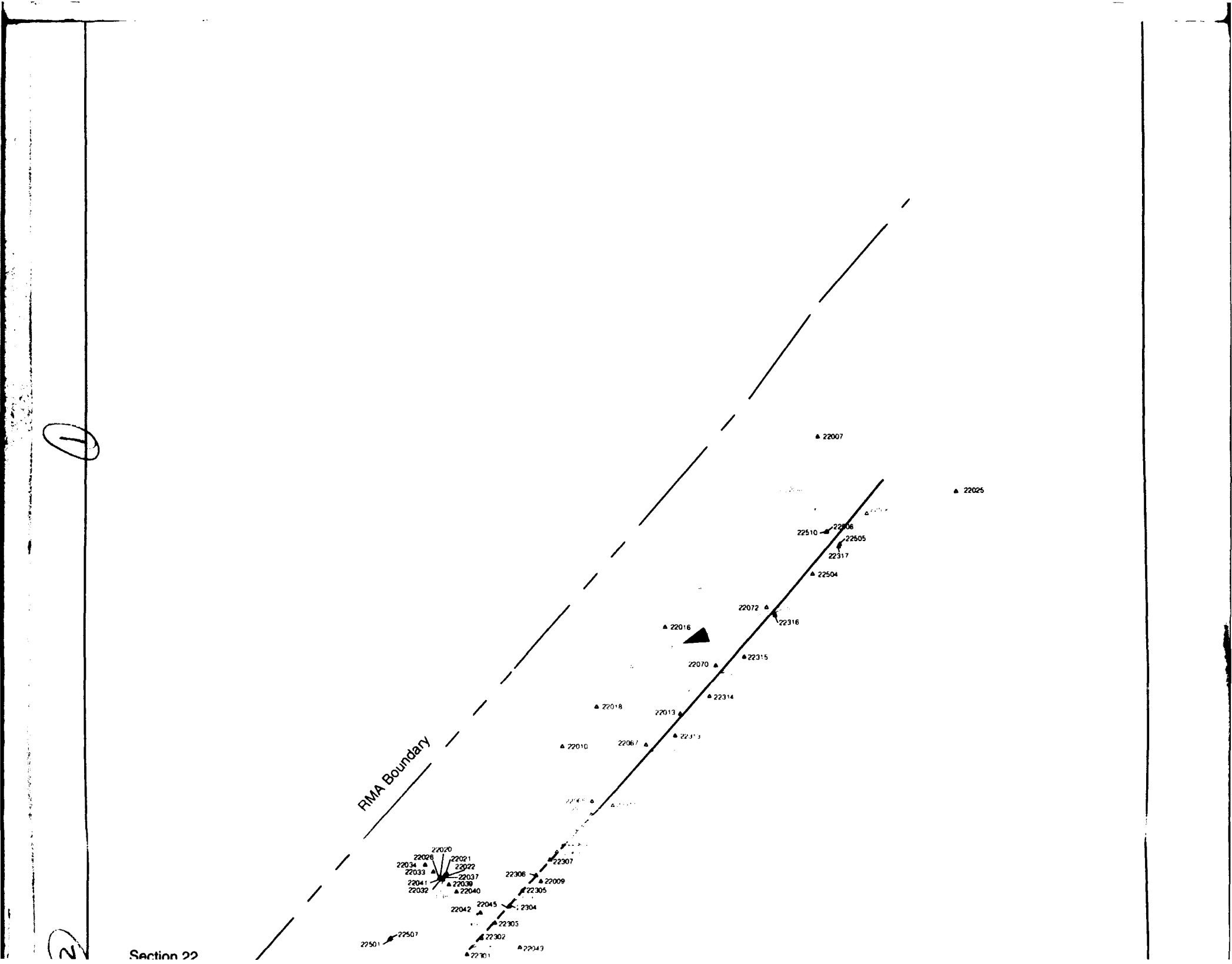
Prepared by:
Harding Lawson Associates

Figure 5.43

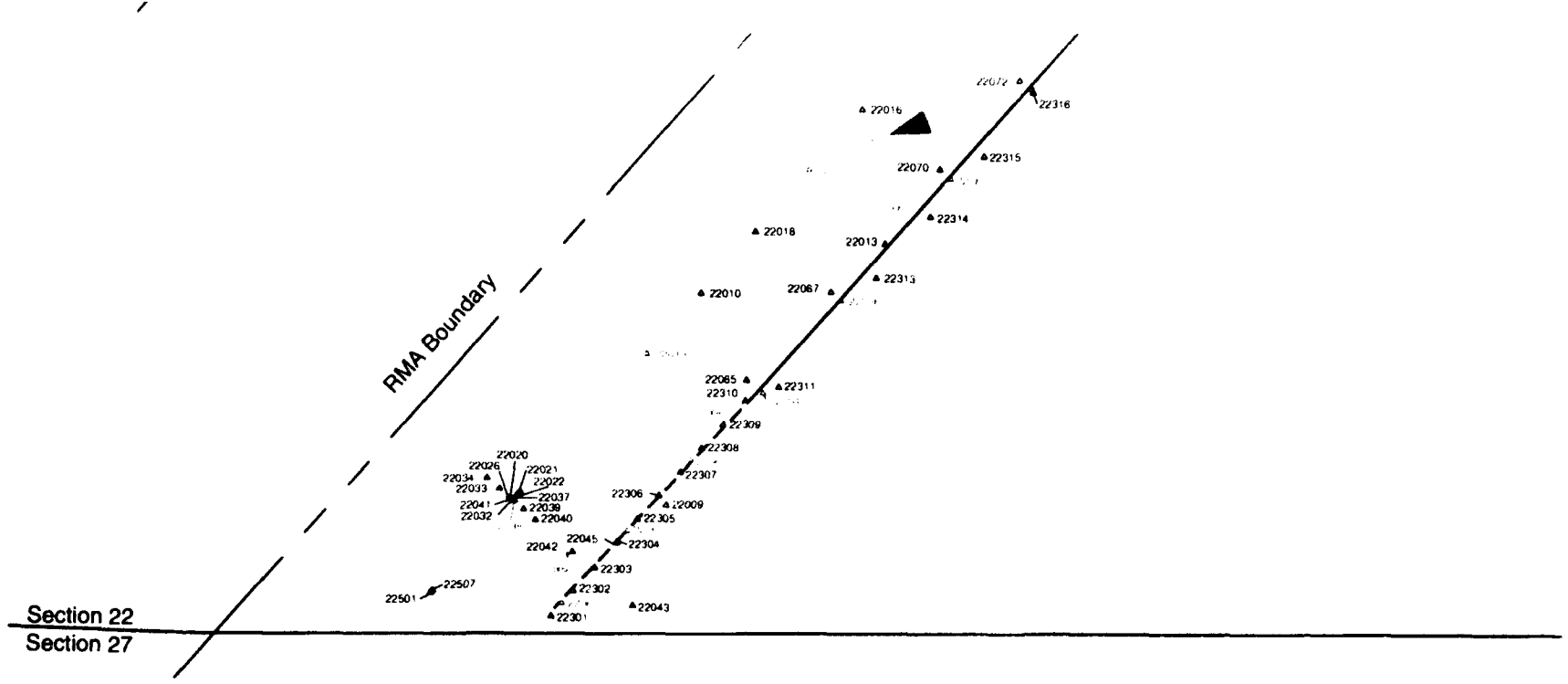
Direction and Magnitude of Water-Table Gradients in the Vicinity of the Northwest Boundary Containment/Treatment System Barrier Wall from January 1 to March 31, 1991

GWAR FY91

8/27/92 mwh/sfig42.JWL


RMA Boundary
22007
22025
22510
22506
22505
22317
22504
22072
22316
22016
22315
22070
22314
22018
22013
22010
22067
22307
22308
22009
22305
22045
2304
22042
22303
22302
22507
22501
22049
22020
22026
22021
22034
22033
22022
22037
22041
22039
22032
22040

Section 22



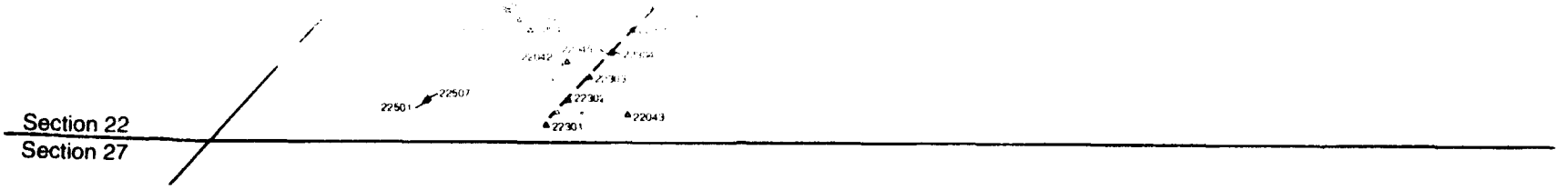
EXPLANATION

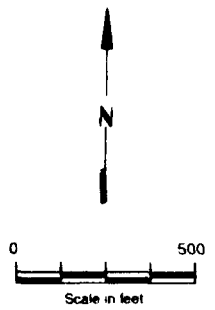
Prepared for

Program Manager for
Rocky Mountain Arsenal

Direction and magnitude of

Harding Lawson Associates





EXPLANAT'ON

▲ 22101 Alluvial well

Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Containment system

Physical barrier

Hydraulic barrier

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

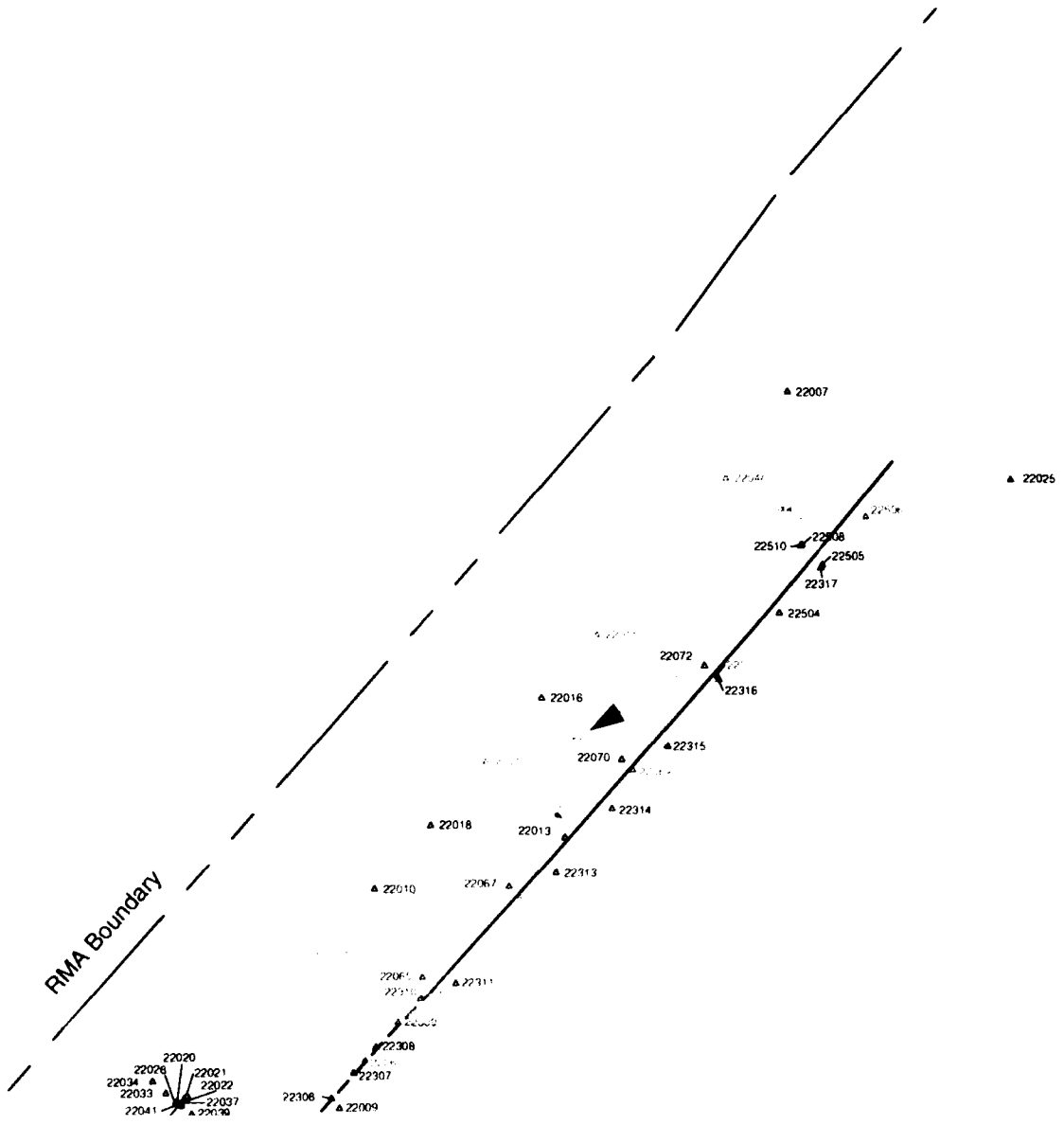
Harding Lawson Associates

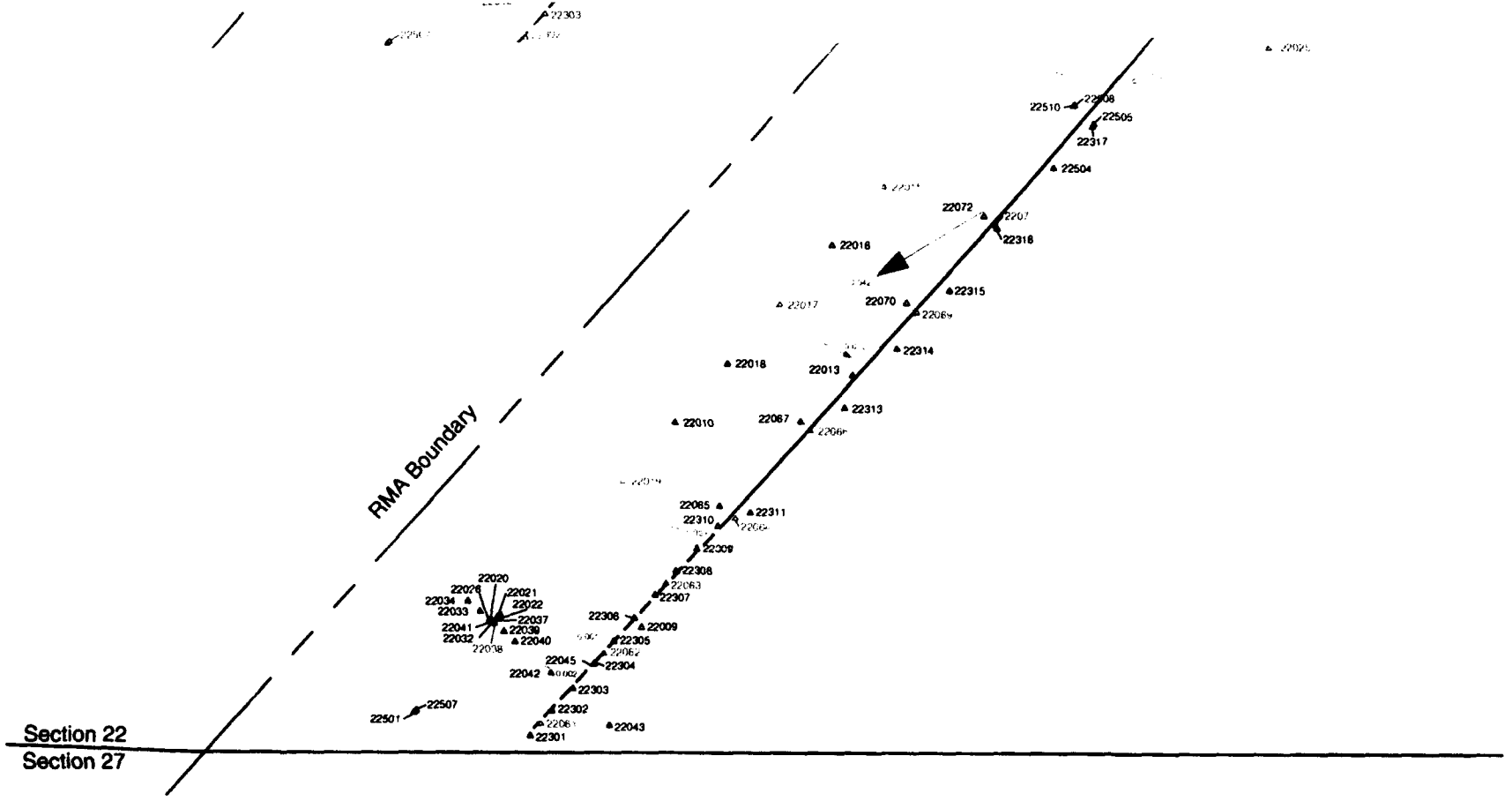
Figure 5.44

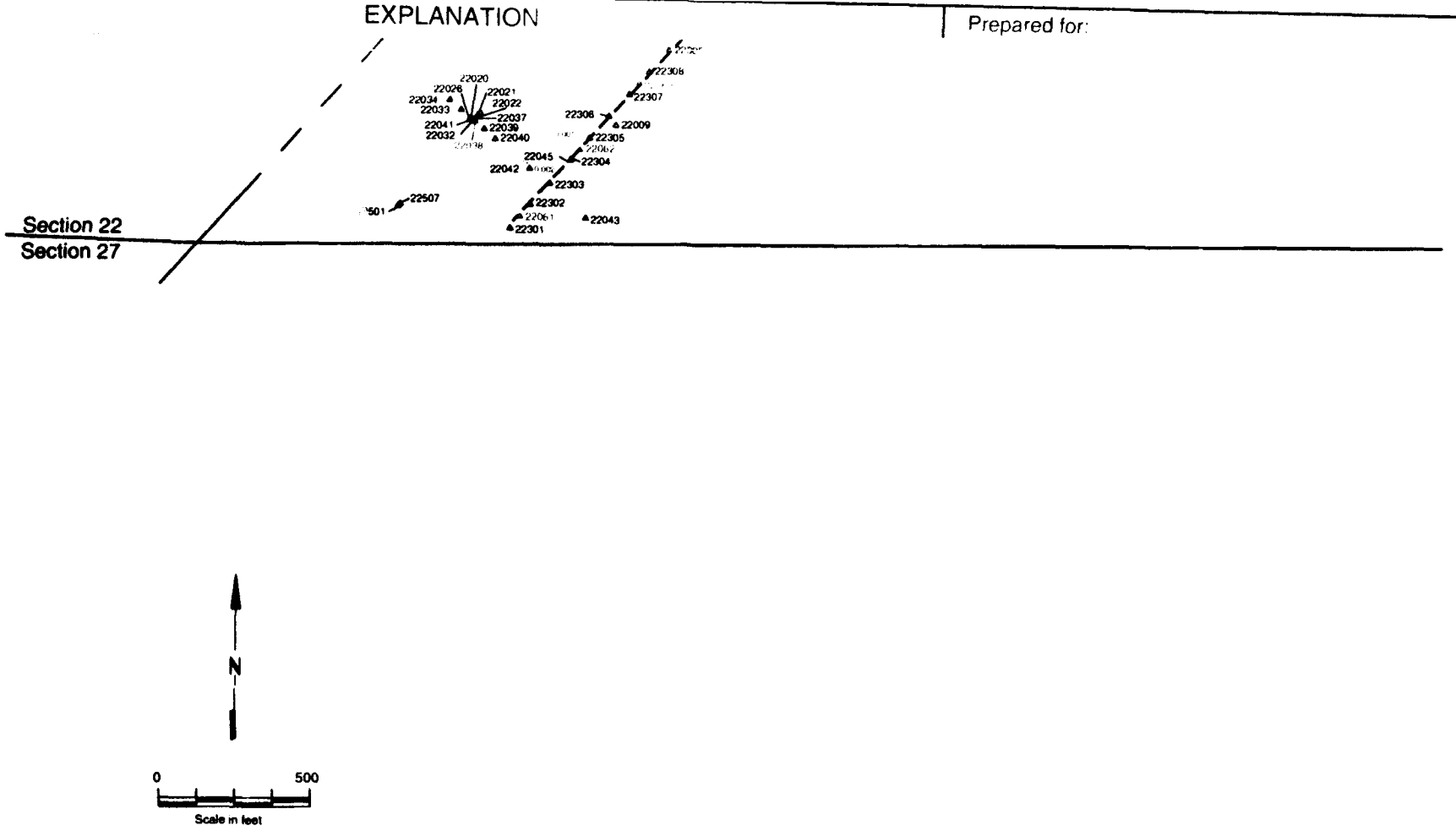
Direction and Magnitude of Water-Table Gradients in the Vicinity of the Northwest Boundary Containment/Treatment System Barrier Wall from April 1 to June 30, 1991

GWAR FY91

8/27/92 rma/rwdpcp3.dgn


RMA Boundary
22007
22025
22510
22505
22317
22504
22072
22316
22016
22315
22070
22314
22018
22013
22313
22010
22067
22308
22307
22306
22009
22020
22026
22021
22034
22022
22033
22037
22041


RMA Boundary
Section 22
Section 27
22510
22505
22317
22504
22072
22318
22018
22315
22070
22314
22013
22313
22010
22067
22085
22310
22311
22309
22308
22063
22307
22308
22009
22305
22045
22304
22042
22303
22302
22043
22301
22501
22507
22020
22026
22021
22034
22033
22022
22037
22041
22036
22032
22040
22038
N
0
500
Scale in feet



EXPLANATION

▲22101 Alluvial well

Direction and magnitude of water-table gradient in feet/feet

Note: Wells in red were utilized in three-point solutions of water-table direction and magnitude.

Containment system

Physical barrier

Hydraulic barrier

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

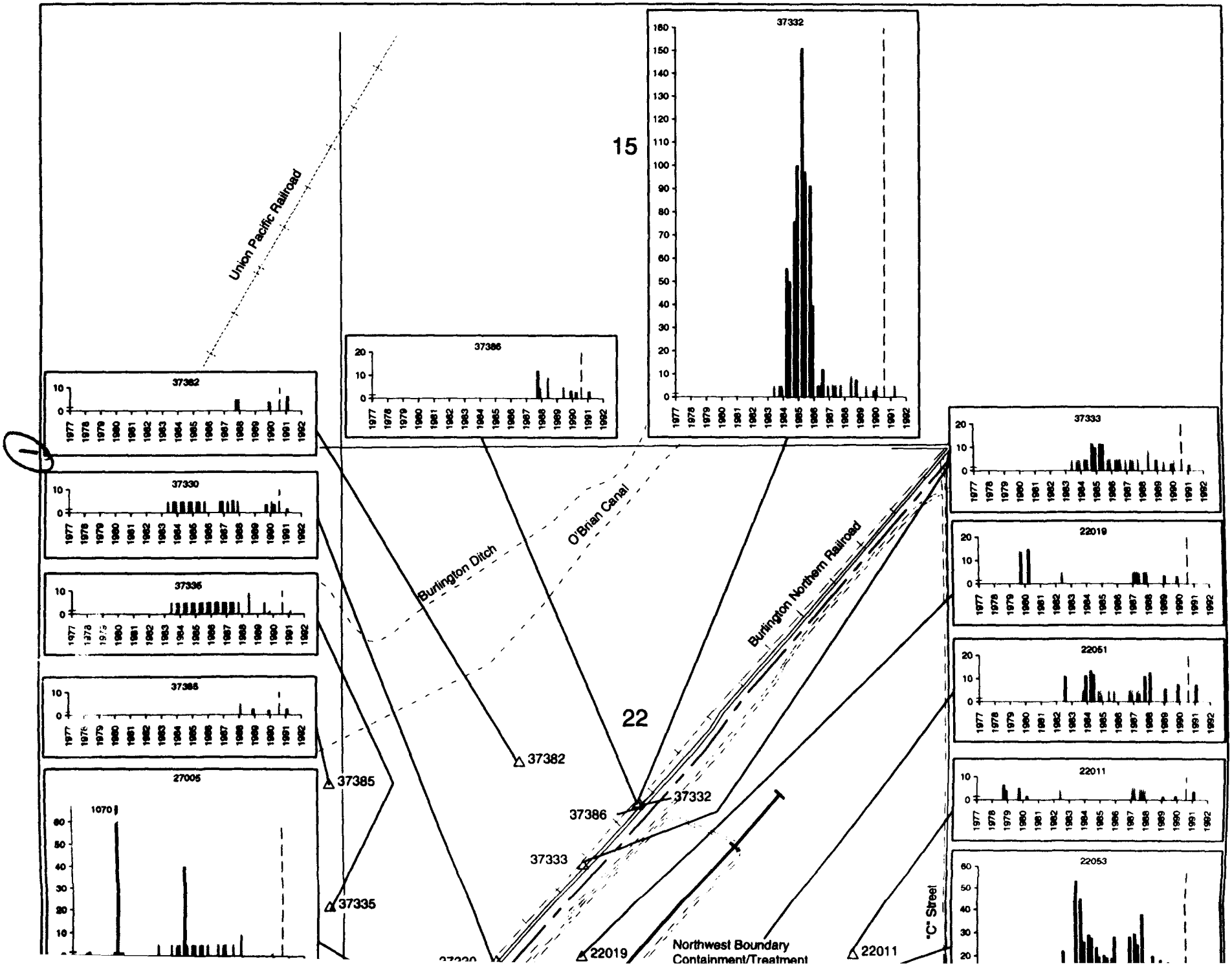
Harding Lawson Associates

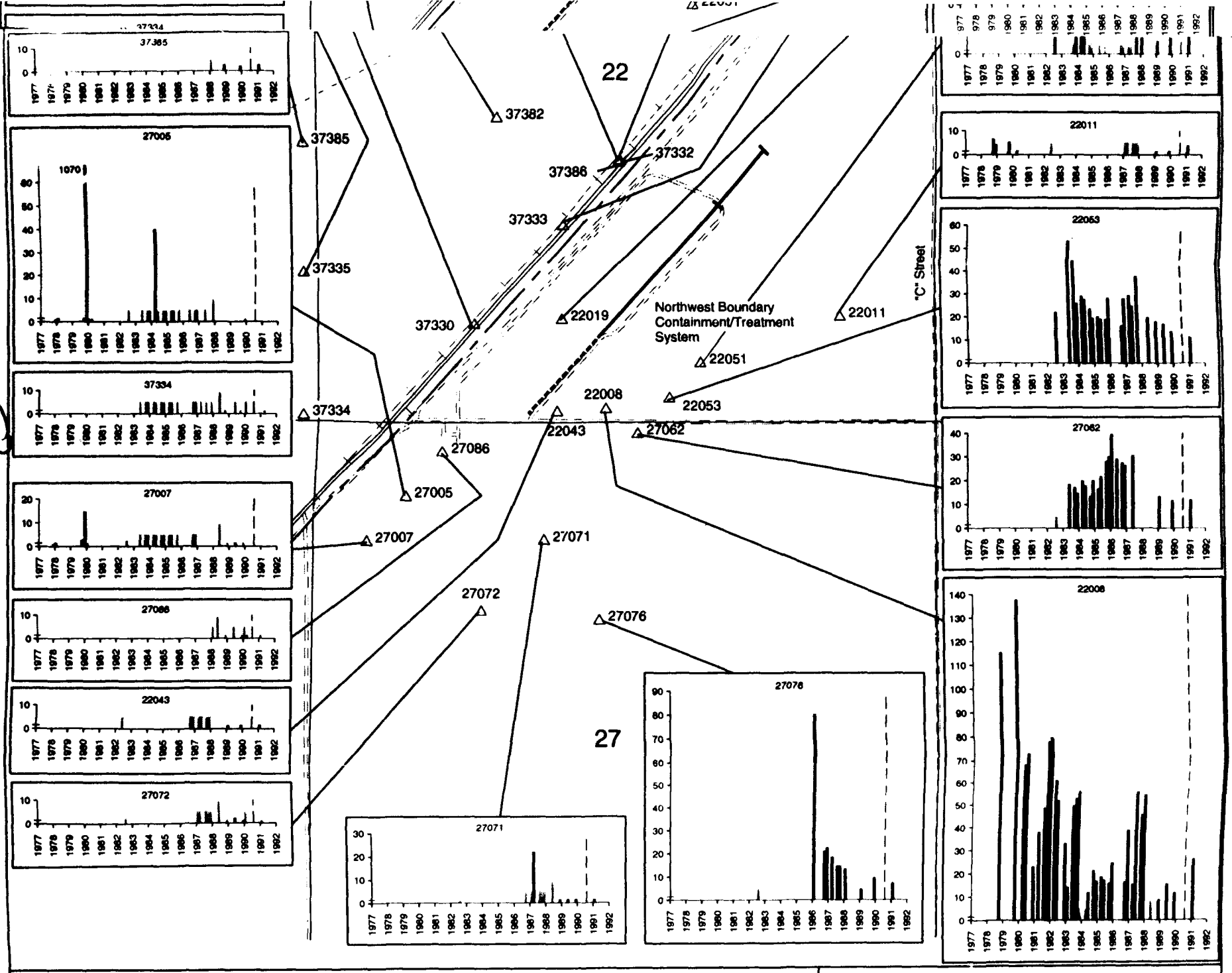
Figure 5.45

Direction and Magnitude of Water-Table Gradients in the Vicinity of the Northwest Boundary Containment/Treatment System Barrier Wall from July 1 to September 30, 1991

GWAR FY91

8/27/92 mwhw3/plot/r JW


15
22
Union Pacific Railroad
Burlington Ditch
O'Brian Canal
Burlington Northern Railroad
"C" Street
Northwest Boundary
Containment/Treatment
37382
37385
37335
37386
37332
37333
22019
22011
37332
37386
37382
37330
37336
37385
27005
1070
37333
22019
22051
22011
22053



EXPLANATION

Well number

Reported value 23085

Startup of slurry wall extension

Certified Reporting Limit (CRL)

Unconfined flow system wells

23085 △ Alluvial well

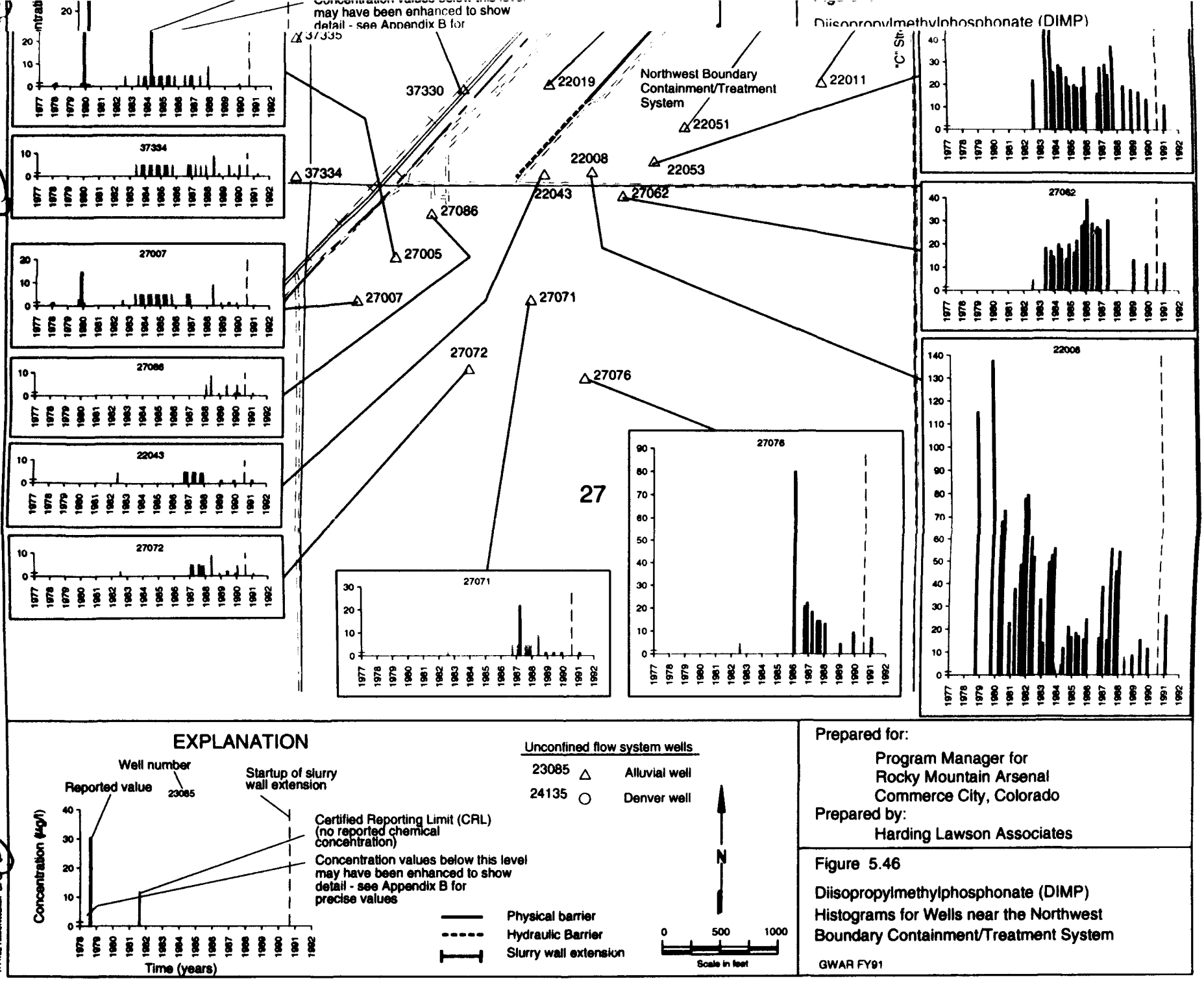
24135 ○ Denver well

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Harding Lawson Associates



Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

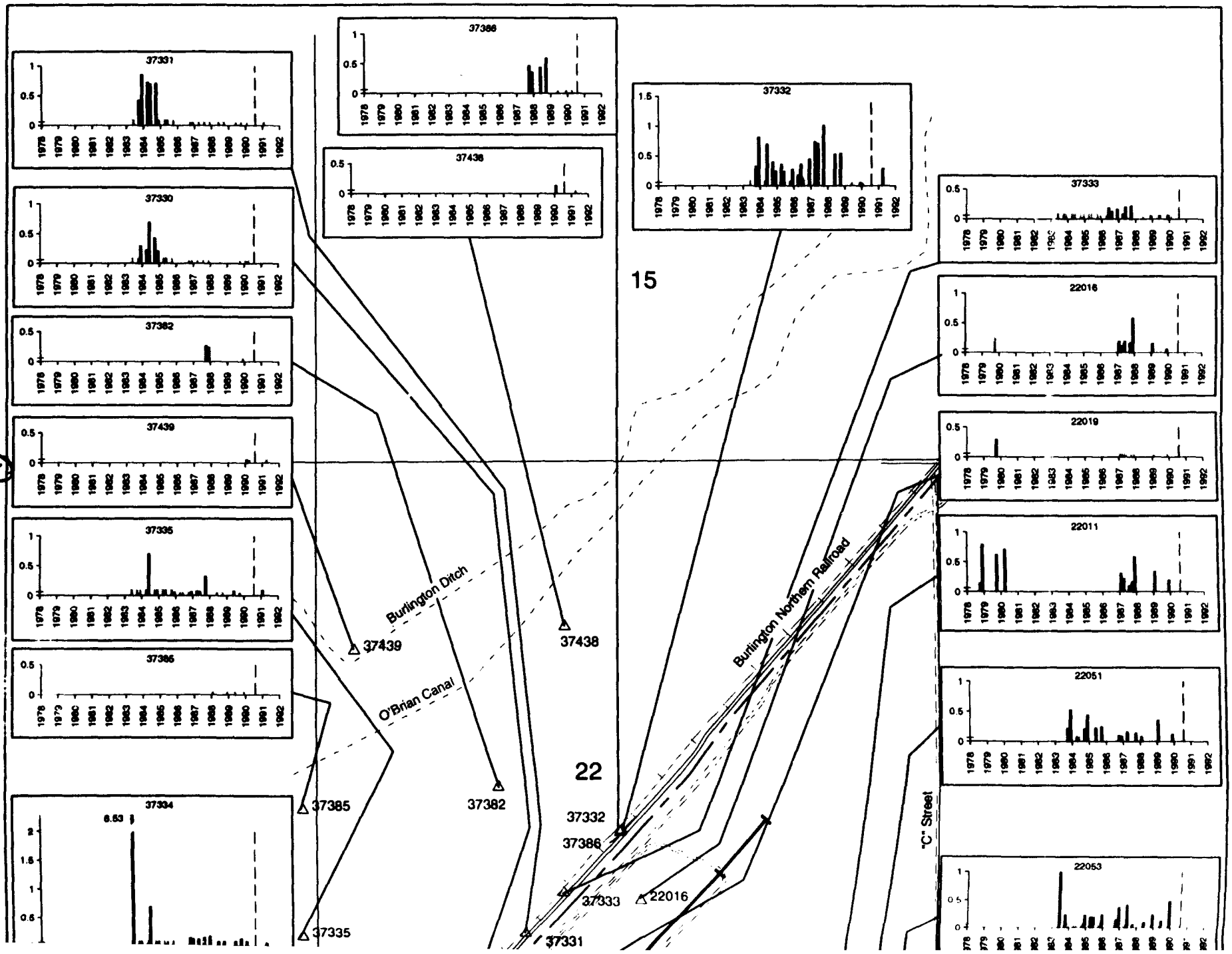
Prepared by:

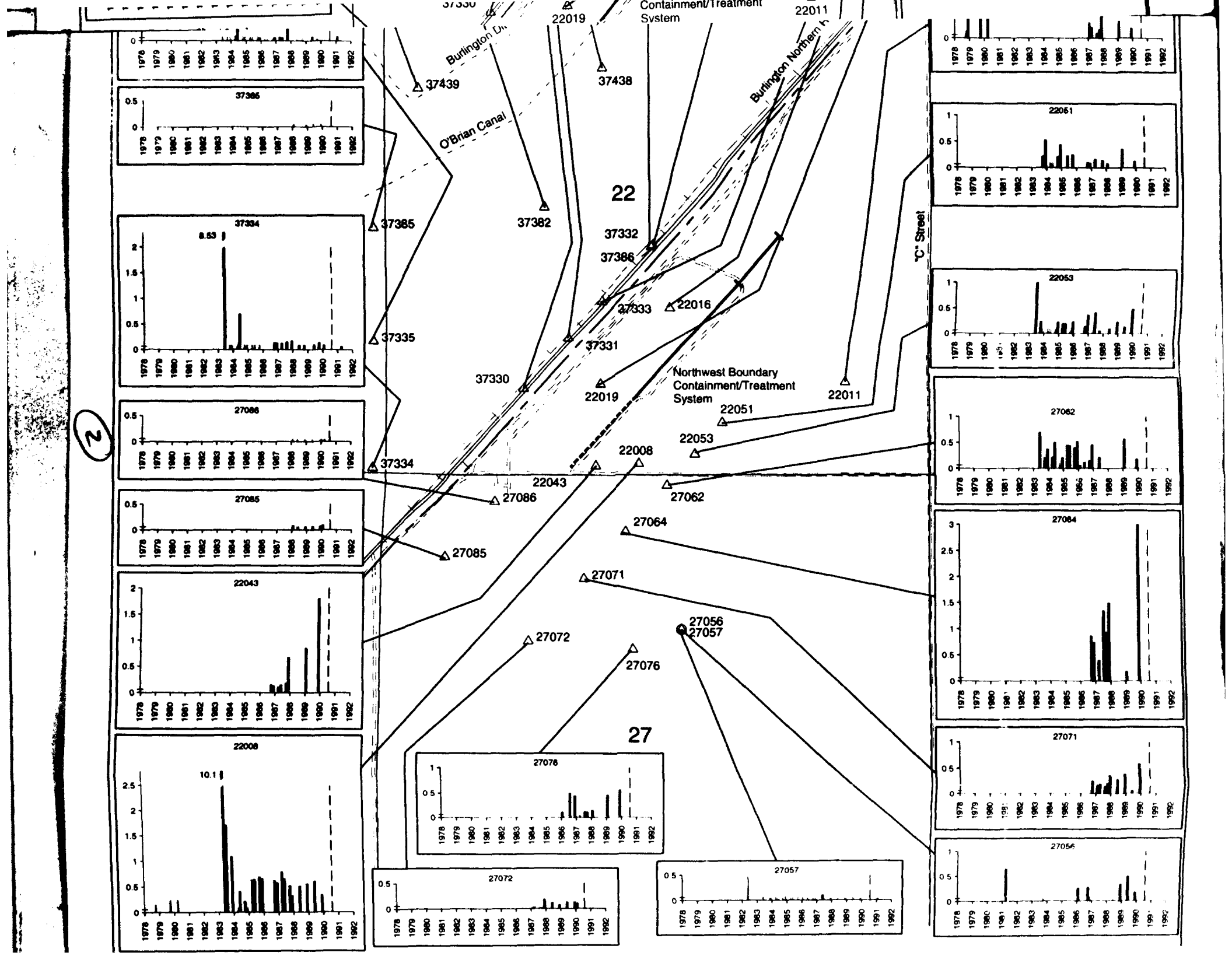
Harding Lawson Associates

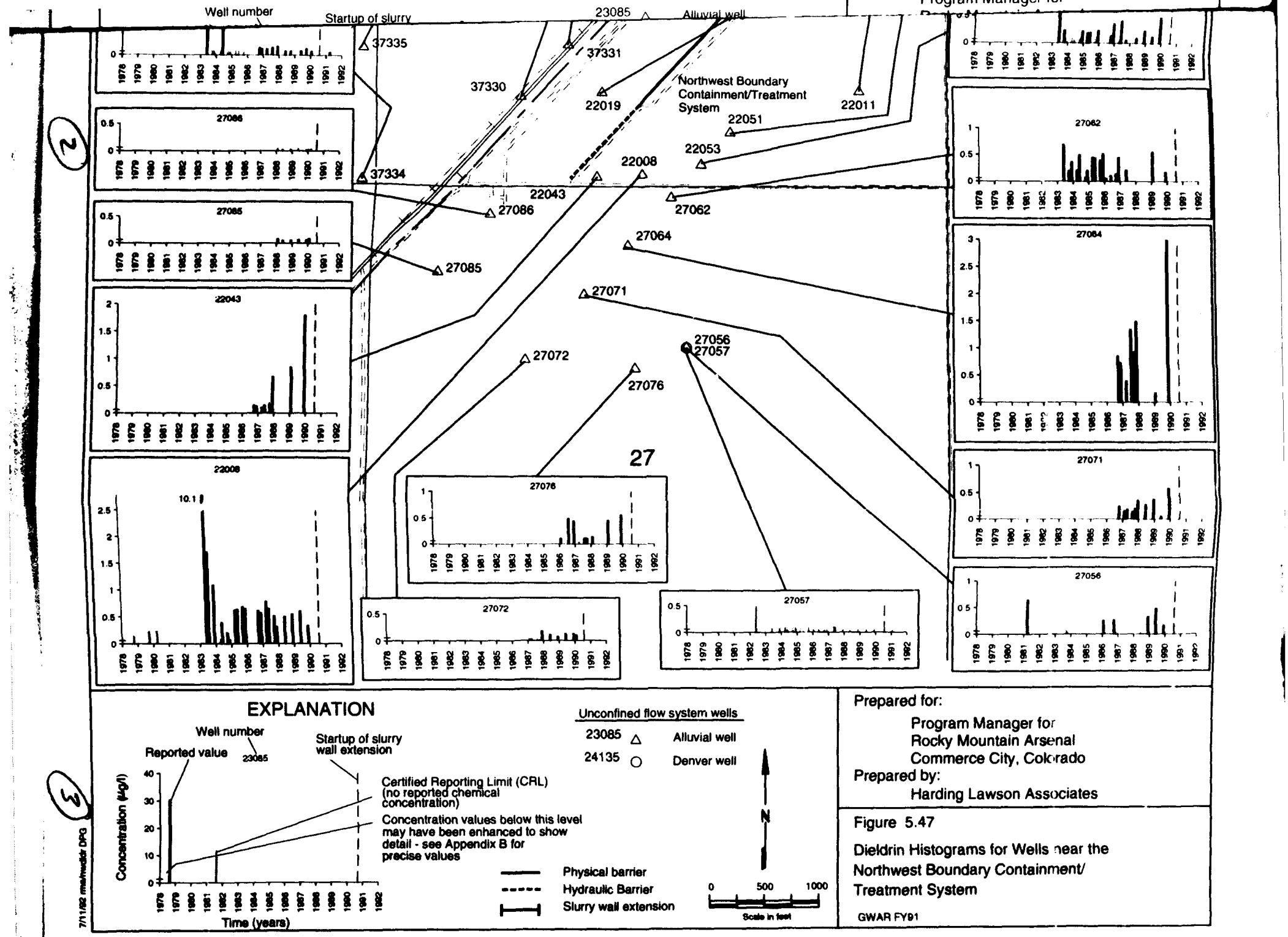
Figure 5.46

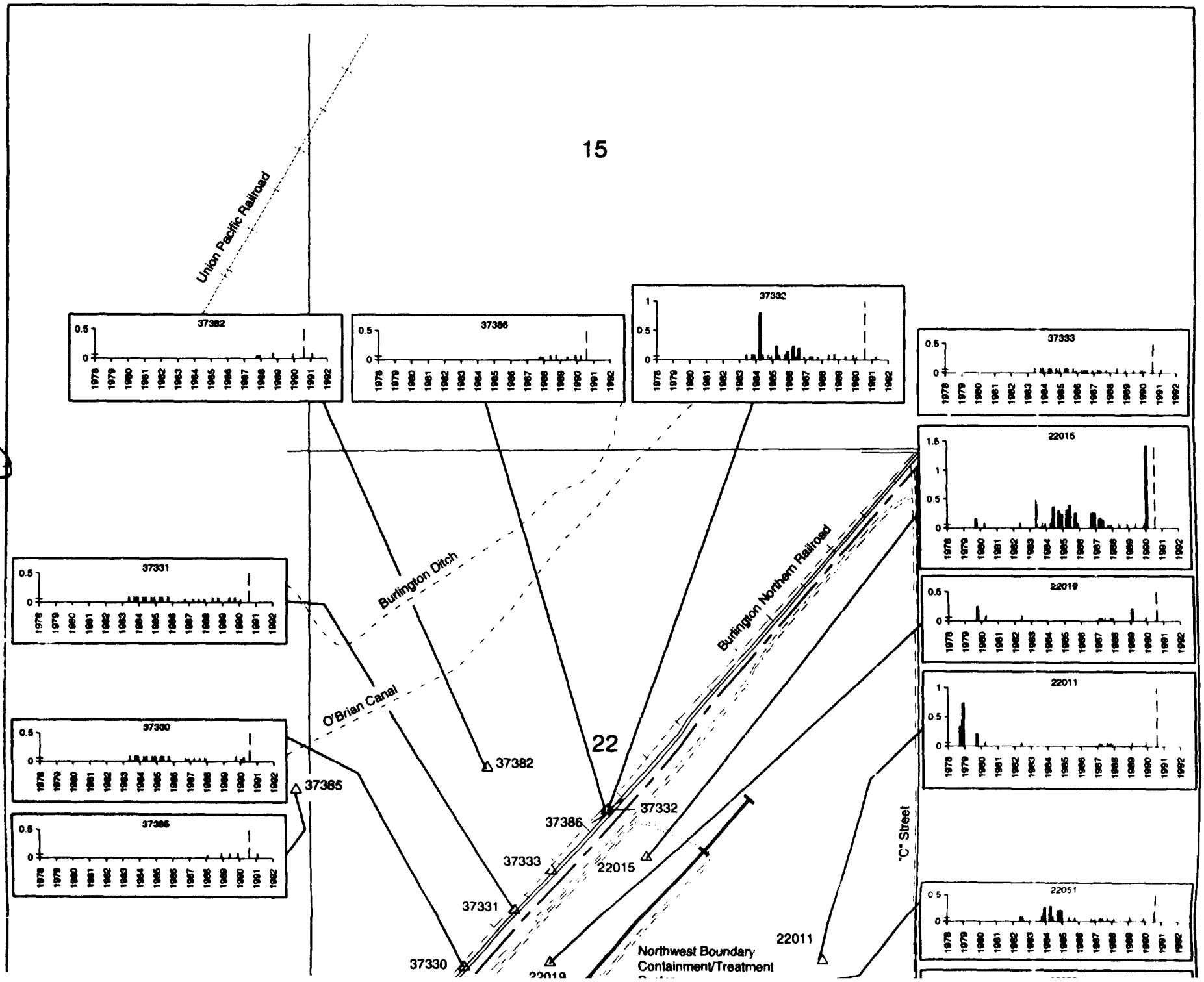
Diisopropylmethylphosphonate (DIMP)
Histograms for Wells near the Northwest Boundary Containment/Treatment System

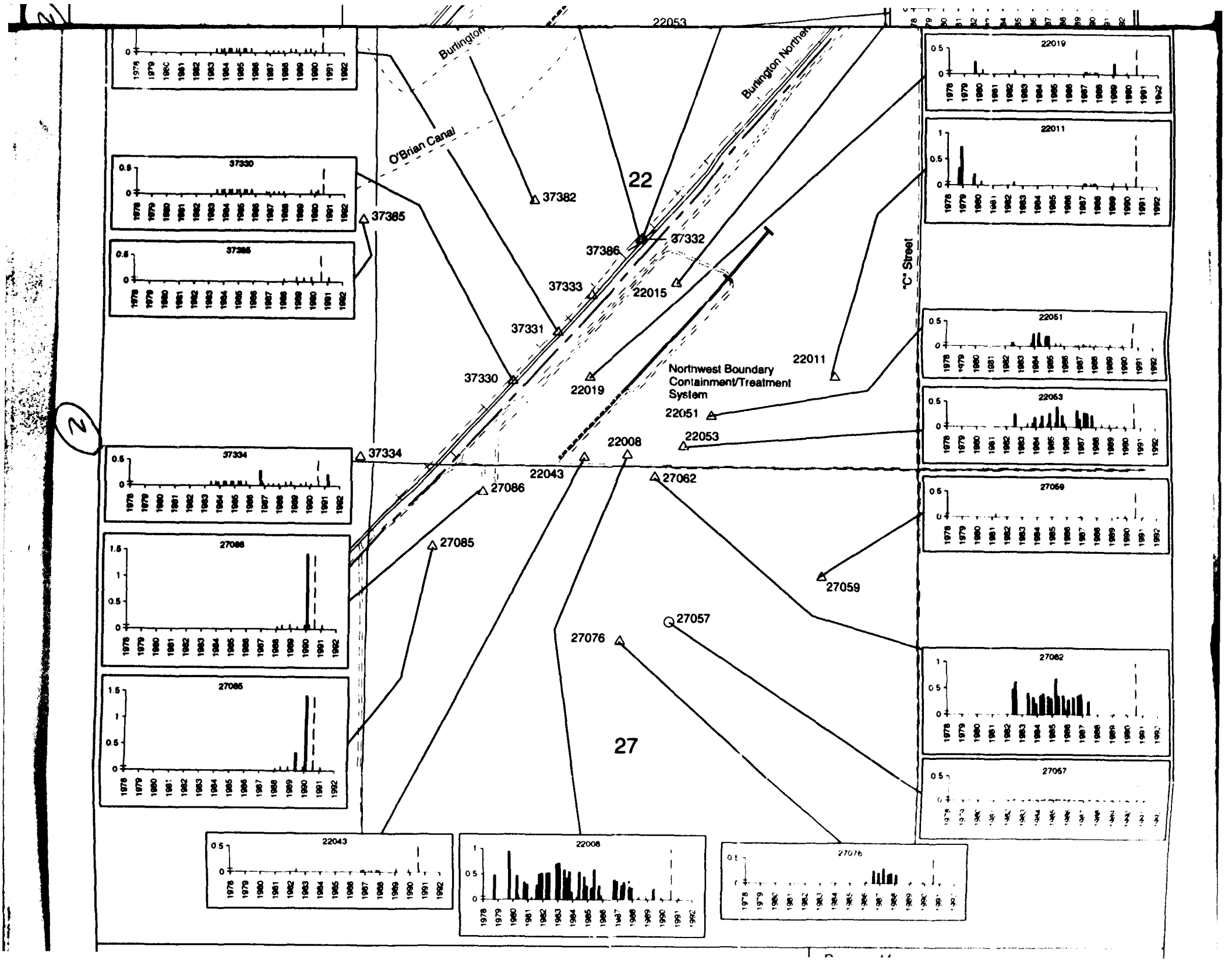
GWAR FY91

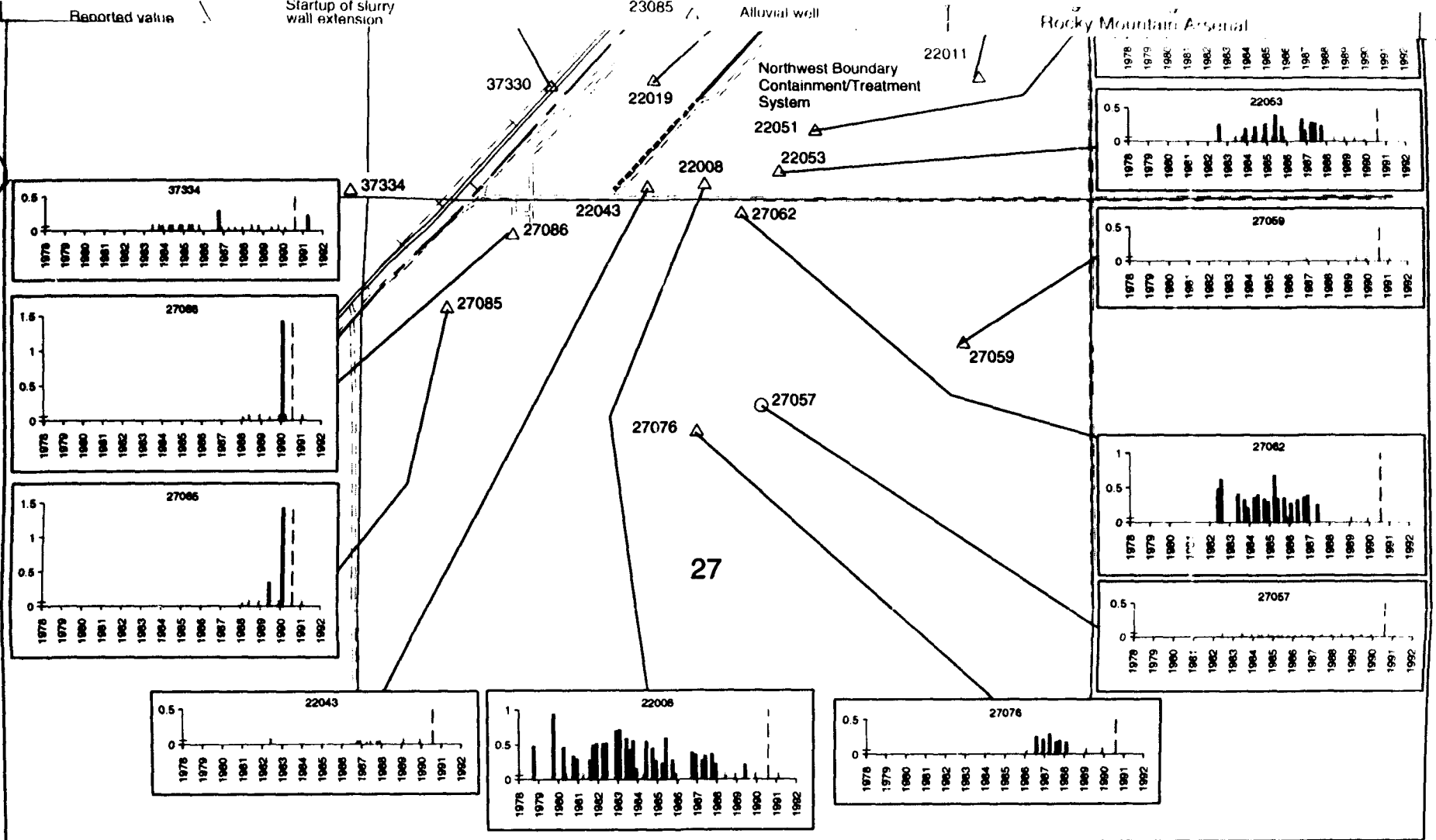

37391
37386
37332
37438
37333
37330
15
22016
37382
37439
22019
37335
22011
37386
Burlington Ditch
Burlington Northern Railroad
O'Brian Canal
37439
37438
37385
37382
22
37332
37386
"C" Street
22051
37394
8.53
37333
22016
37335
37331
22053


Burlington Northern h
O'Brian Canal
"C" Street
Northwest Boundary Containment/Treatment System
22
27
37439
37438
37385
37382
37332
37386
37333
37331
37330
37335
37334
27086
27085
22019
22016
22011
22051
22053
22008
22043
27062
27064
27071
27056
27057
27072
27076
37386
37334
27086
27085
22043
22008
27076
27072
27057
27062
27064
27071
27056
22051
22053


Well number
Startup of slurry
23085
Alluvial well
37335
37331
37330
22019
Northwest Boundary
Containment/Treatment
System
22011
22051
22053
37334
22008
22043
27086
27062
27085
27064
27071
27056
27057
27072
27076
27
22008
10.1
27086
27062
27085
22043
27064
27076
27071
27072
27057
27056
EXPLANATION
Well number
Reported value
23085
Startup of slurry
wall extension
Concentration (µg/l)
Certified Reporting Limit (CRL)
(no reported chemical
concentration)
Concentration values below this level
may have been enhanced to show
detail - see Appendix B for
precise values
Time (years)
Unconfined flow system wells
23085 Alluvial well
24135 Denver well
Physical barrier
Hydraulic Barrier
Slurry wall extension
N
0
500
1000
Scale in feet
7/11/92 ma/medstr DPG
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates
Figure 5.47
Dieldrin Histograms for Wells near the
Northwest Boundary Containment/
Treatment System
GWAR FY91


15
Union Pacific Railroad
37382
37386
37332
37333
22015
37331
Burlington Ditch
Burlington Northern Railroad
22019
O'Brian Canal
22
37330
37385
22011
37382
37386
37332
37333
22015
37331
22051
"C" Street
37330
22011
Northwest Boundary
Containment/Treatment


22053
Burlington
Burlington Northern
O'Brian Canal
22
37382
37385
37332
37386
37333
22015
37331
37330
22019
22011
Northwest Boundary
Containment/Treatment
System
22051
22053
22008
37334
22043
27086
27062
27085
27059
27057
27076
27
"C" Street
37330
37385
37386
37334
22019
22011
22051
22053
27086
27085
27059
27082
27057
22043
22008
27076



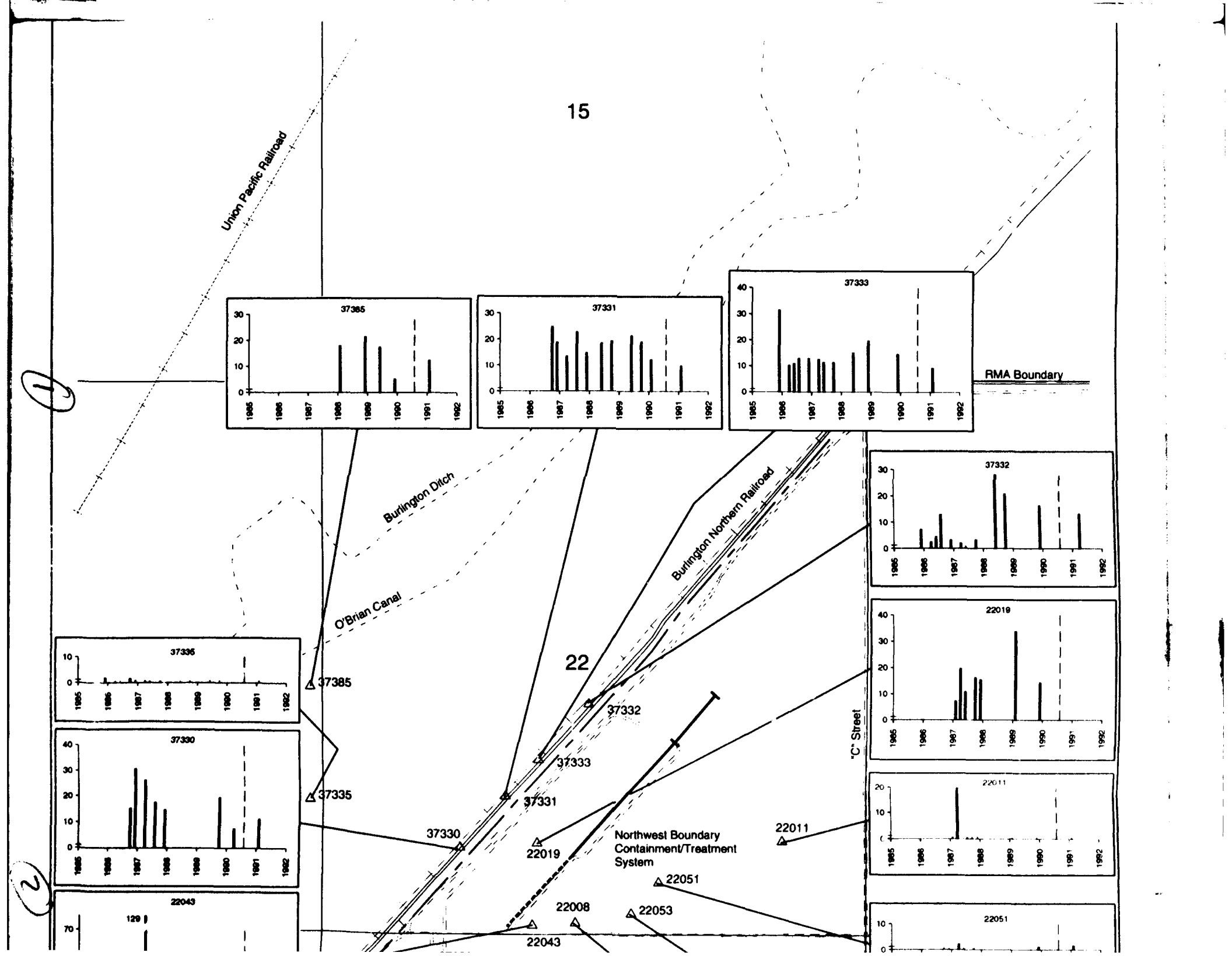
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

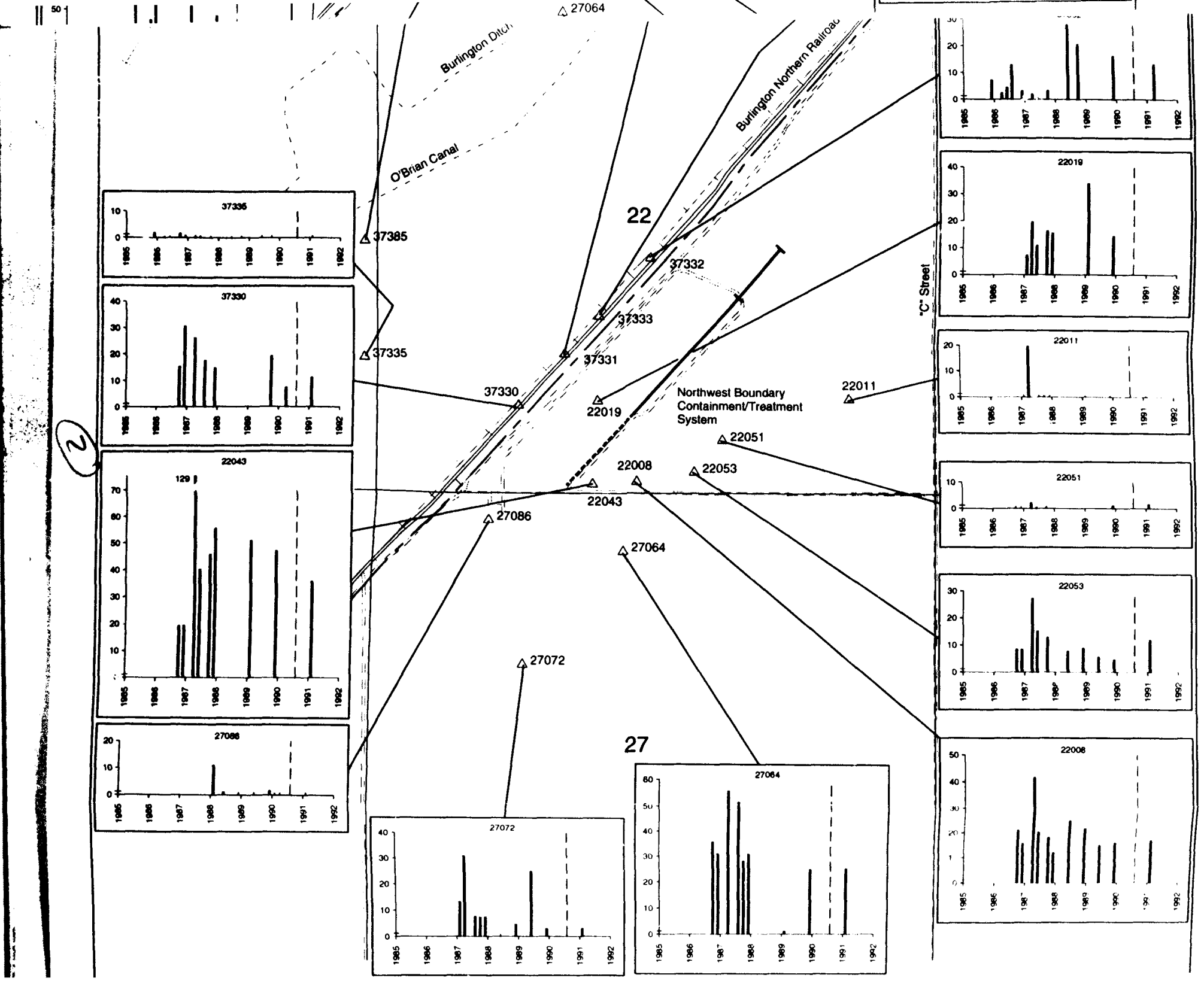
Figure 5.48

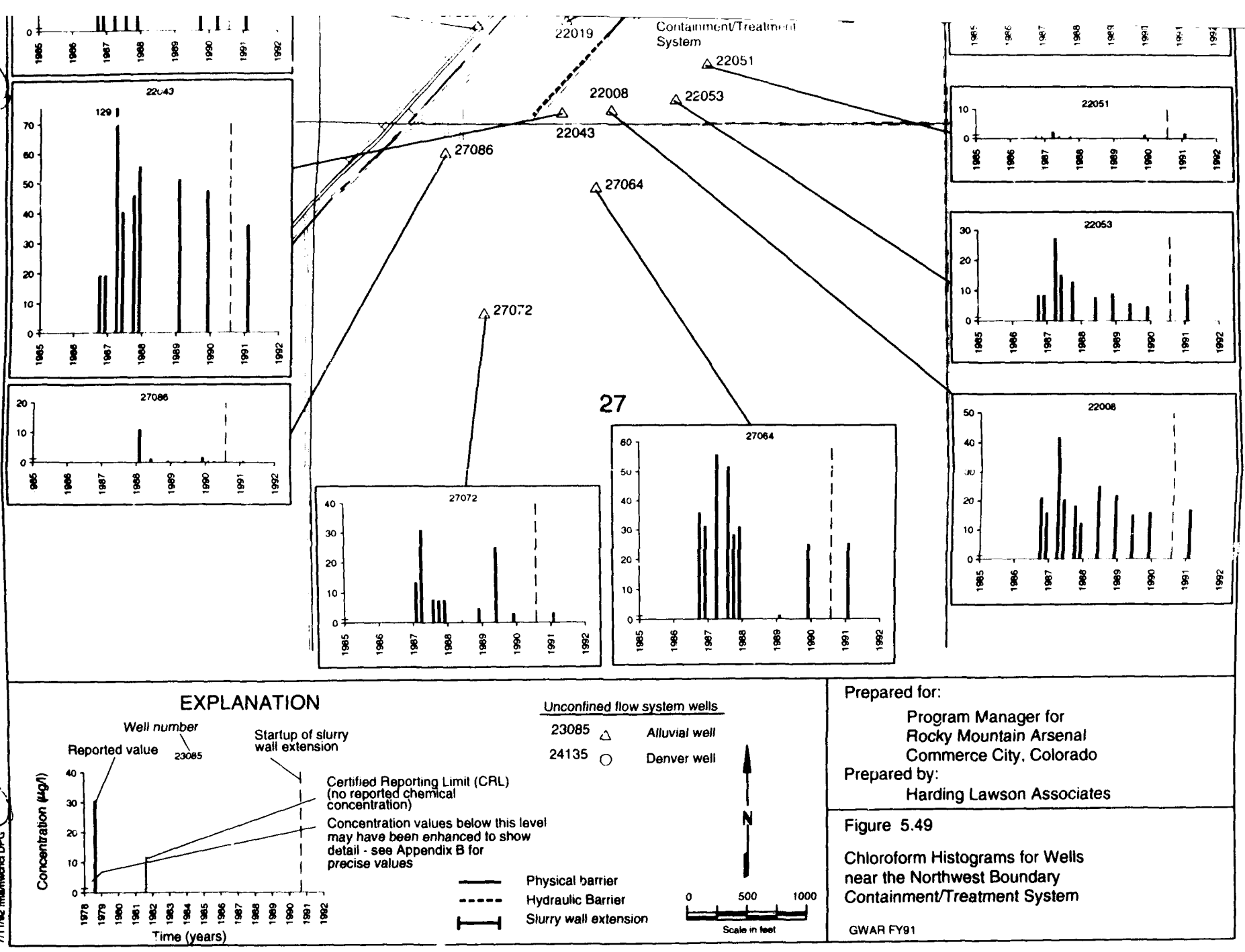
Dibromochloropropane (DBCP)
Histograms for Wells near the Northwest Boundary Containment/Treatment System

GWAR FY91

7/11/92 ms/nwbdap DPC


Union Pacific Railroad
Burlington Ditch
O'Brian Canal
Burlington Northern Railroad
RMA Boundary
"C" Street
Northwest Boundary
Containment/Treatment
System
37385
37332
37333
37331
37330
37335
22019
22011
22051
22008
22053
22043
22
37385
37331
37333
37332
37336
37330
22019
22011
22043
22051


Burlington Ditch
O'Brian Canal
Burlington Northern Railroad
"C" Street
22
27
37385
37332
37333
37331
37335
37330
22019
22011
Northwest Boundary
Containment/Treatment
System
22051
22008
22053
22043
27086
27064
27072
37336
37330
22043
27086
27072
27064
22019
22011
22051
22053
22008



Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

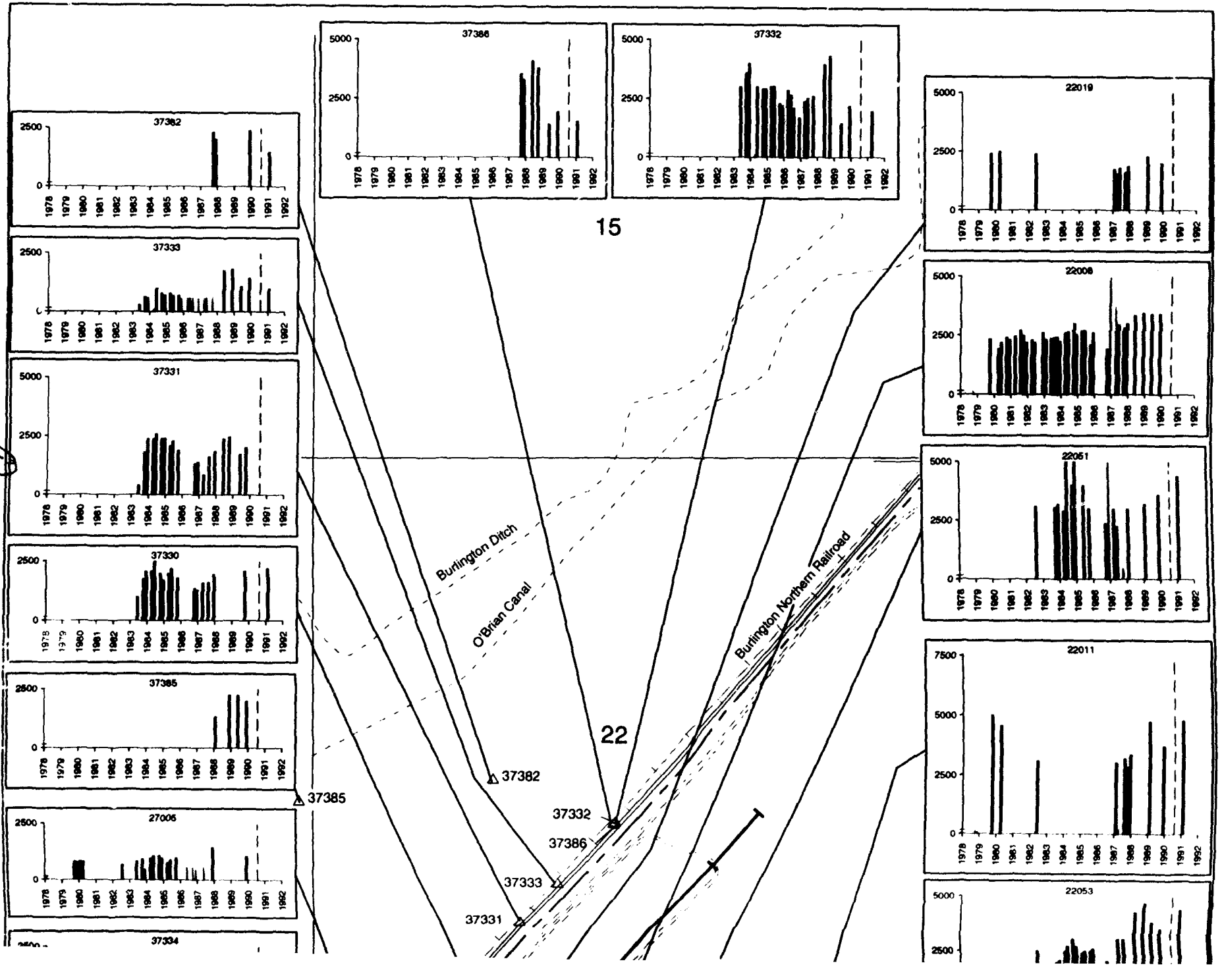
Prepared by:

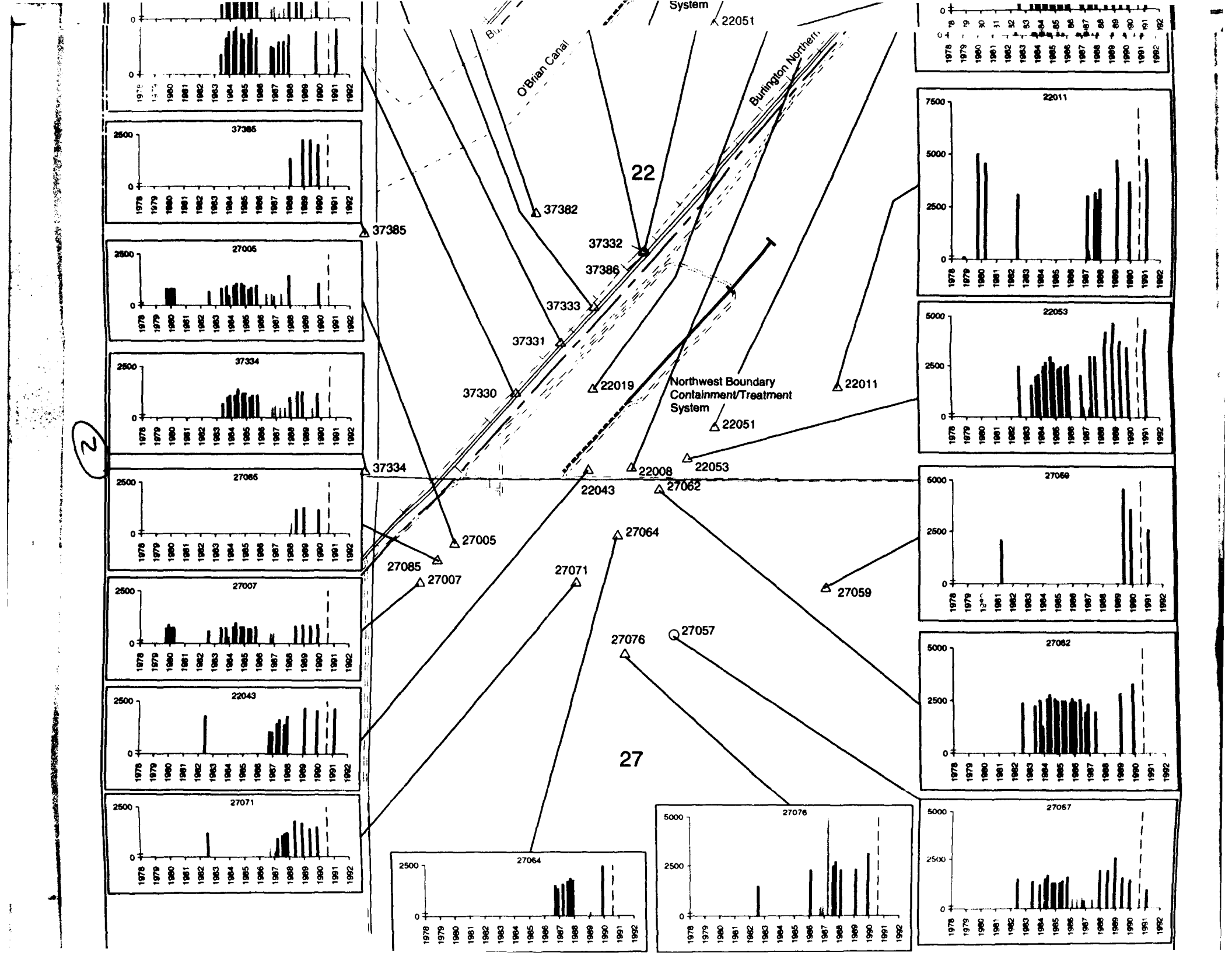
Harding Lawson Associates

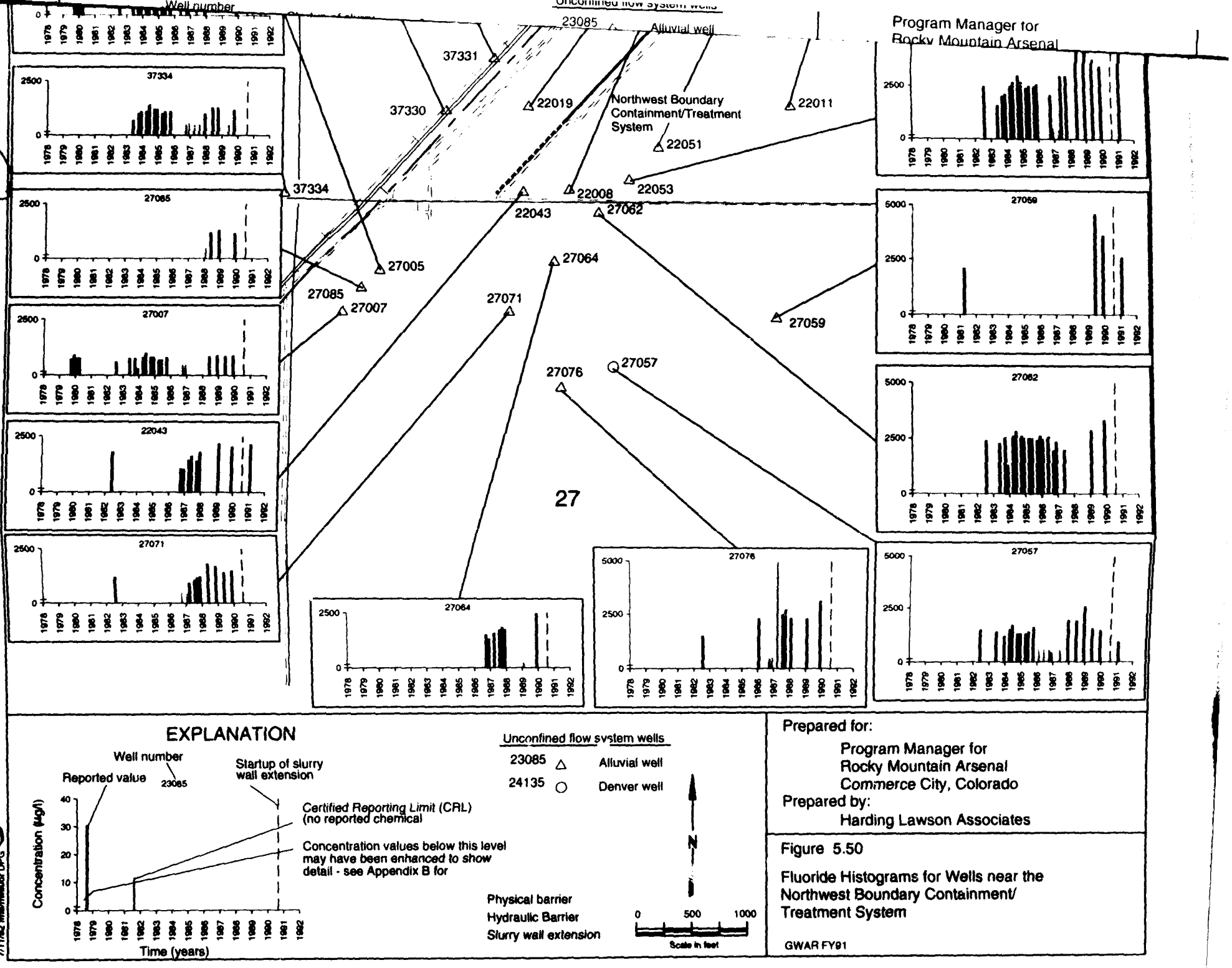
Figure 5.49

Chloroform Histograms for Wells near the Northwest Boundary Containment/Treatment System

GWAR FY91


37386
37332
37382
37333
37331
37330
37385
27006
37334
22019
22008
22051
22011
22053
15
22
Burlington Ditch
O'Brian Canal
Burlington Northern Railroad
37382
37385
37332
37386
37333
37331


O'Brian Canal
Burlington Northern
Northwest Boundary Containment/Treatment System
22
27
37382
37385
37332
37386
37333
37331
37330
37334
22019
22008
22043
22053
22011
22051
27062
27005
27085
27007
27064
27071
27059
27076
27057
37385
27005
37334
27085
27007
22043
27071
27064
27076
27057
22011
22053
27059
27062



EXPLANATION

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

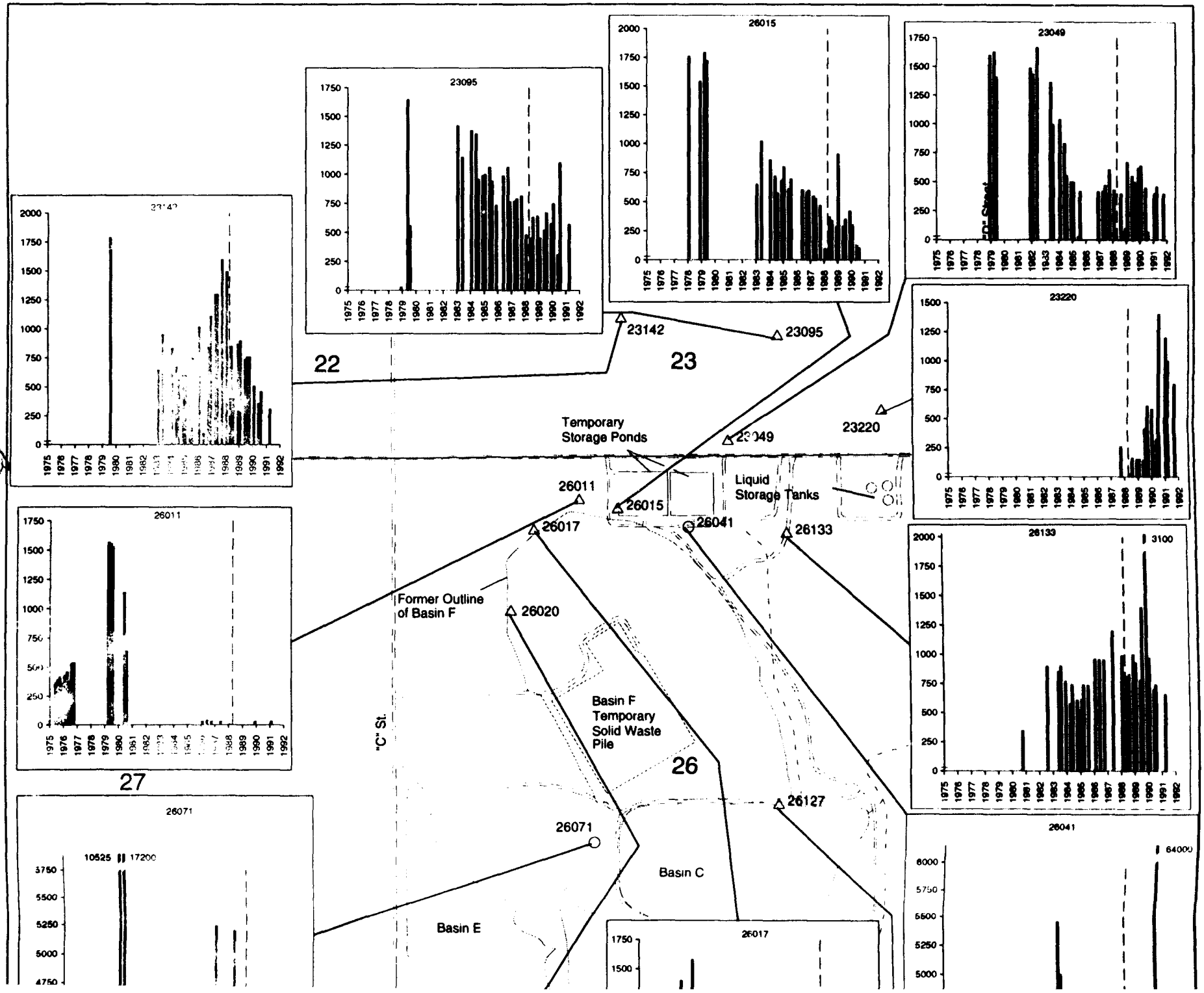
Harding Lawson Associates

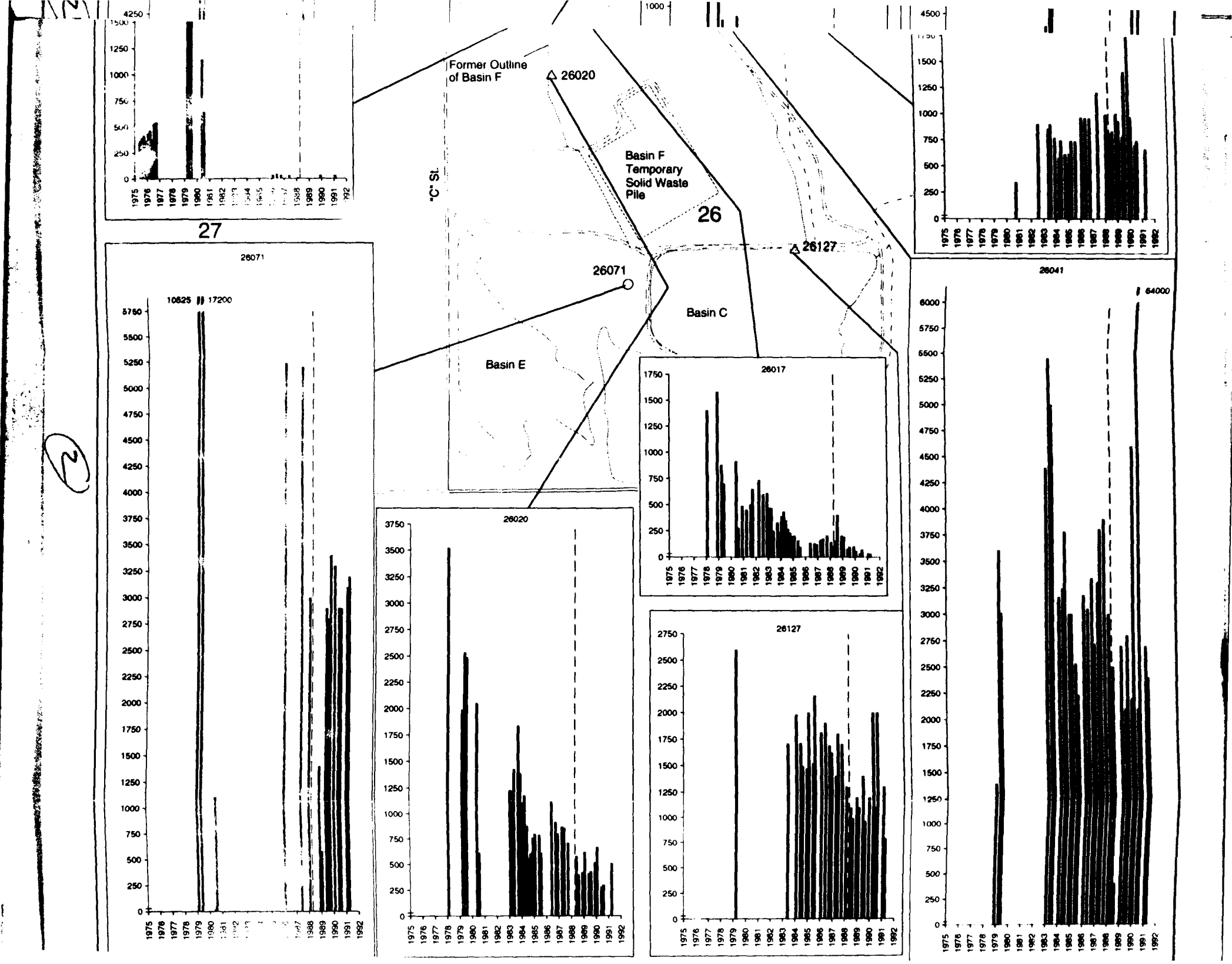
Figure 5.50

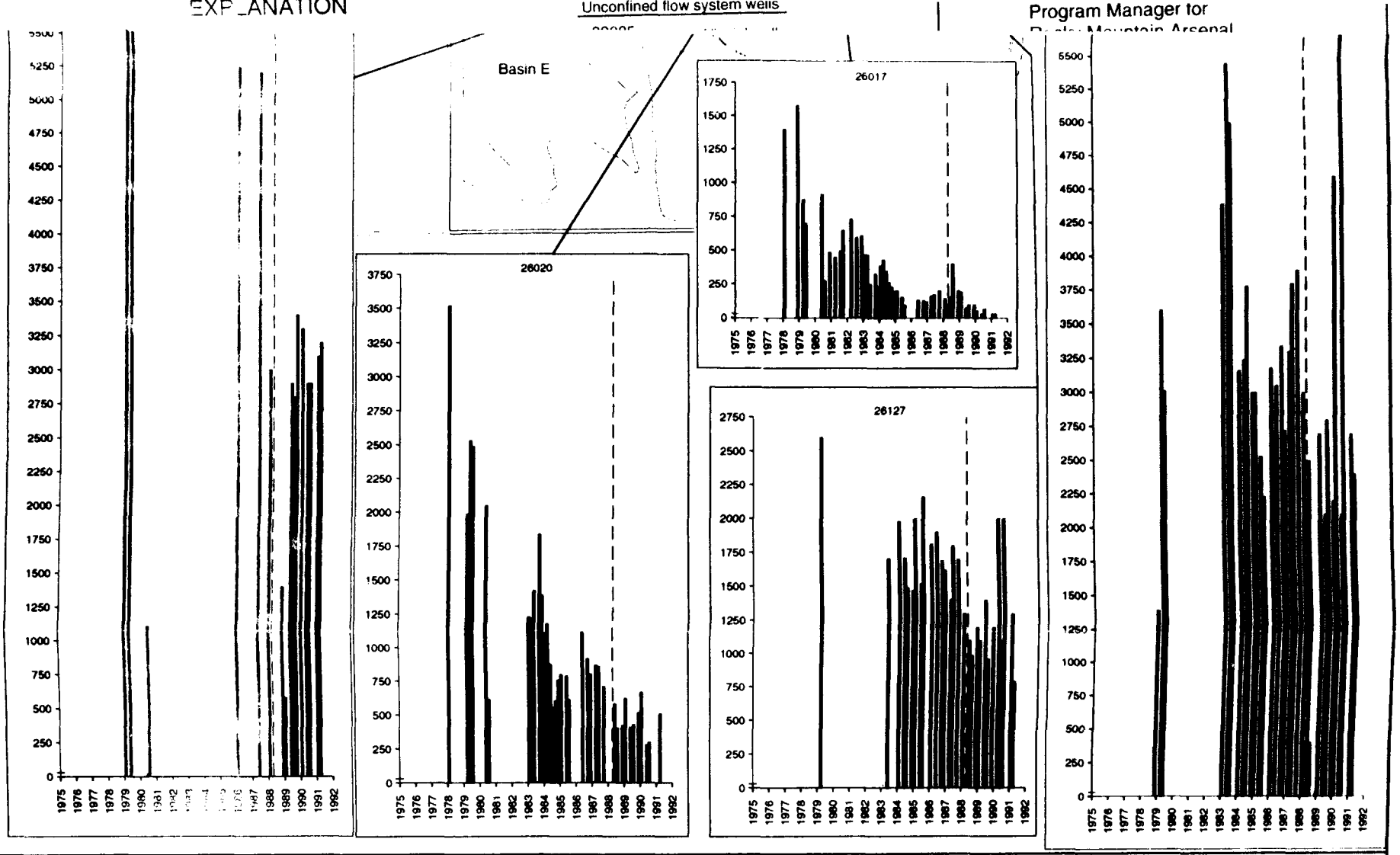
Fluoride Histograms for Wells near the Northwest Boundary Containment/ Treatment System

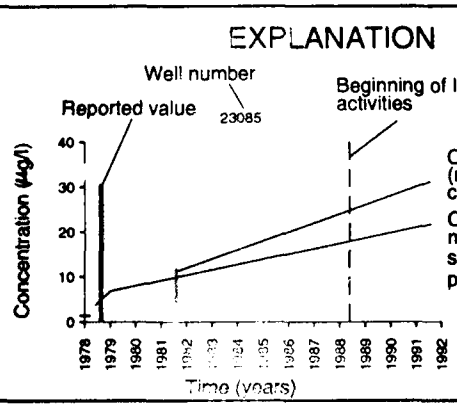
GWAR FY91

7/11/92 mwh/fluor DPG


23095
26015
23049
23142
22
23
Temporary
Storage Ponds
23049
23220
Liquid
Storage Tanks
26011
26015
26017
26041
26133
Former Outline
of Basin F
26020
"C" St.
Basin F
Temporary
Solid Waste
Pile
26
27
26127
26071
Basin C
Basin E
26017
26041
64000
10525
17200

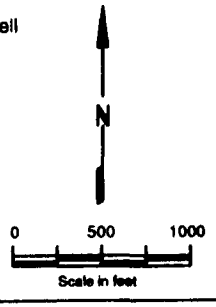

Former Outline of Basin F
26020
Basin F Temporary Solid Waste Pile
"C" St.
26
27
26127
26071
Basin C
Basin E
26071
10625
17200
26020
26017
26127
26041
64000





Unconfined flow system wells

23085	△	Alluvial well
24135	○	Denver well



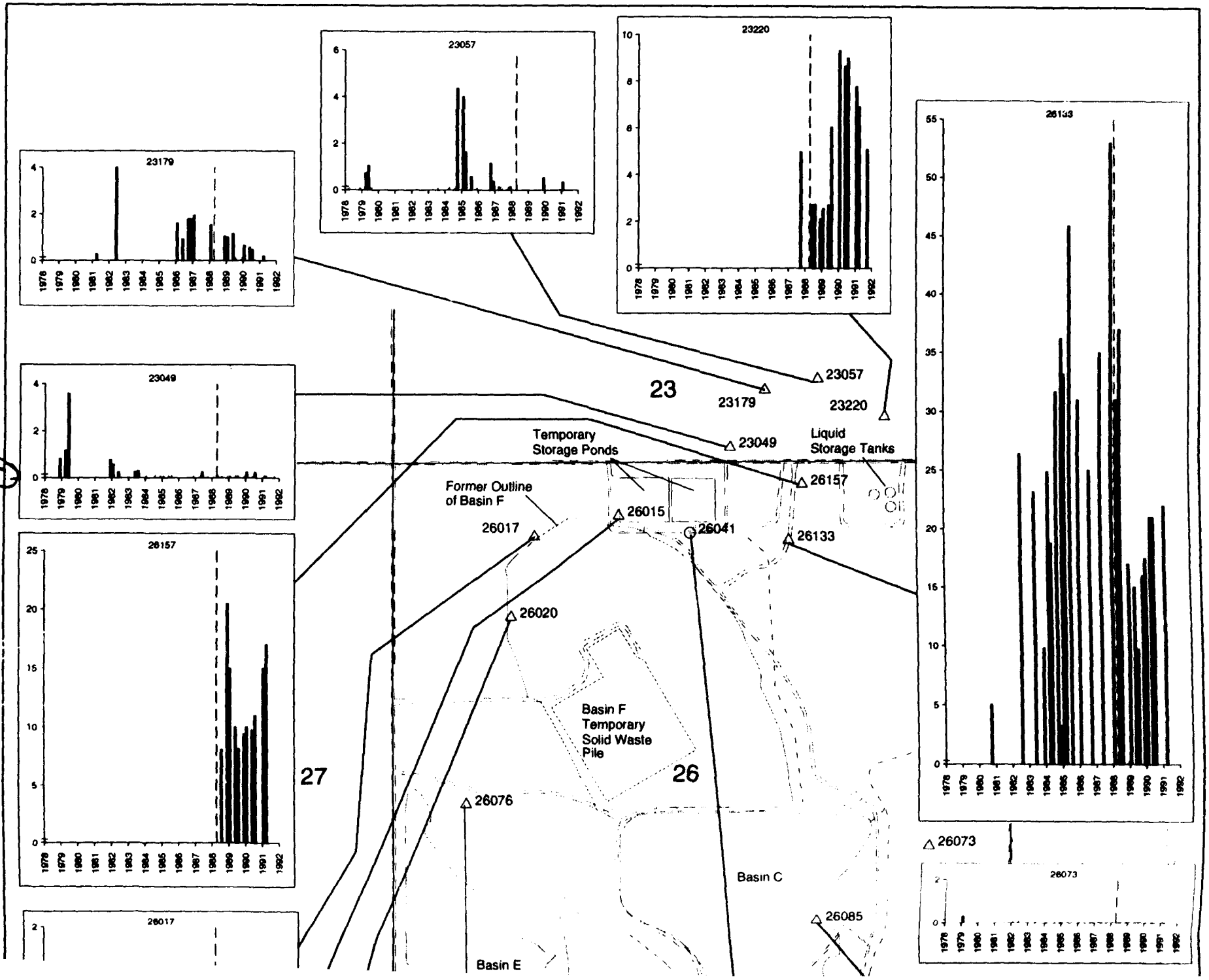
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

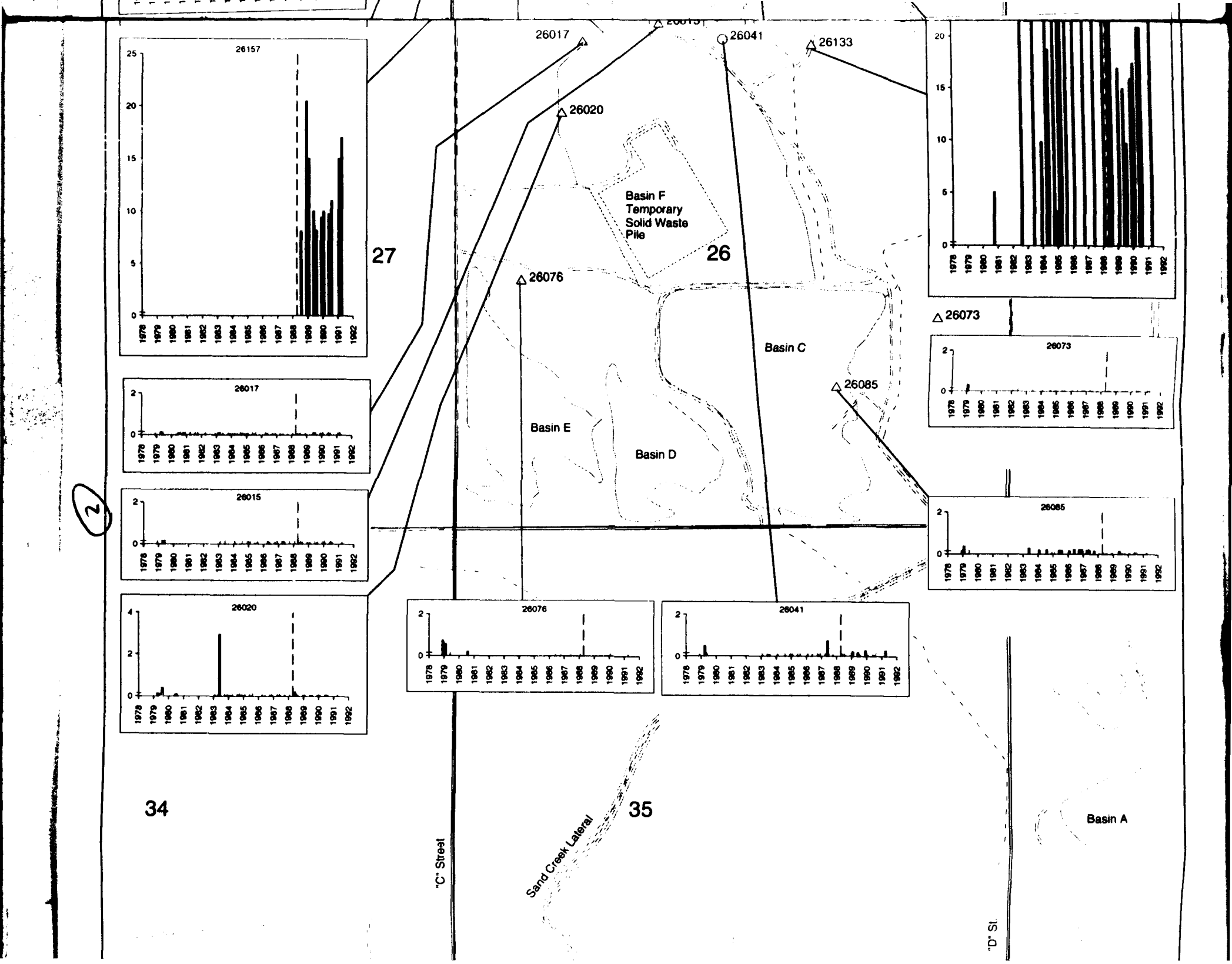
Figure 5.51

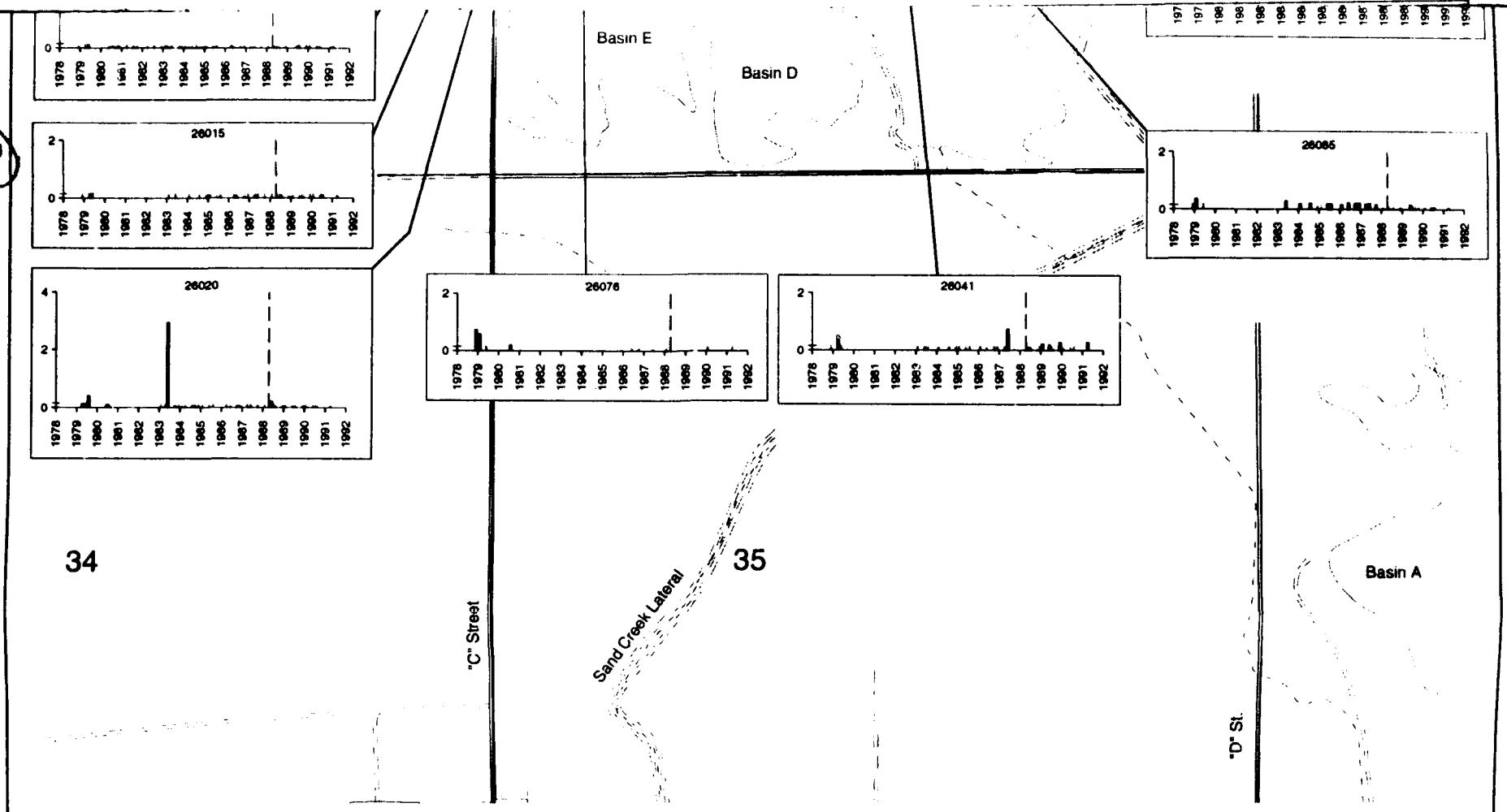
Diisopropylmethylphosphonate (DIMP)
Histograms for Wells near Basin F

GWAR FY91

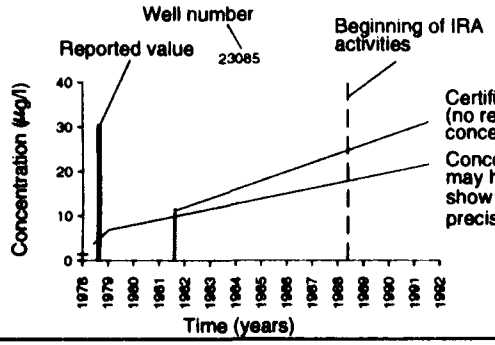
7/13/92 RMA/6/DIMP.DPG


23057
23179
23220
23049
26157
26133
26017
26073
23
27
26
Temporary
Storage Ponds
Liquid
Storage Tanks
Former Outline
of Basin F
26015
26041
26020
Basin F
Temporary
Solid Waste
Pile
26076
Basin C
26085
Basin E


26017
26041
26133
26020
Basin F
Temporary
Solid Waste
Pile
26
27
26076
Basin C
26073
26085
Basin E
Basin D
26157
26017
26015
26020
26076
26041
26085
26073
34
35
"C" Street
Sand Creek Lateral
"D" St
Basin A



EXPLANATION



Certified Reporting Limit (CRL) (no reported chemical concentration)

Concentration values below this level may have been enhanced to show detail - see Appendix B for precise values

Unconfined flow system wells

23085	△	Alluvial well
24135	○	Denver well

N

0 500 1000

Scale in feet

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

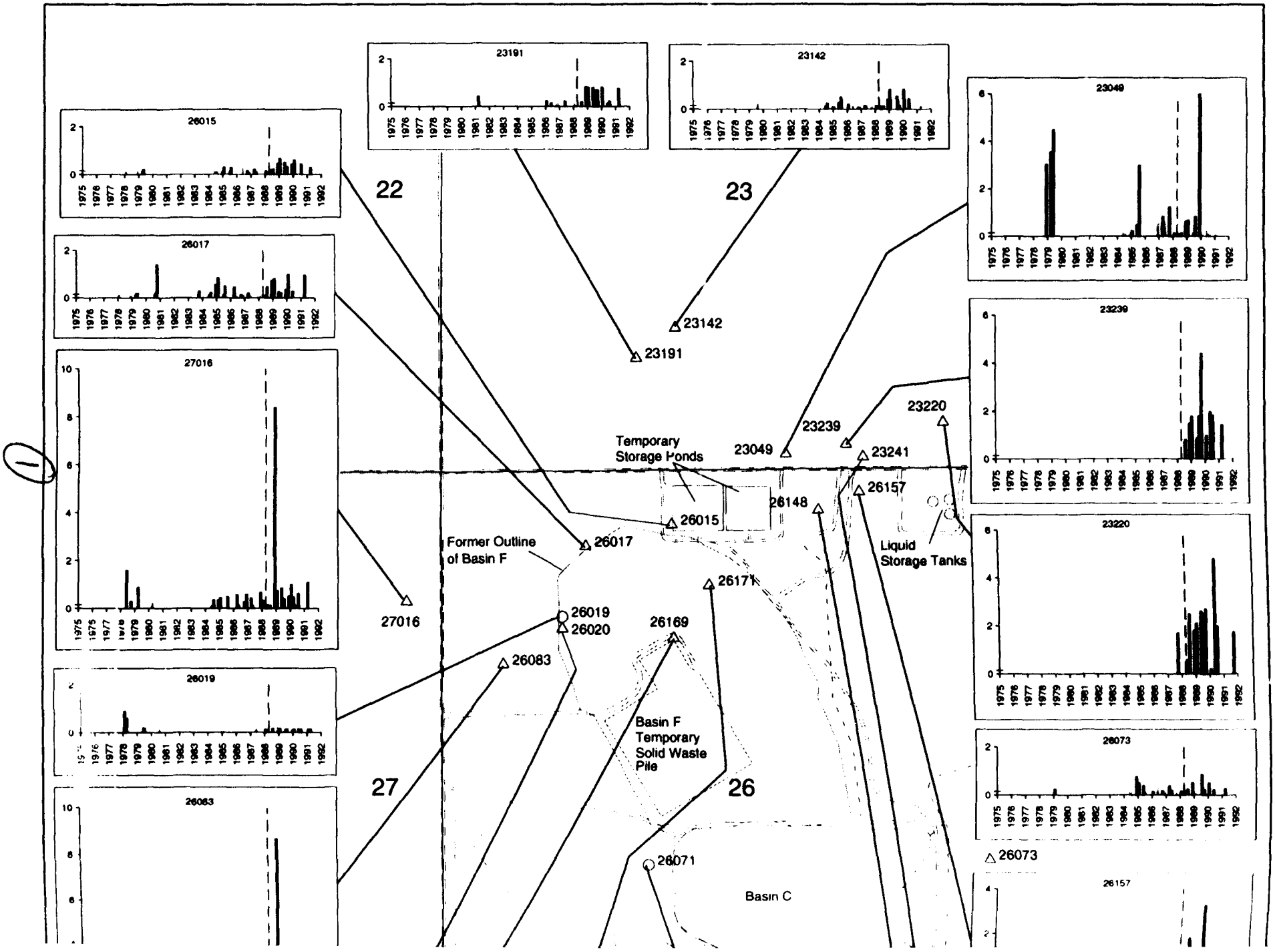
Prepared by:
Harding Lawson Associates

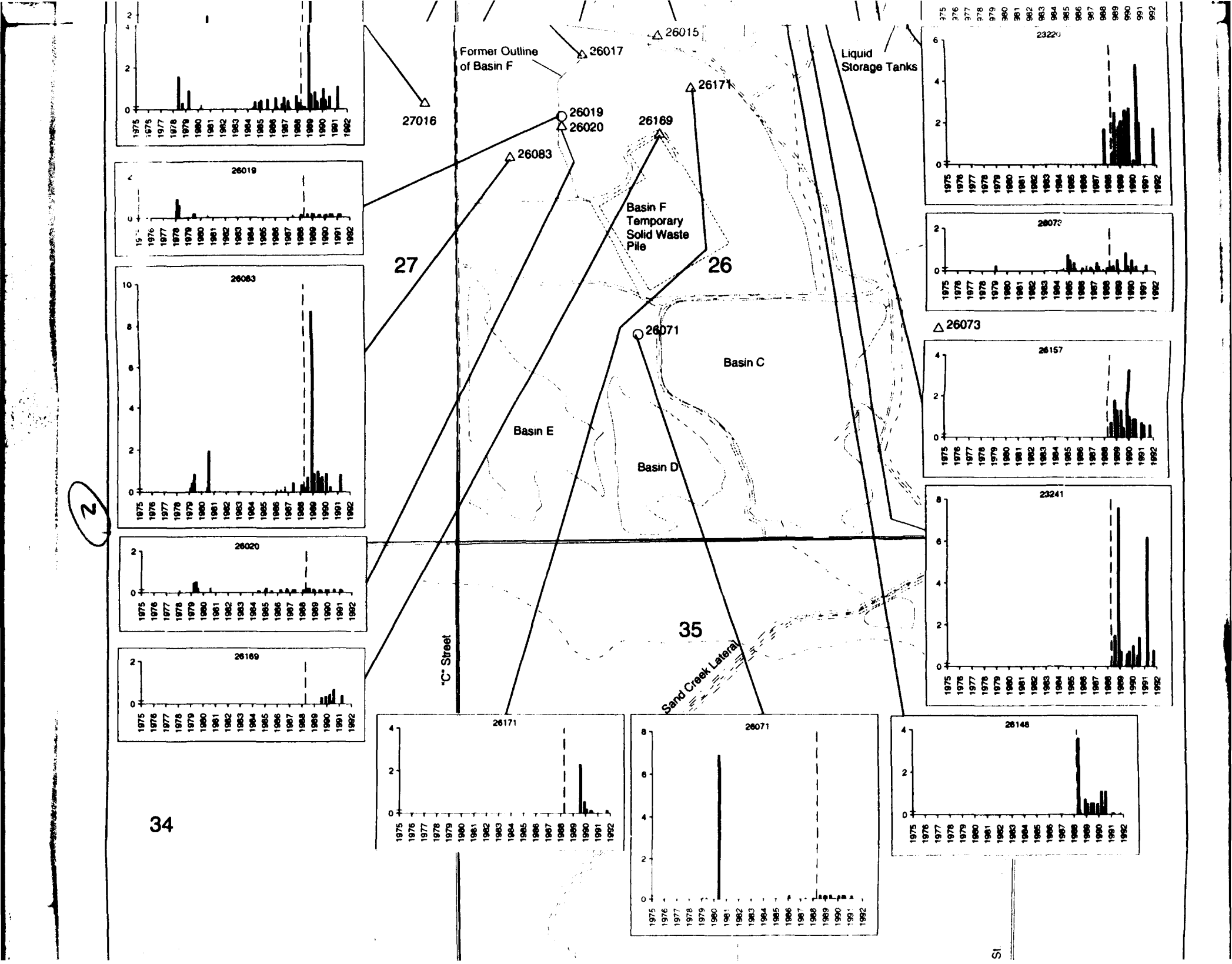
Figure 5.52

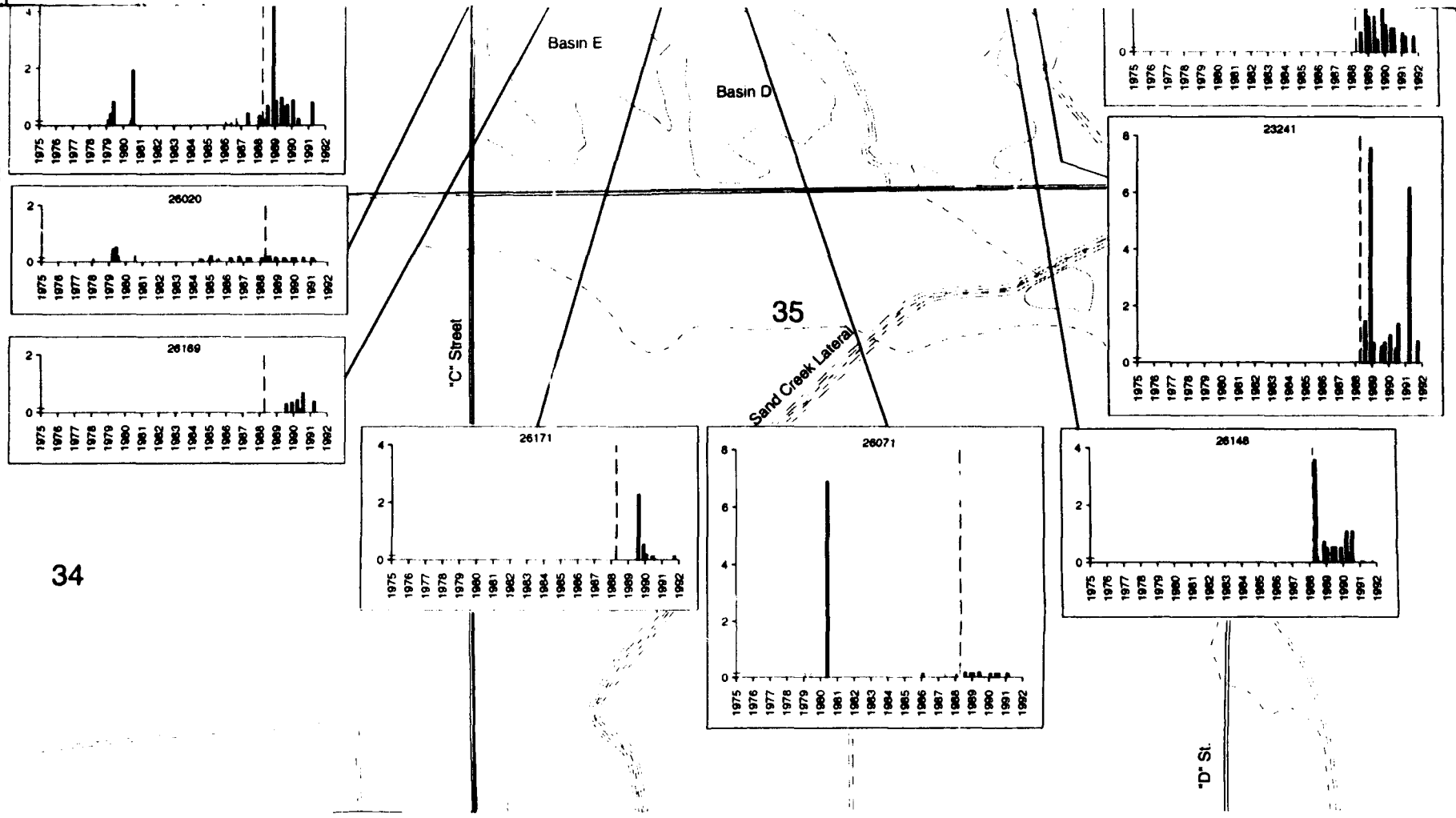
Dibromochloropropane (DBCP) Histograms for Wells near Basin F

GWAR FY91

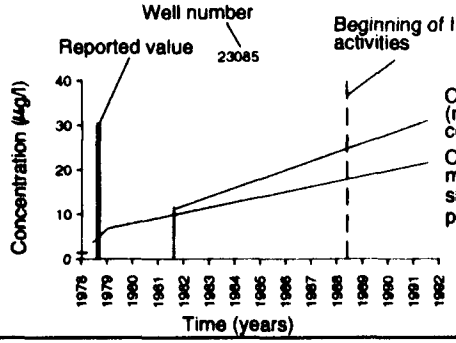
7/12/92 RMA/BFDBCP DPG


23191
23142
26015
26017
27016
26019
26083
23049
23239
23220
26073
26157
22
23
27
26
Temporary Storage Ponds
Former Outline of Basin F
Basin F Temporary Solid Waste Pile
Basin C
Liquid Storage Tanks
23142
23191
23049
23241
23239
23220
26148
26157
26015
26017
26171
27016
26019
26020
26169
26083
26071
26073


Former Outline of Basin F
26015
26017
26171
Liquid Storage Tanks
27016
26019
26020
26169
26083
Basin F Temporary Solid Waste Pile
27
26
26071
Basin C
Basin E
Basin D
26073
35
"C" Street
Sand Creek Lateral
34
26019
26083
26020
26169
26171
26071
26148
26157
23241
23220
26073



EXPLANATION



Certified Reporting Limit (CRL) (no reported chemical concentration)

Concentration values below this level may have been enhanced to show detail - see Appendix B for precise values

Unconfined flow system wells

23085 △ Alluvial well

24135 ○ Denver well

N

0 500 1000

Scale in feet

Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

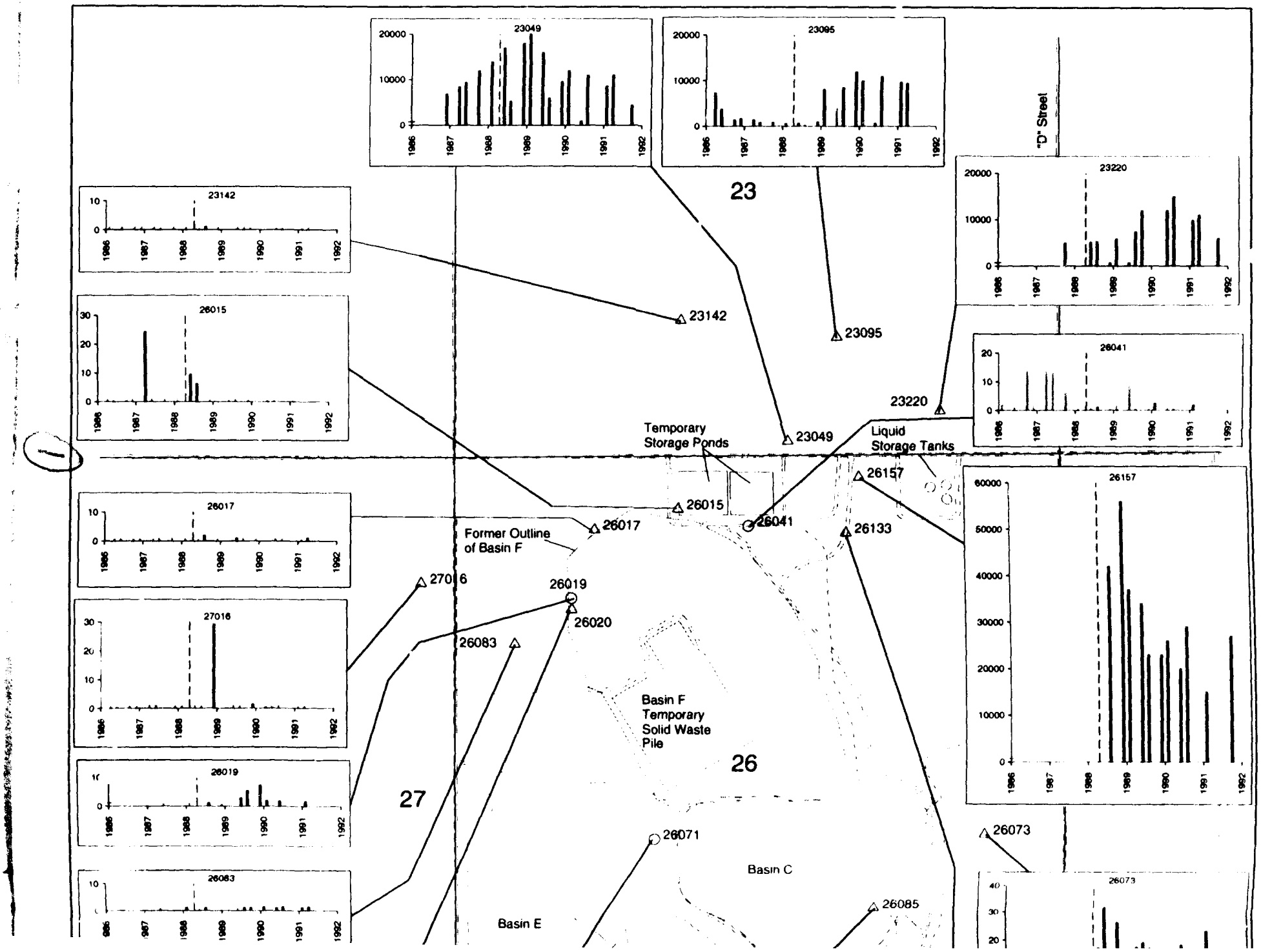
Prepared by:
Harding Lawson Associates

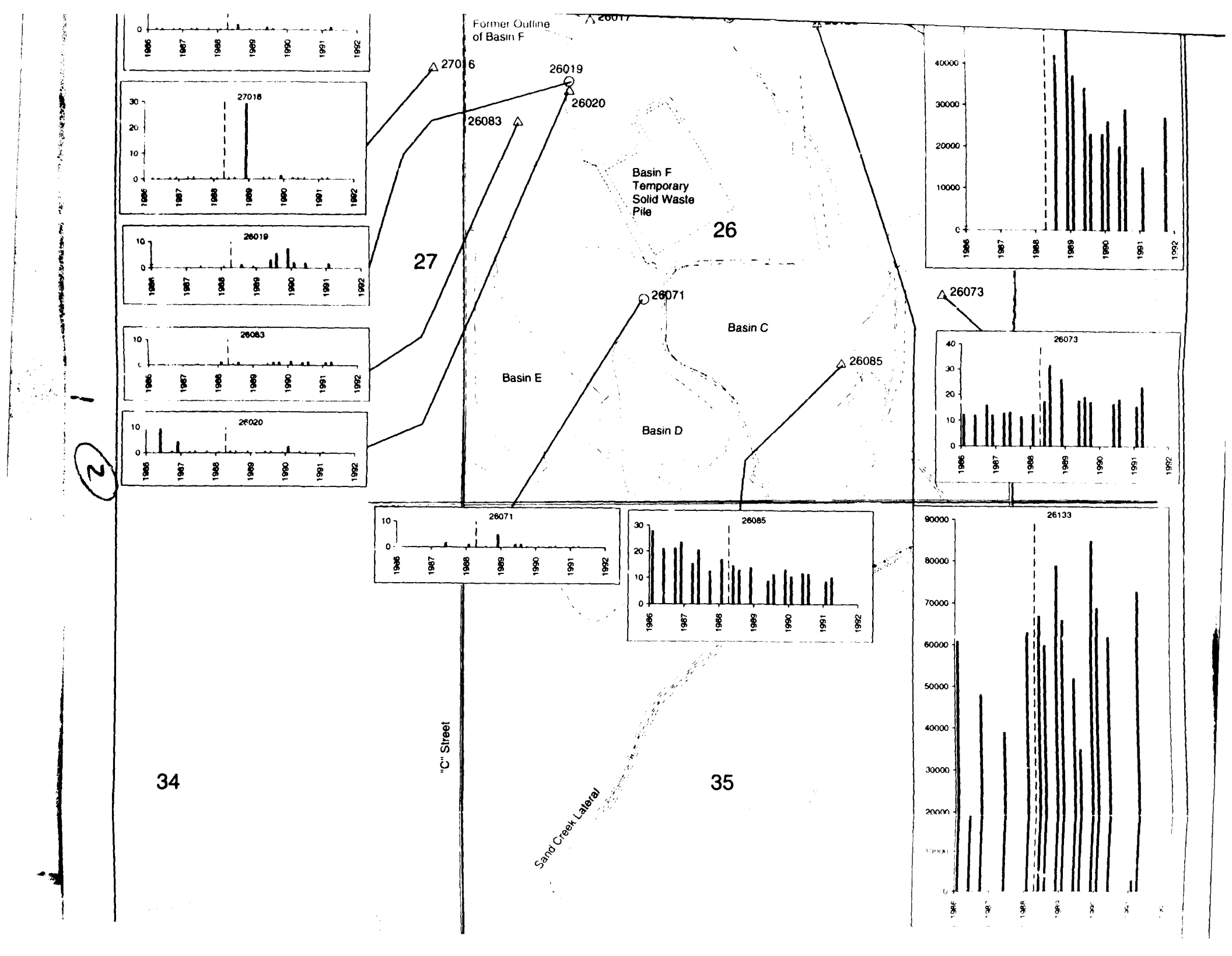
Figure 5.53

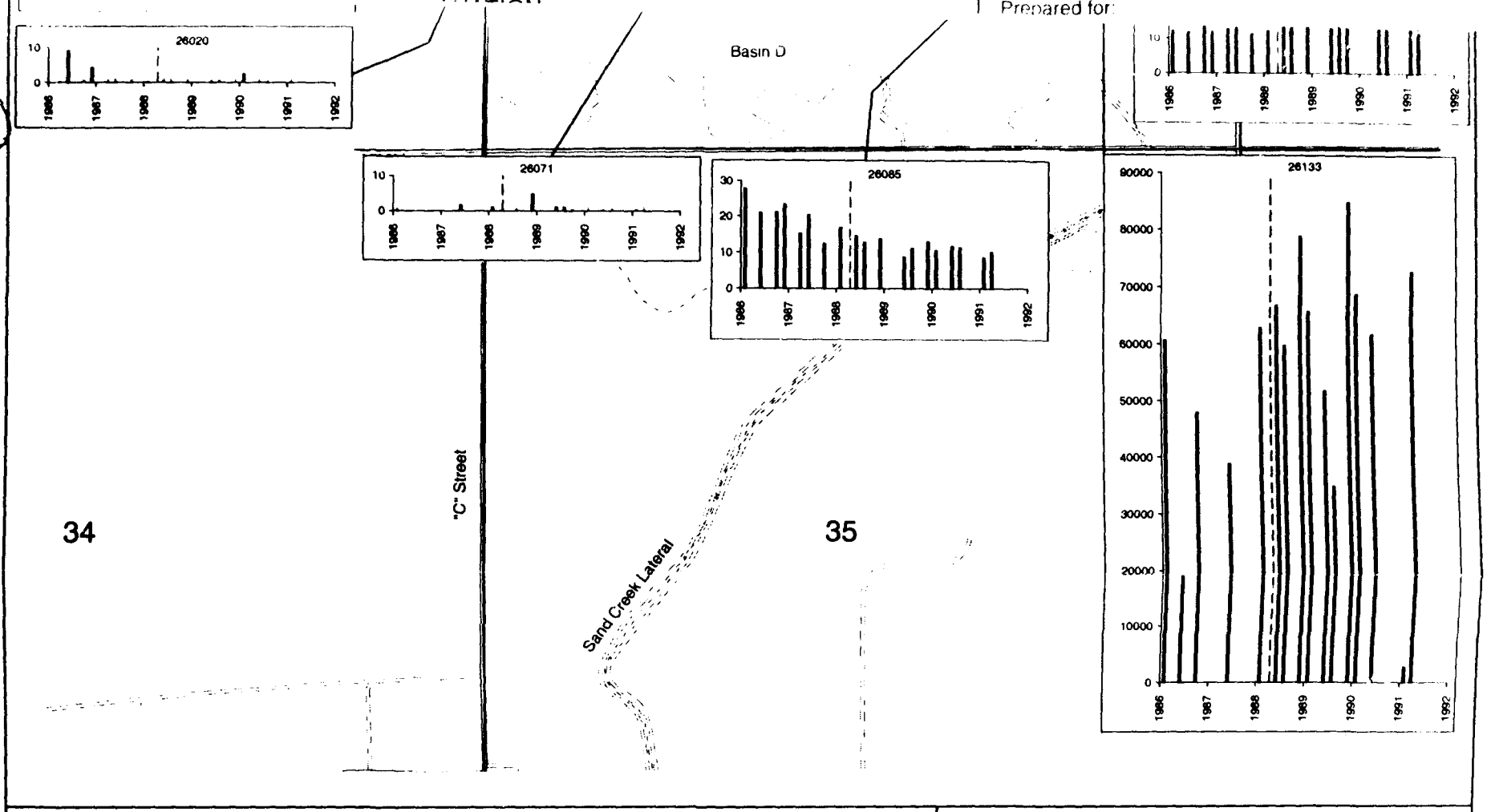
Dieldrin Histograms for Wells near Basin F

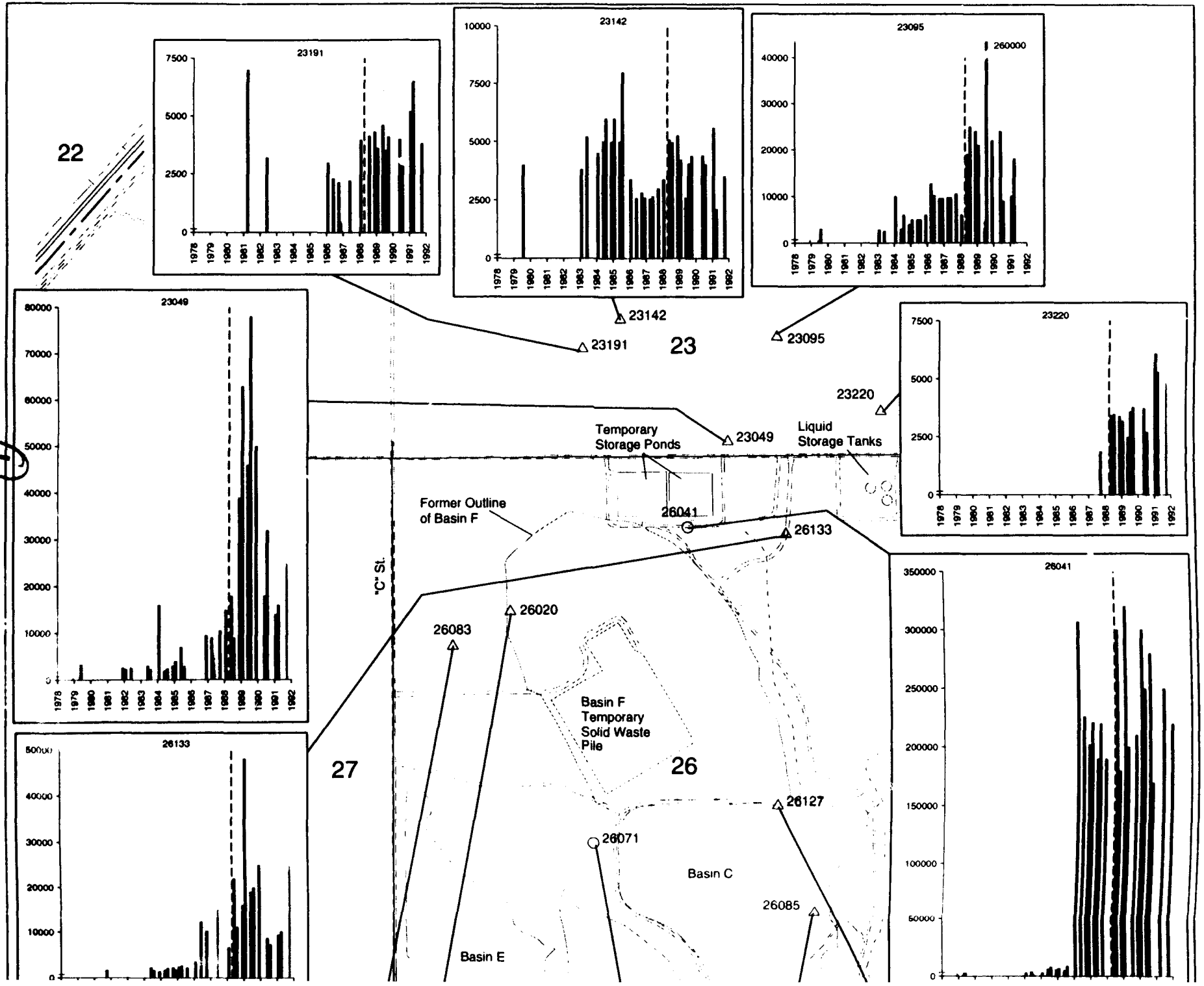
GWAR FY91

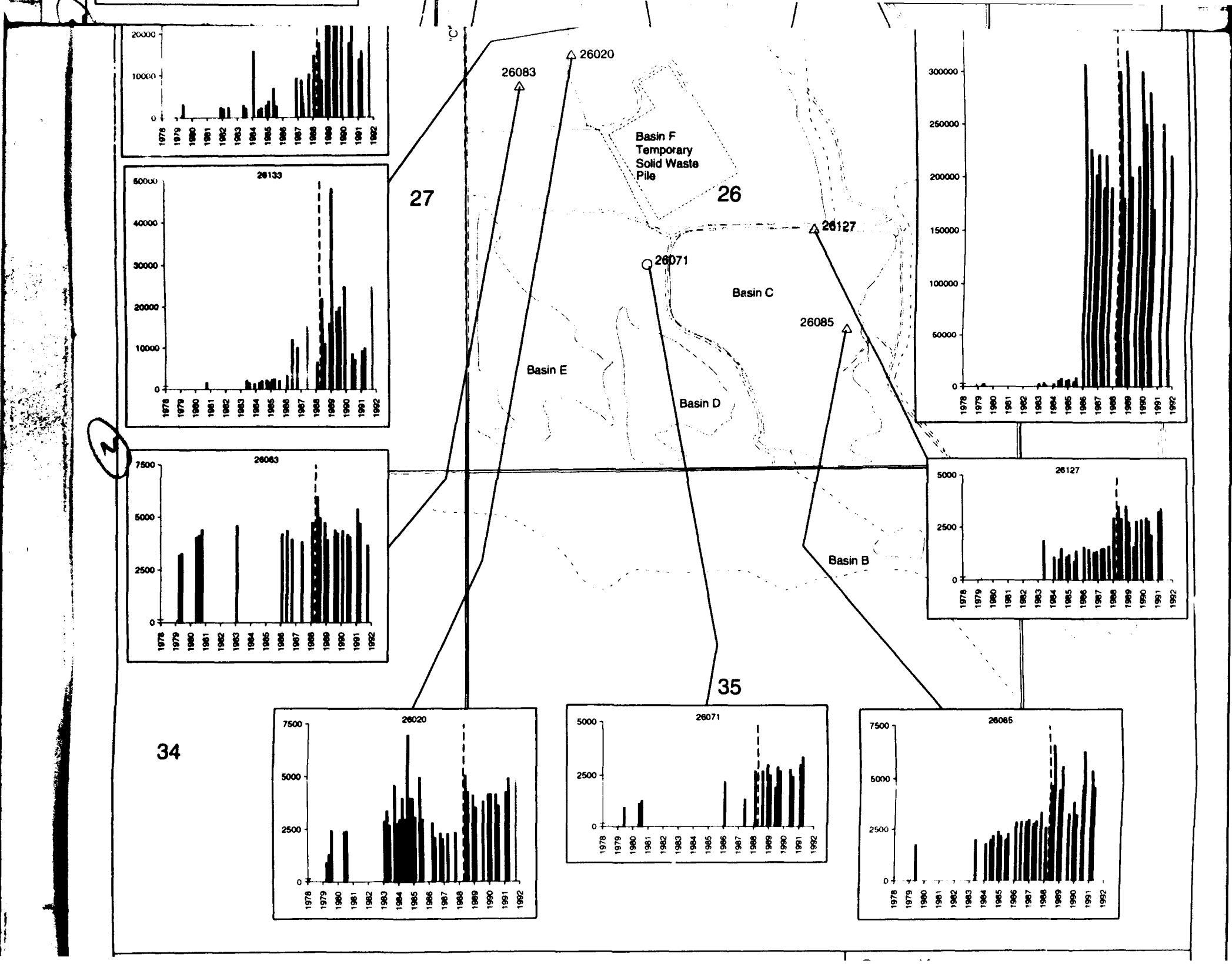
7/13/92 RMA/dldr DPG

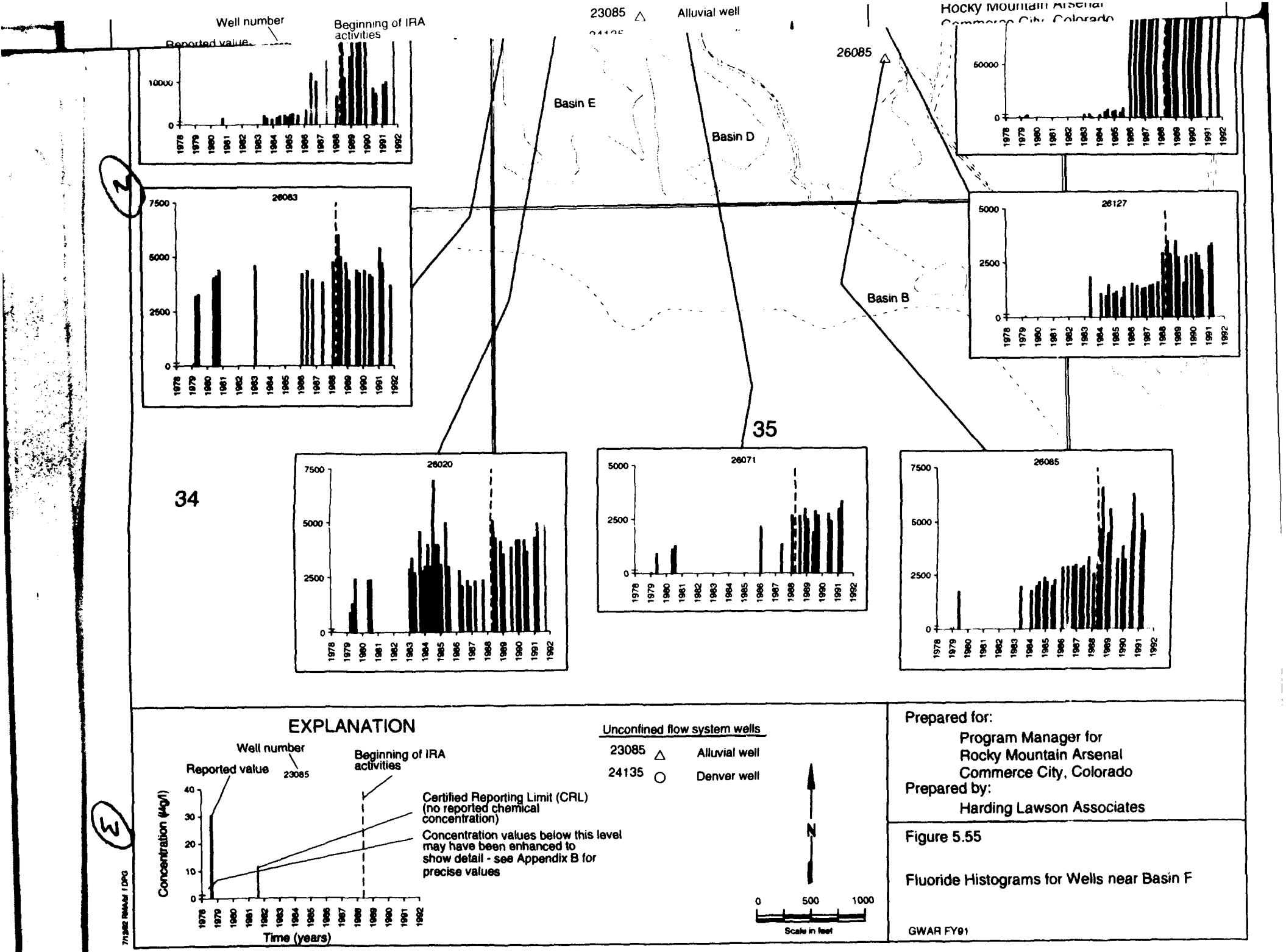

23049
23095
23142
26015
23220
26041
26017
27016
26019
26083
26157
26073
23
"D" Street
23142
23095
23220
23049
Temporary
Storage Ponds
Liquid
Storage Tanks
26157
26015
26041
26133
26017
Former Outline
of Basin F
27016
26019
26020
26083
Basin F
Temporary
Solid Waste
Pile
26
27
26071
26073
Basin C
26085
Basin E

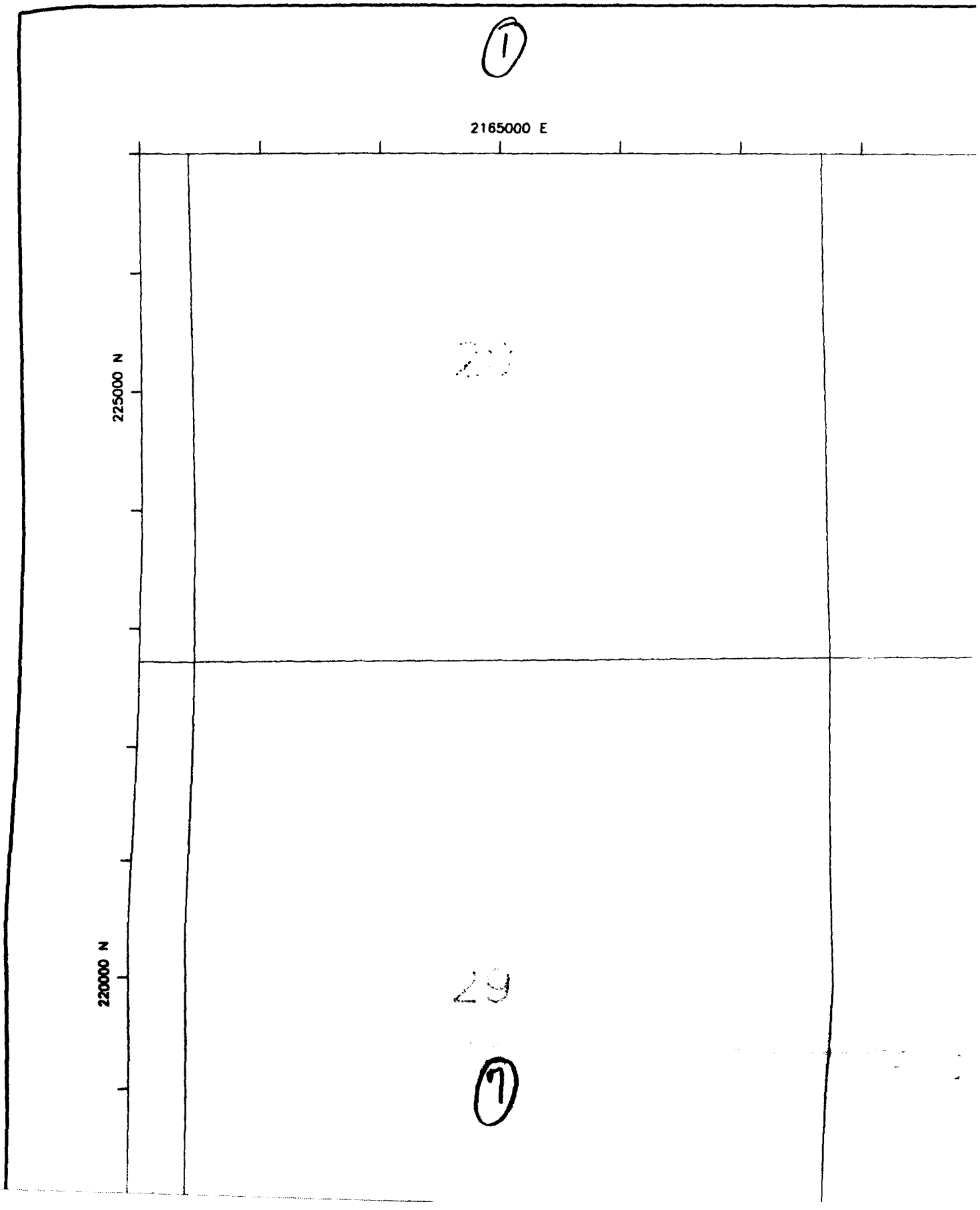

Former Outline of Basin F
27016
26019
26020
26083
26017
Basin F Temporary Solid Waste Pile
26
27
26071
Basin C
Basin E
Basin D
26085
26073
34
35
"C" Street
Sand Creek Lateral
1986
1987
1988
1989
1990
1991
1992

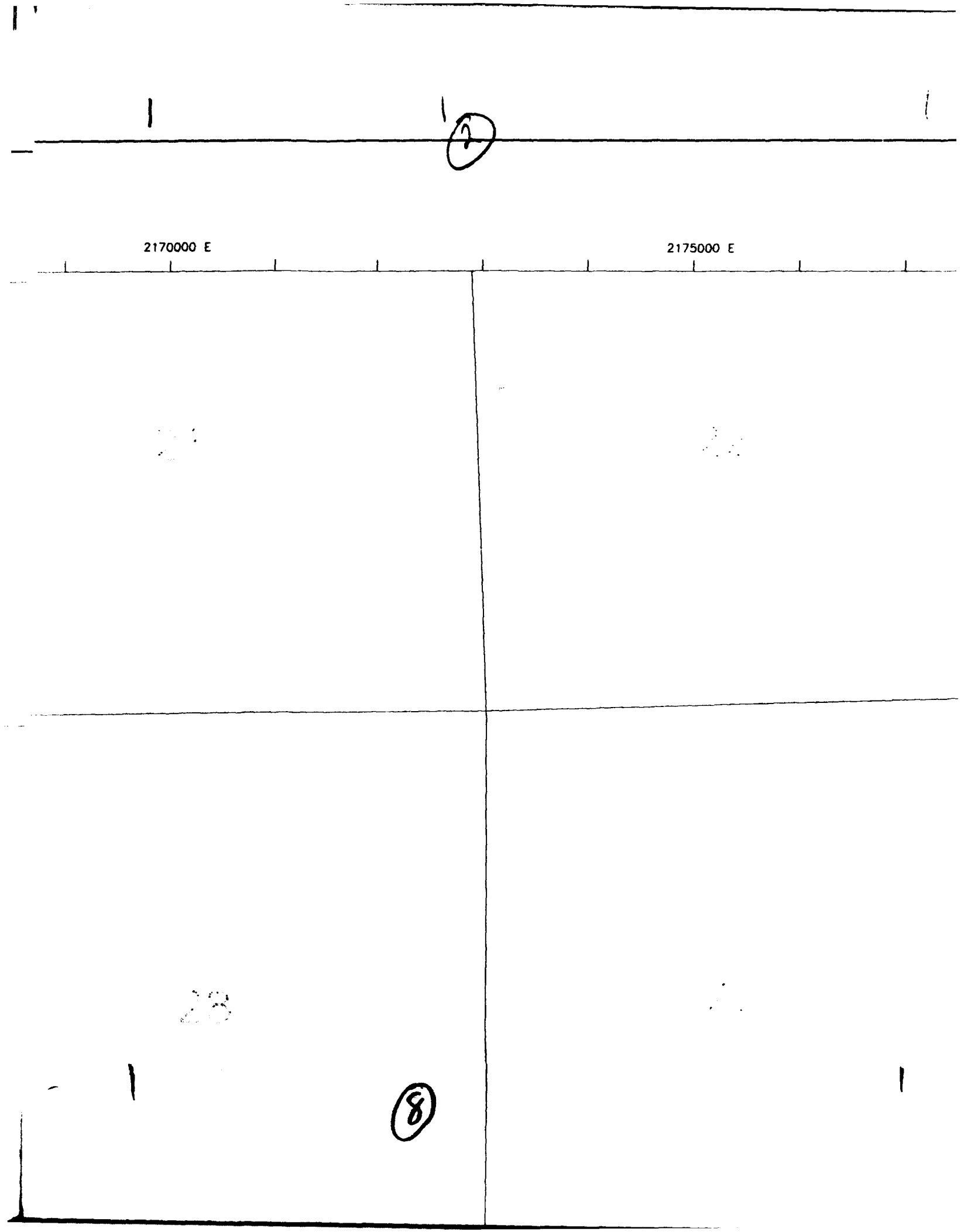

Prepared for:
Basin D
26020
26071
26085
26133
"C" Street
Sand Creek Lateral
34
35
EXPLANATION
Well number
Reported value
23085
Startup of initial
10 recharge trenches
Concentration (µg/l)
Certified Reporting Limit (CRL)
(no reported chemical
concentration)
Concentration values below this level
may have been enhanced to show
detail - see Appendix B for
precise values
Startup of additional
5 recharge trenches
Time (years)
Unconfined flow system wells
23085 △ Alluvial well
24135 ○ Denver well
N
0 500 1000
Scale in feet
Prepared for:
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates
Figure 5.54
Chloroform Histograms for Wells near Basin F
GWAR FY91

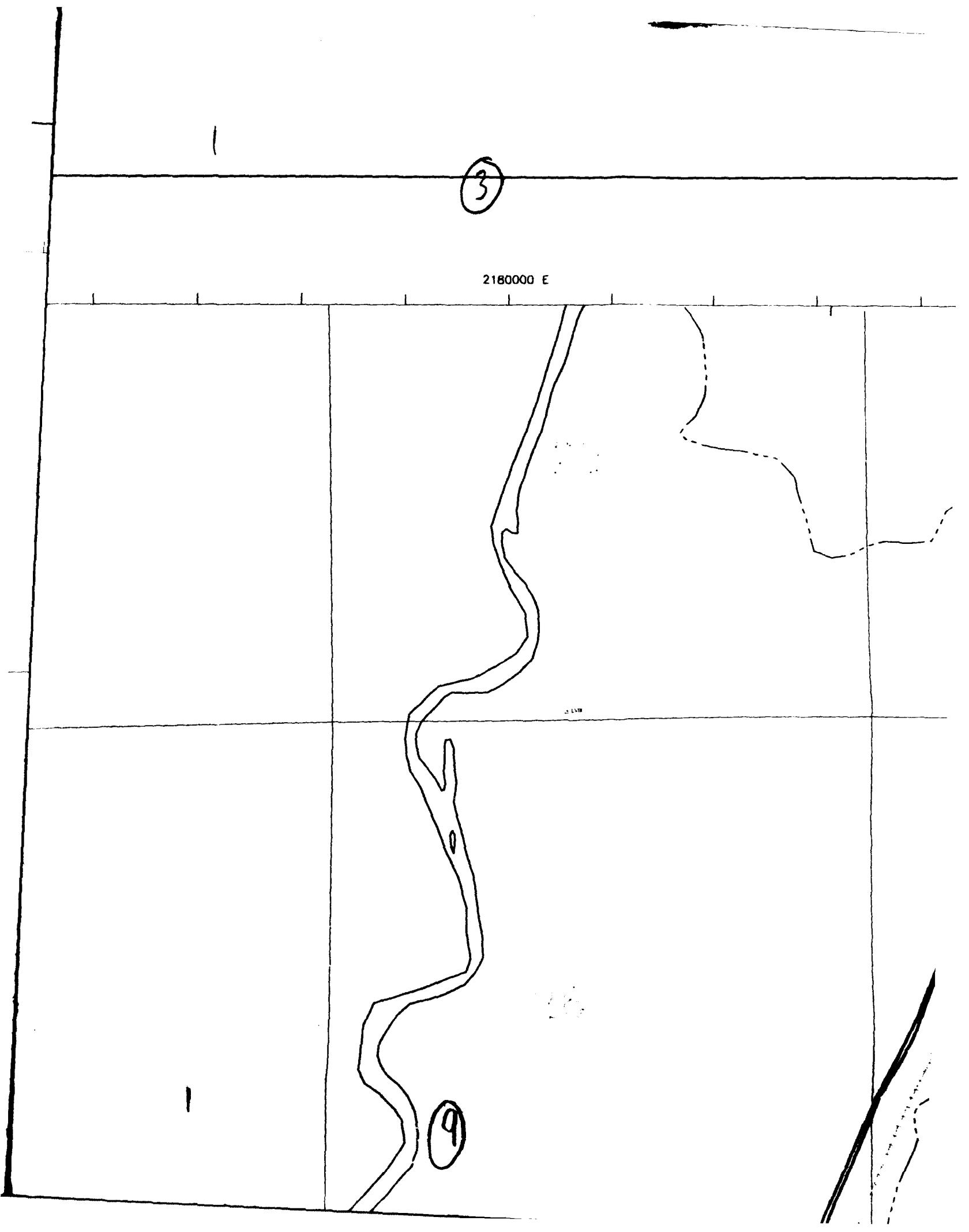

22
23191
23142
23095
23
23049
23220
Temporary
Storage Ponds
Liquid
Storage Tanks
Former Outline
of Basin F
26041
26133
"C" St.
26020
26083
Basin F
Temporary
Solid Waste
Pile
26
27
26127
26071
Basin C
26085
Basin E

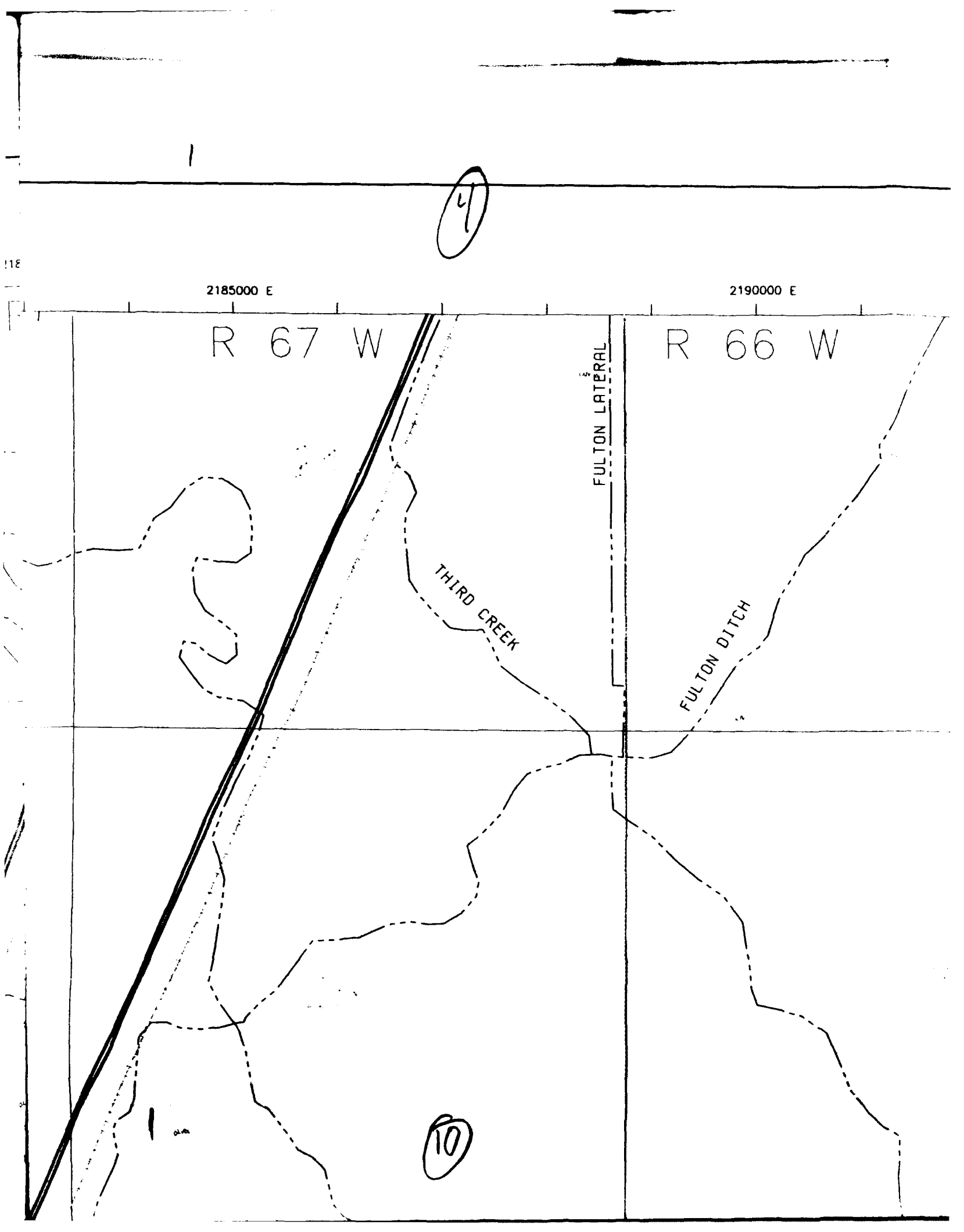

26020
26083
Basin F
Temporary
Solid Waste
Pile
26
27
26127
26071
Basin C
26085
Basin E
Basin D
Basin B
35
34
26133
26083
26020
26071
26085
26127

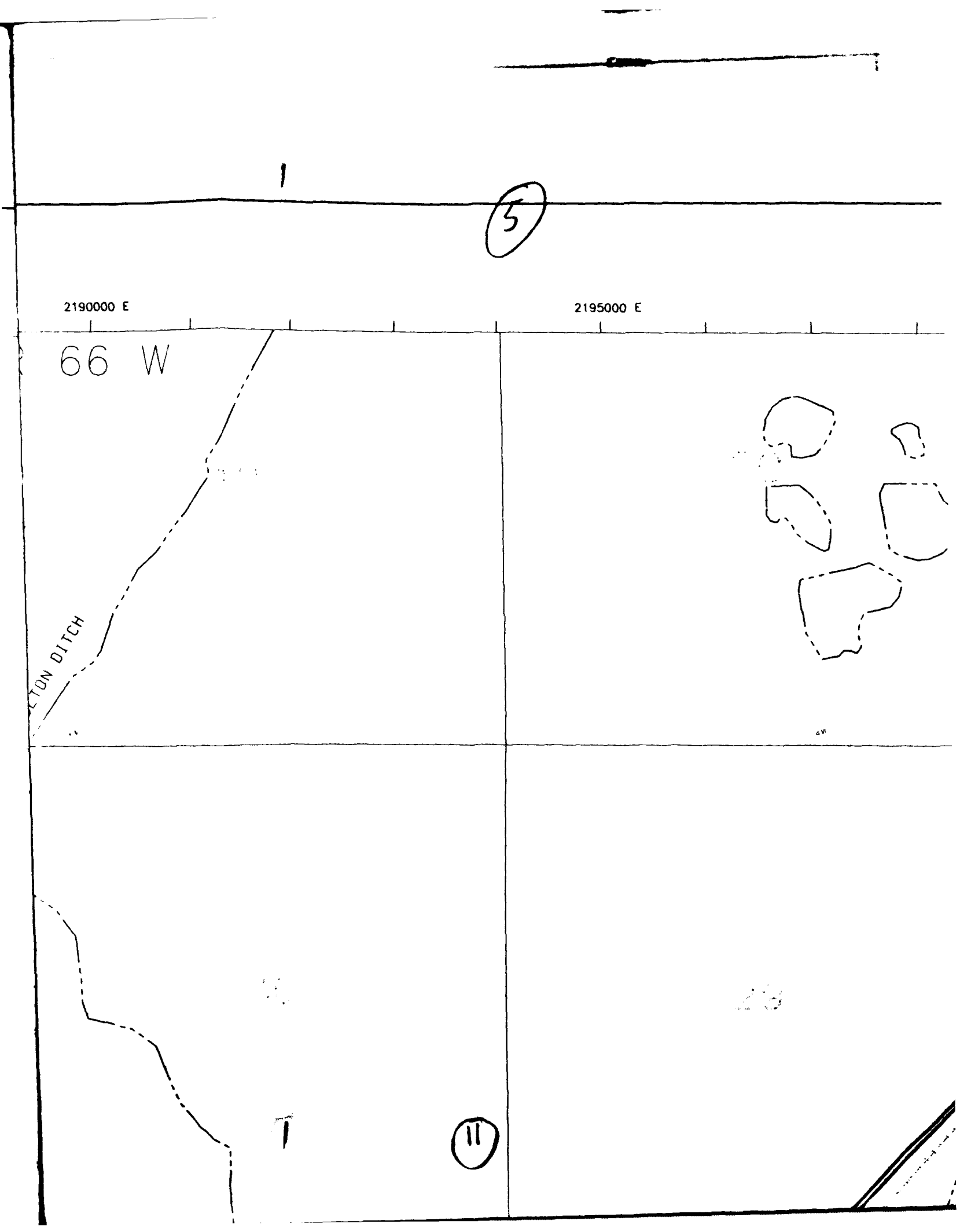

Well number
Reported value
Beginning of IRA activities
23085 △ Alluvial well
26085
Basin E
Basin D
Basin B
26063
26127
26020
26071
26085
34
35
EXPLANATION
Well number
Reported value
23085
Beginning of IRA activities
Concentration (mg/l)
Time (years)
Certified Reporting Limit (CRL) (no reported chemical concentration)
Concentration values below this level may have been enhanced to show detail - see Appendix B for precise values
Unconfined flow system wells
23085 △ Alluvial well
24135 ○ Denver well
N
0 500 1000
Scale in feet
Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates
Figure 5.55
Fluoride Histograms for Wells near Basin F
GWAR FY91

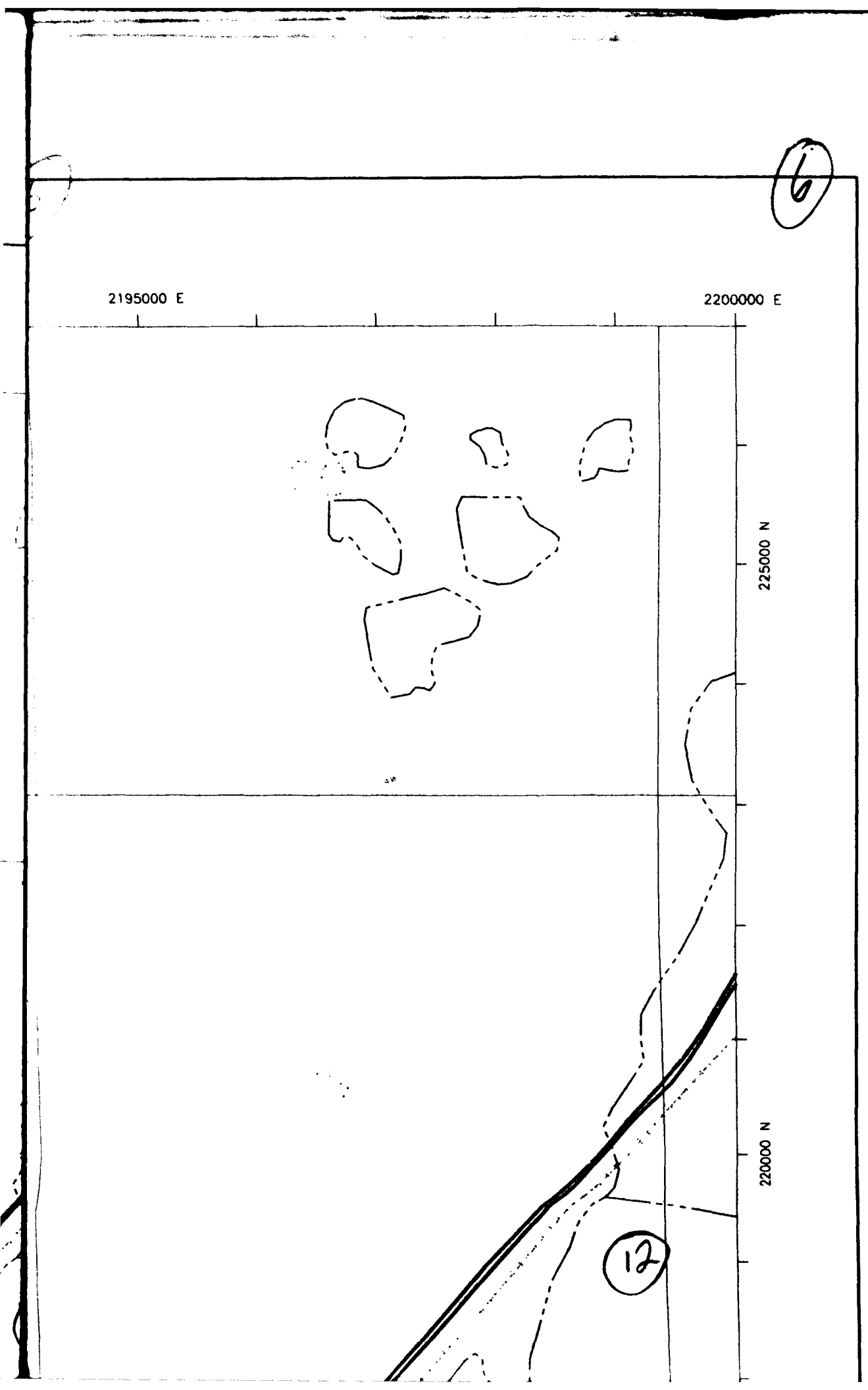

2165000 E
225000 N
220000 N


2170000 E
2175000 E

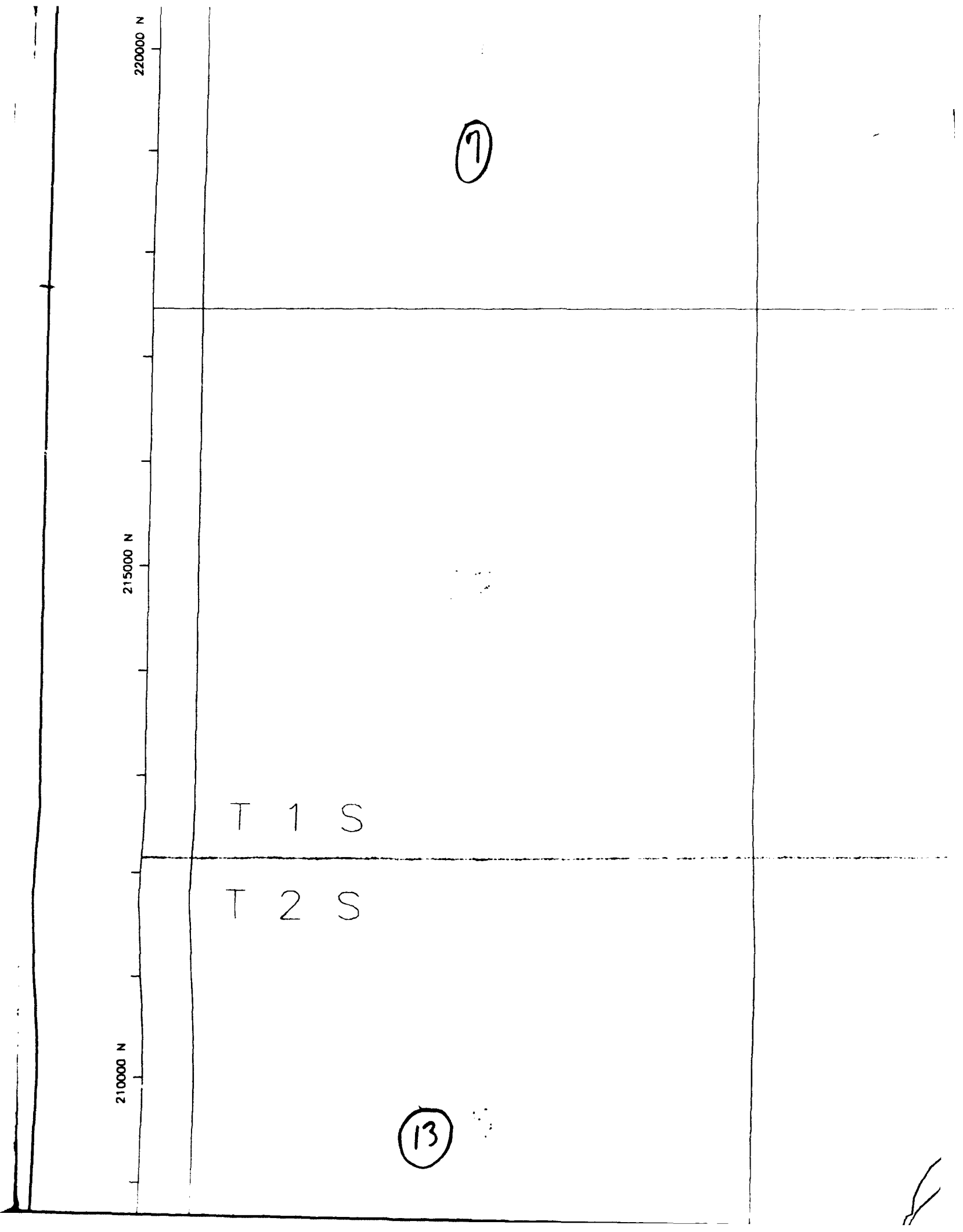

2160000 E

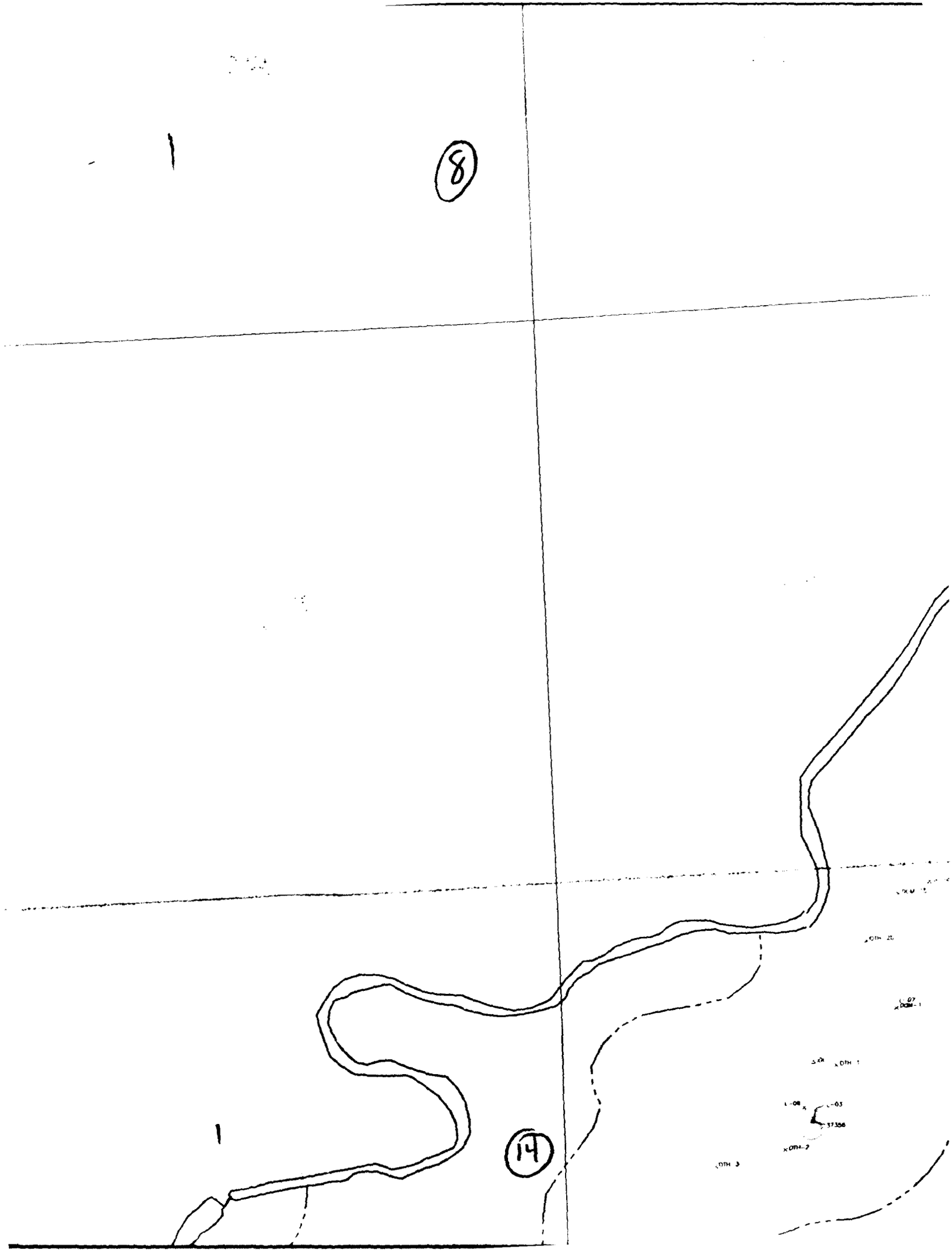

2185000 E
2190000 E
R 67 W
R 66 W
FULTON LATERAL
THIRD CREEK
FULTON DITCH
10

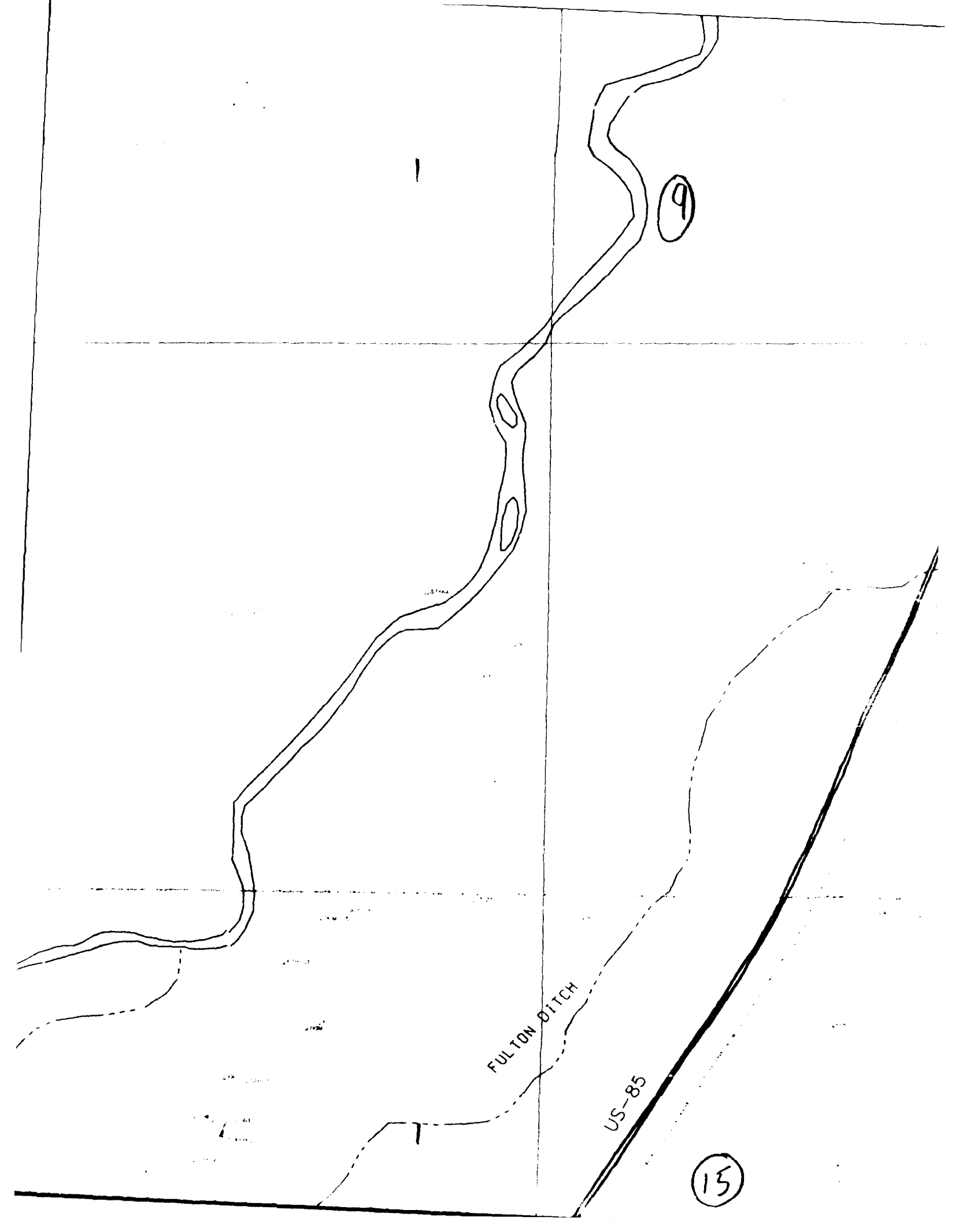

1
5
2190000 E
2195000 E
66 W
TON DITCH
T
11

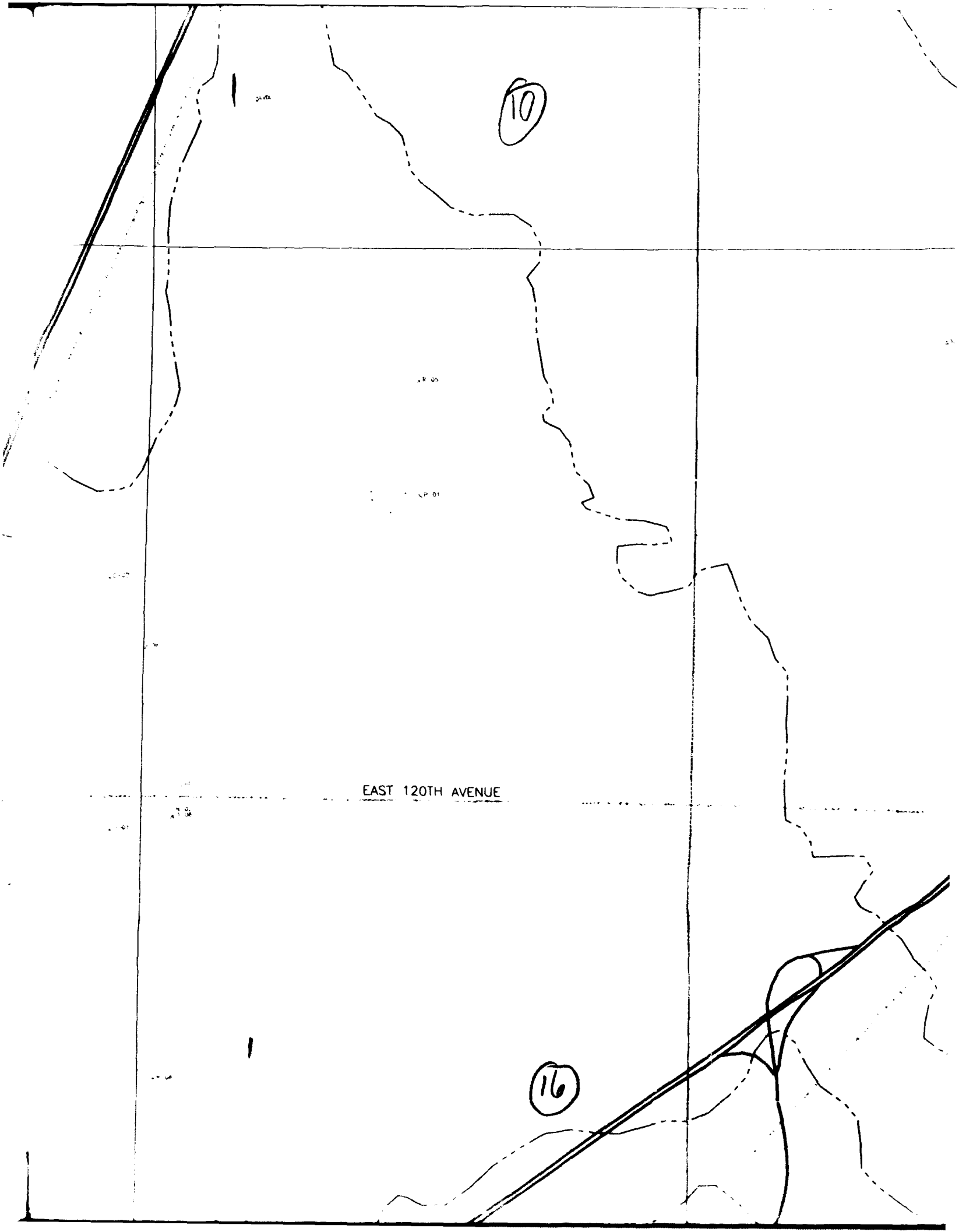

6
2195000 E
2200000 E
225000 N
220000 N
12

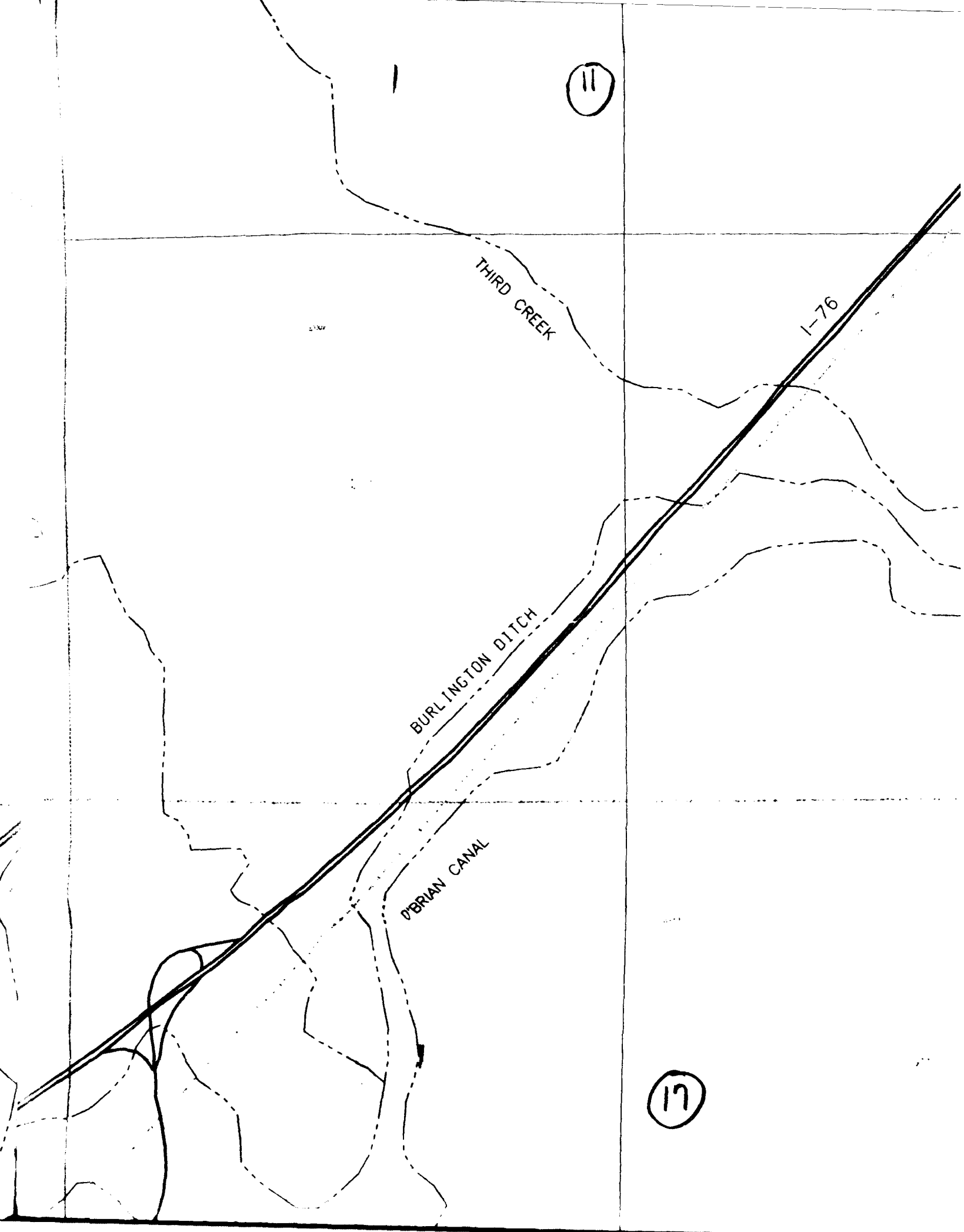
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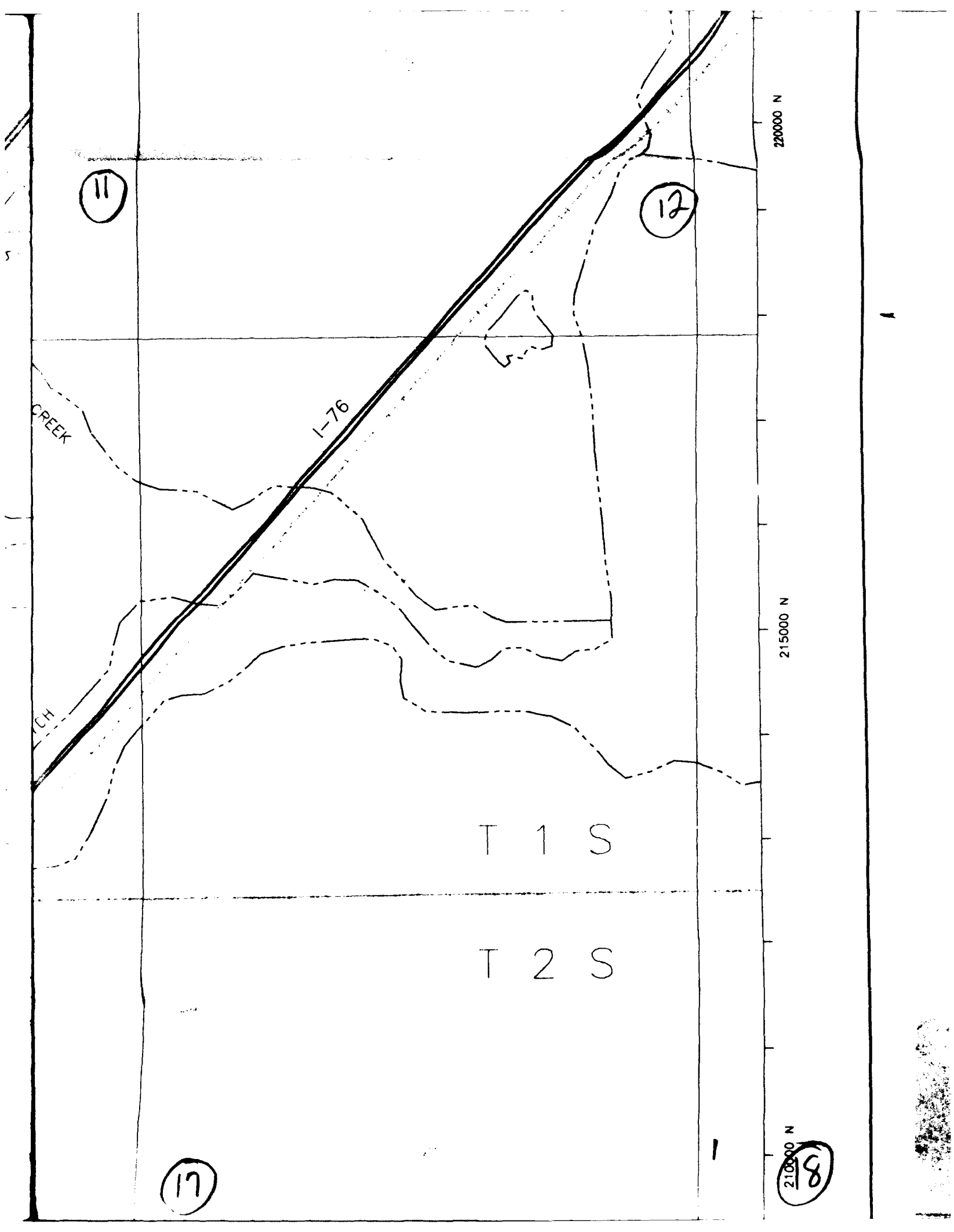

220000 N
215000 N
210000 N
T 1 S
T 2 S
7
13

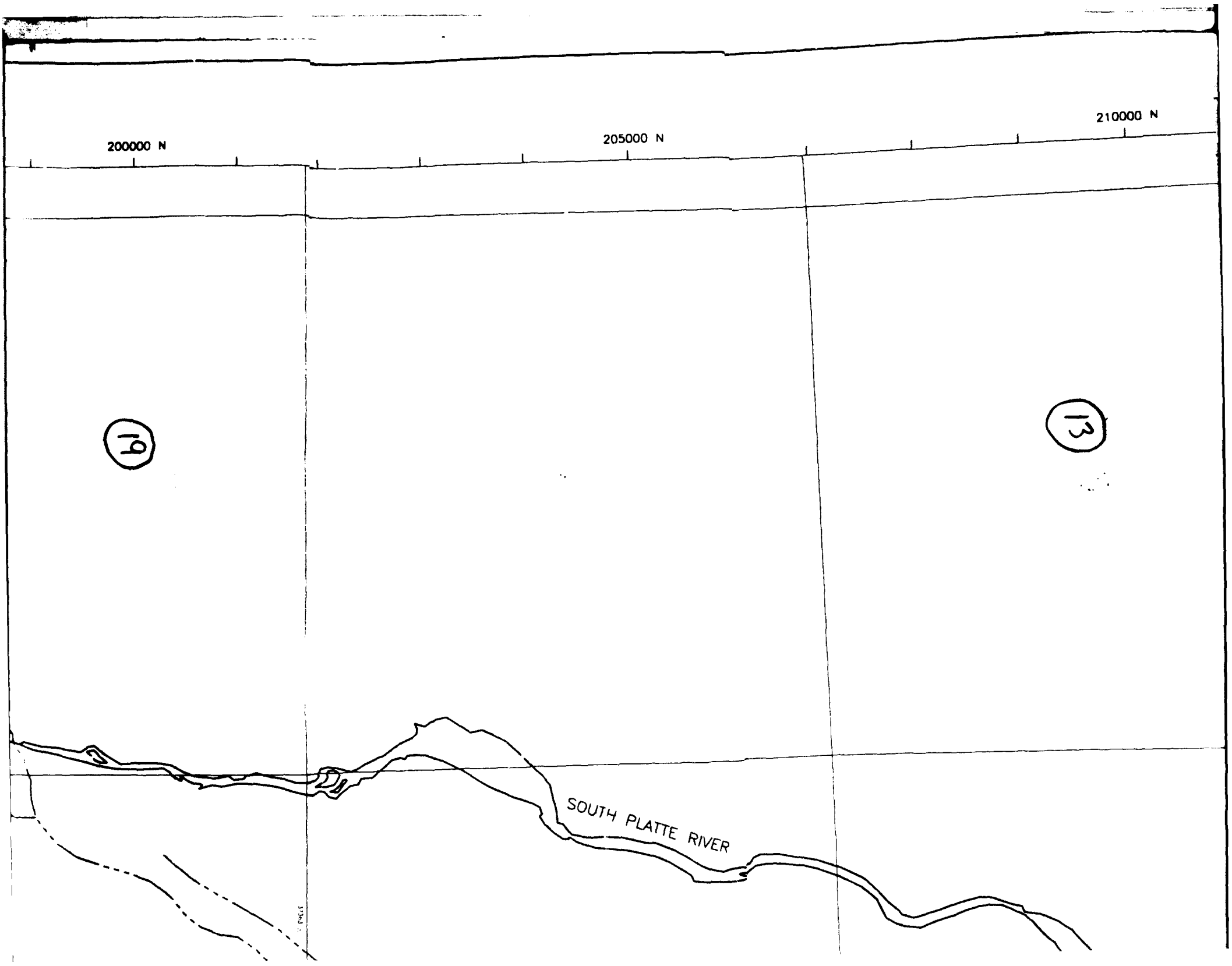

8
14

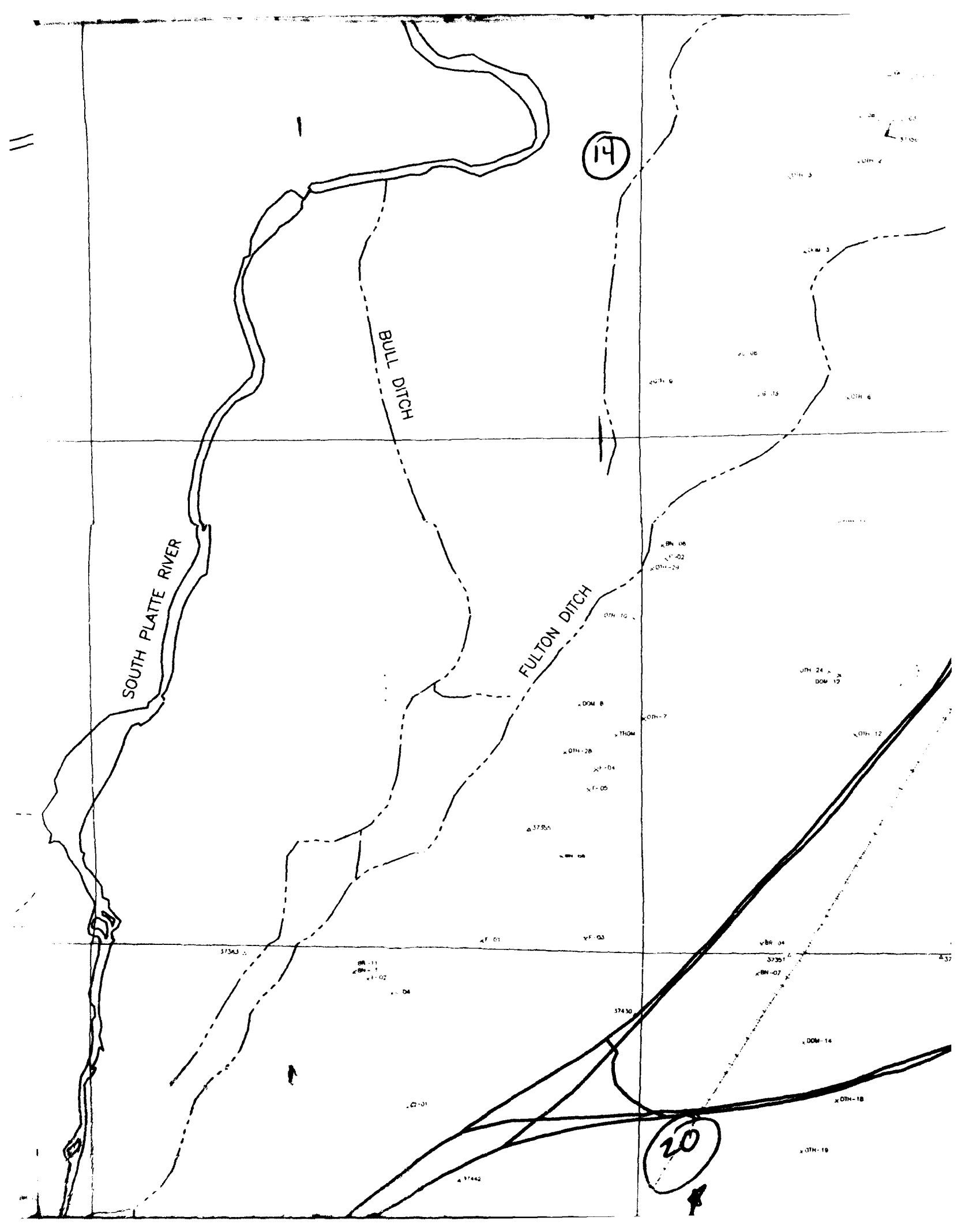

9
FULTON DITCH
US-85
15

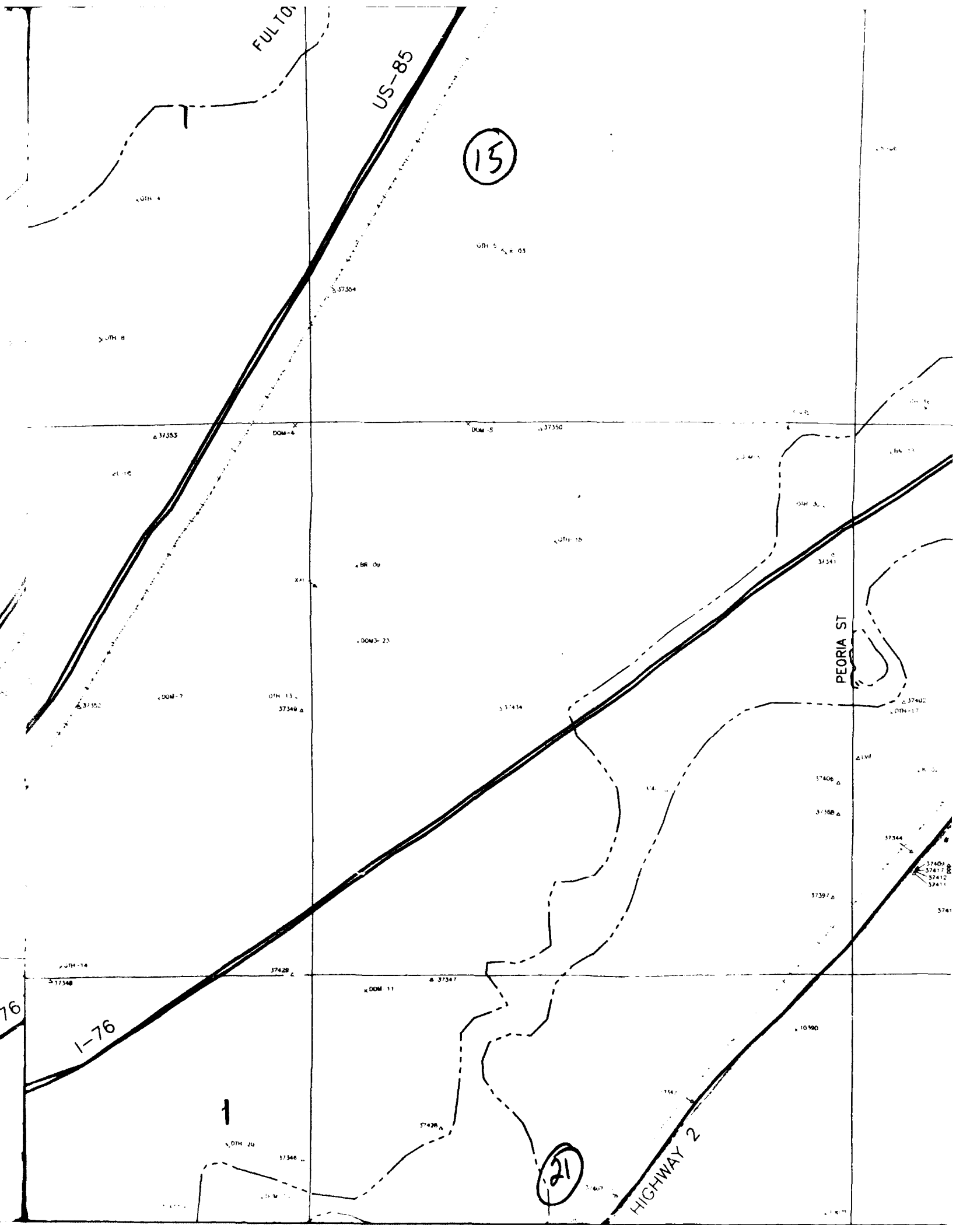

10
EAST 120TH AVENUE
16

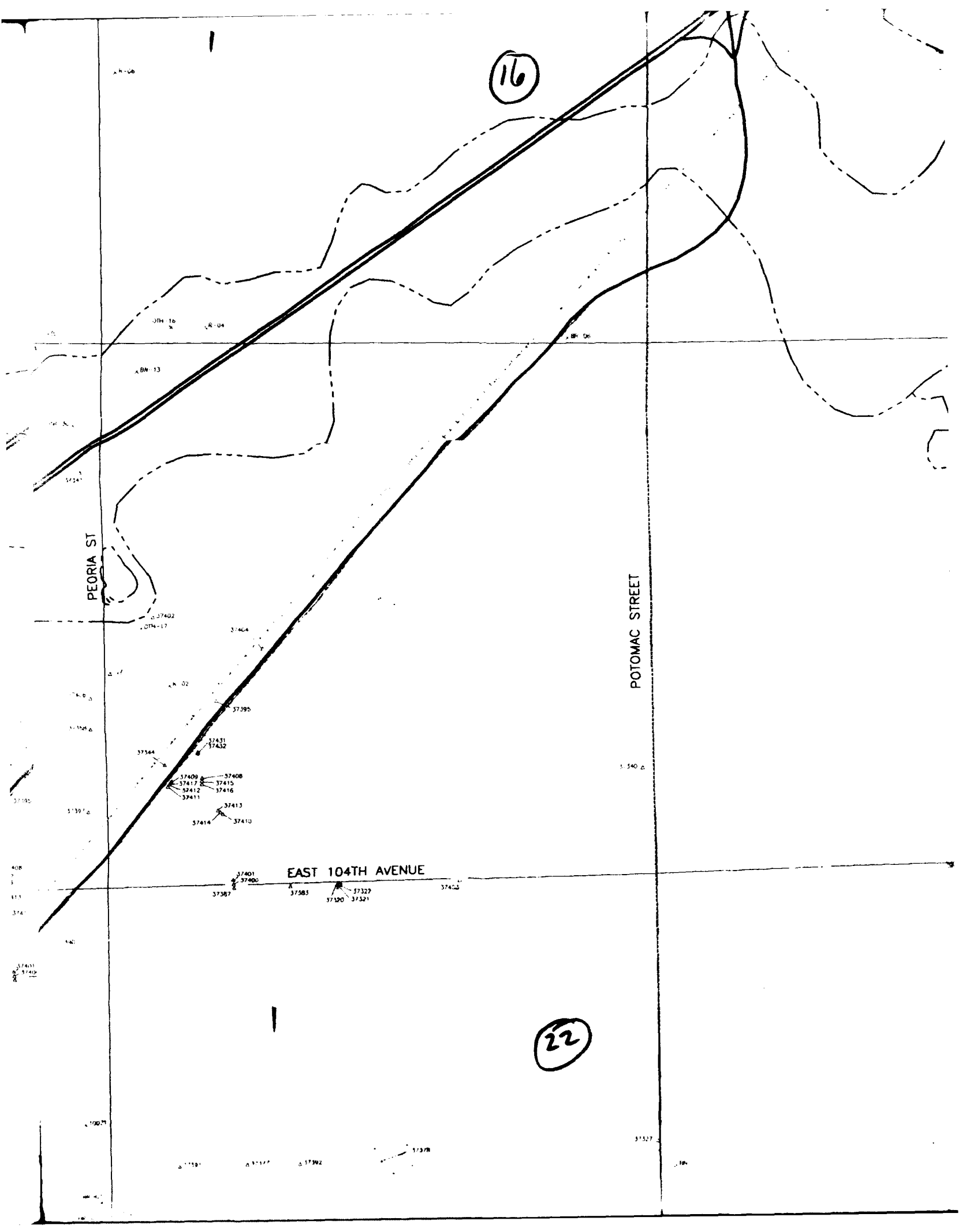

11
THIRD CREEK
I-76
BURLINGTON DITCH
O'BRIAN CANAL
17

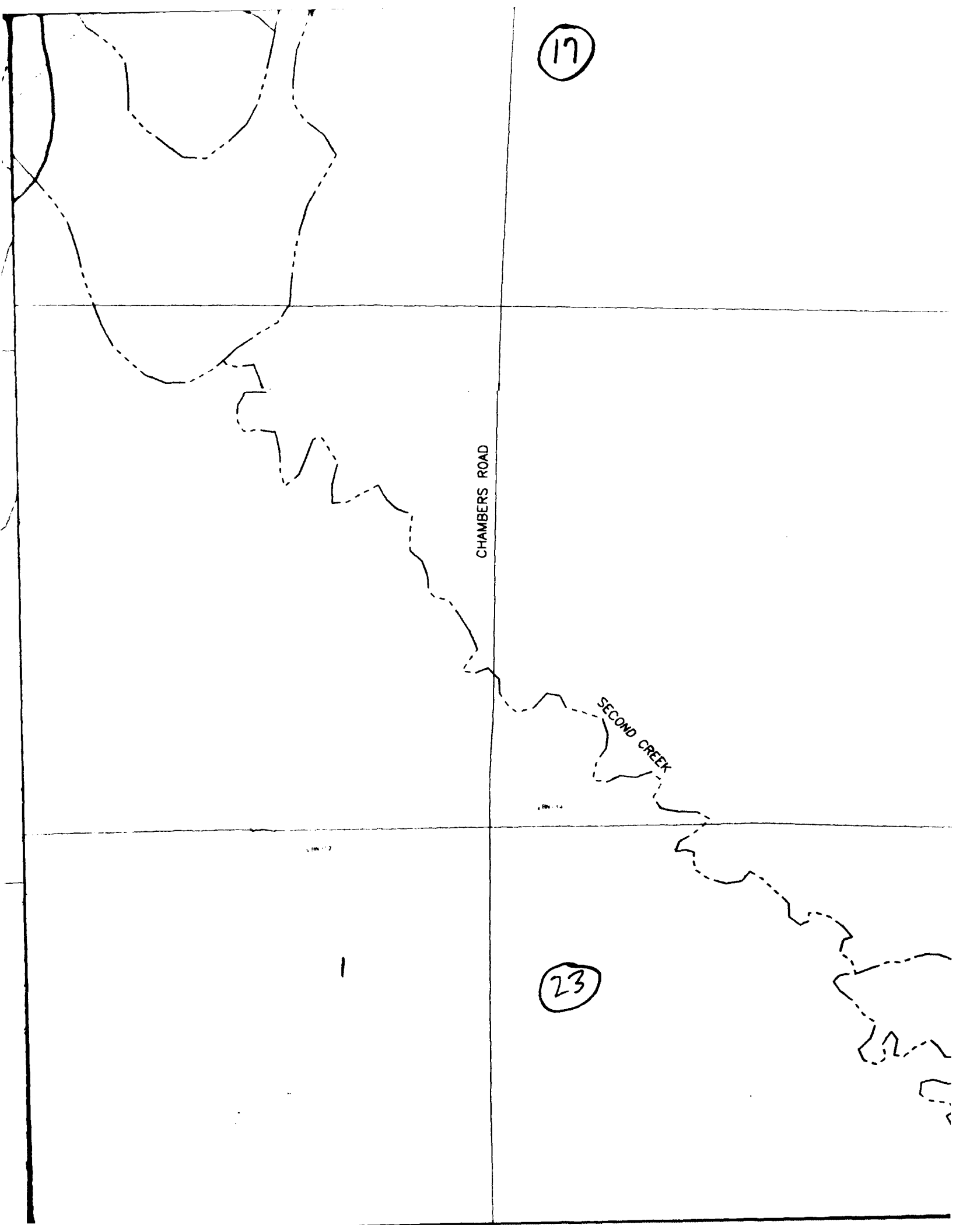

11
12
17
18
I-76
CREEK
T 1 S
T 2 S
220000 N
215000 N
210000 N


200000 N
205000 N
210000 N
19
13
SOUTH PLATTE RIVER

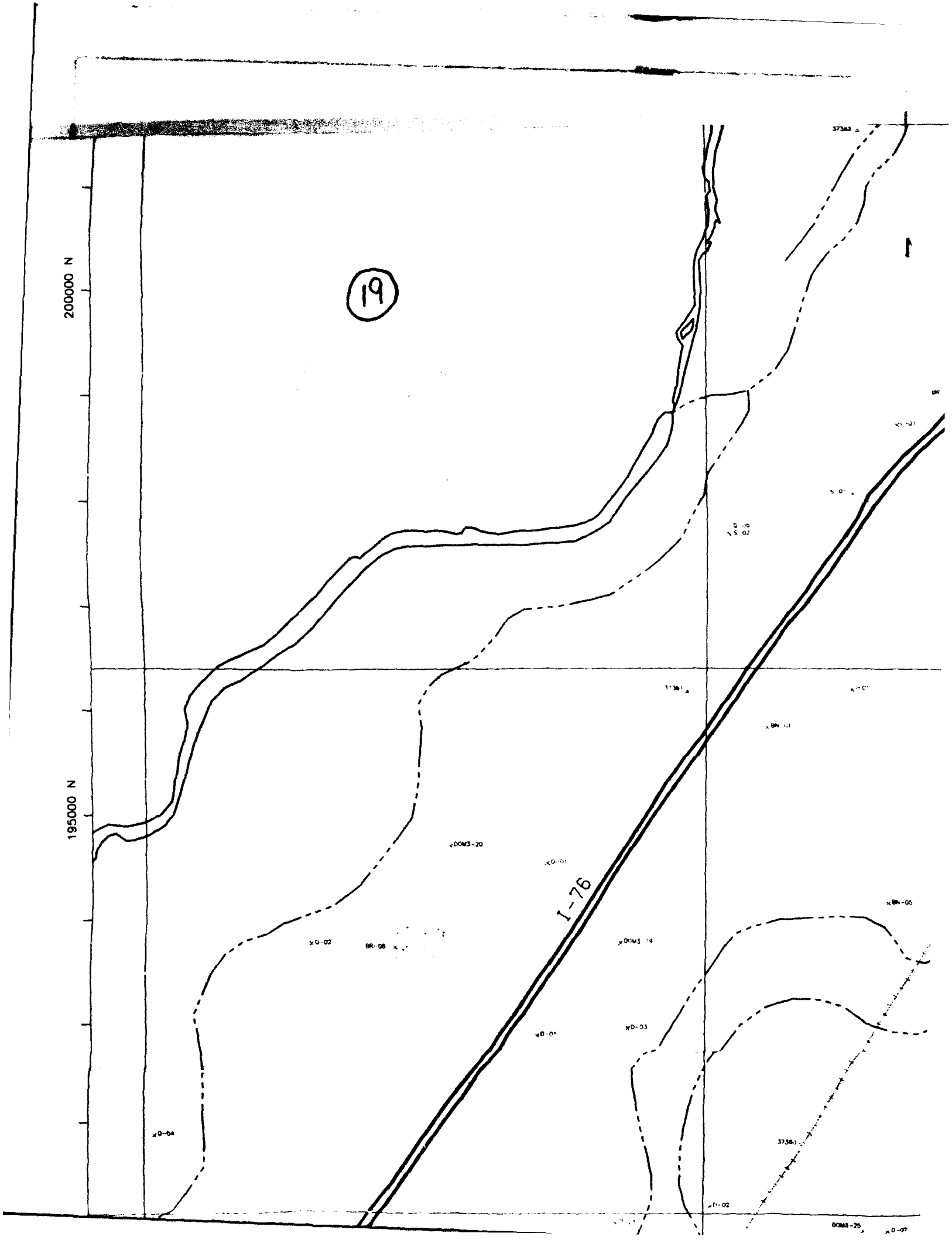

1
14
BULL DITCH
SOUTH PLATTE RIVER
FULTON DITCH
20

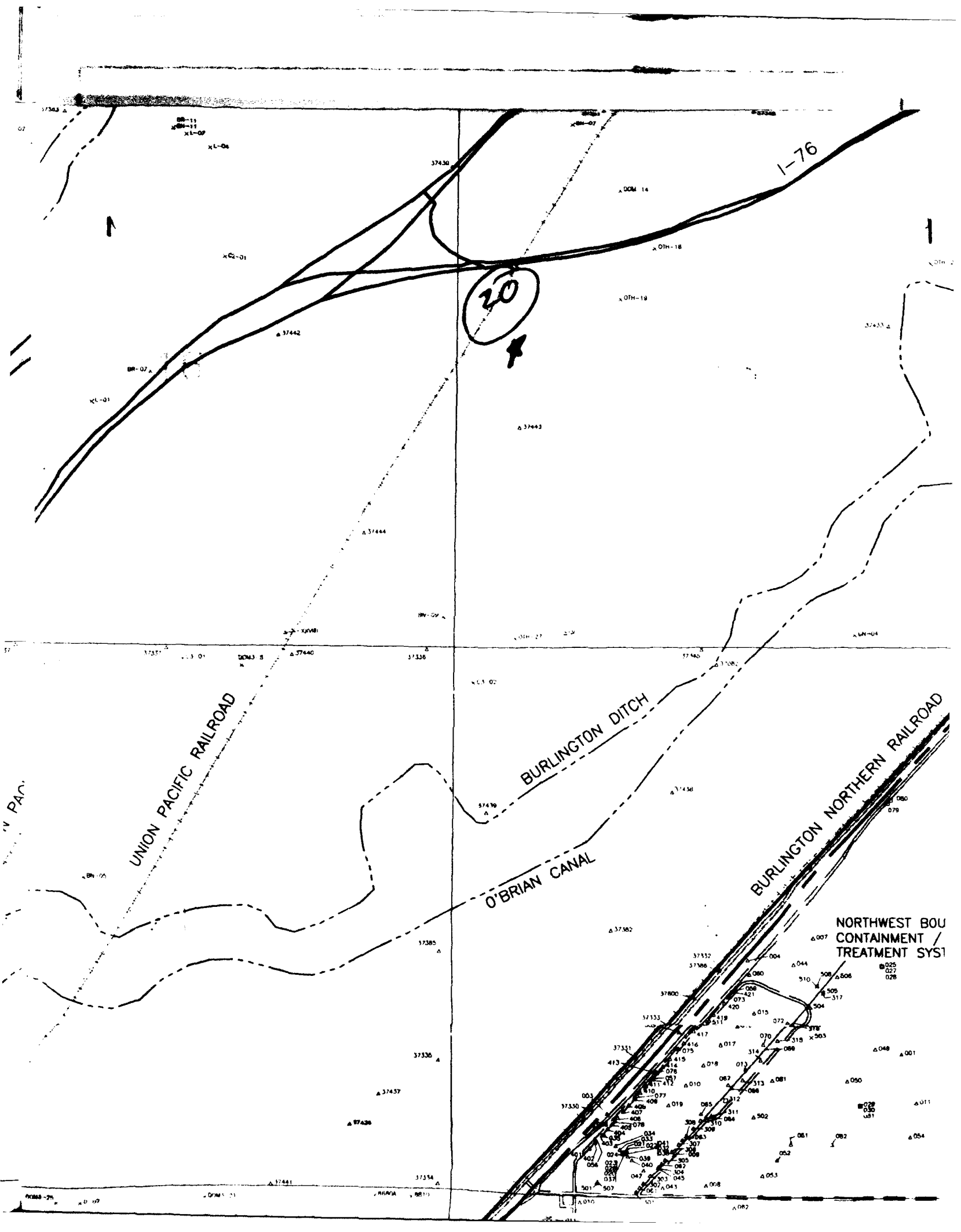

US-85
15
PEORIA ST
I-76
HIGHWAY 2
21

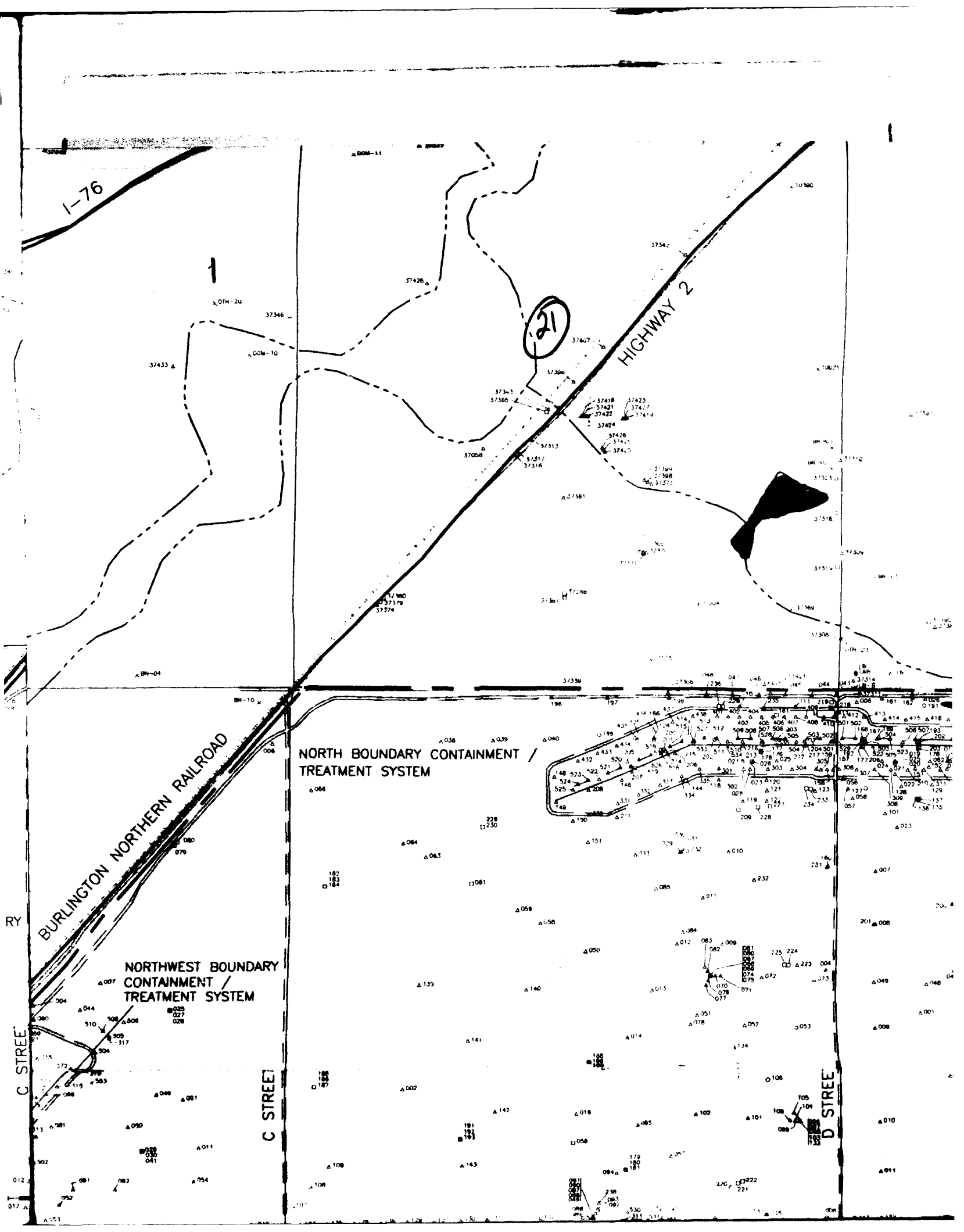

16
PEORIA ST
POTOMAC STREET
EAST 104TH AVENUE
22

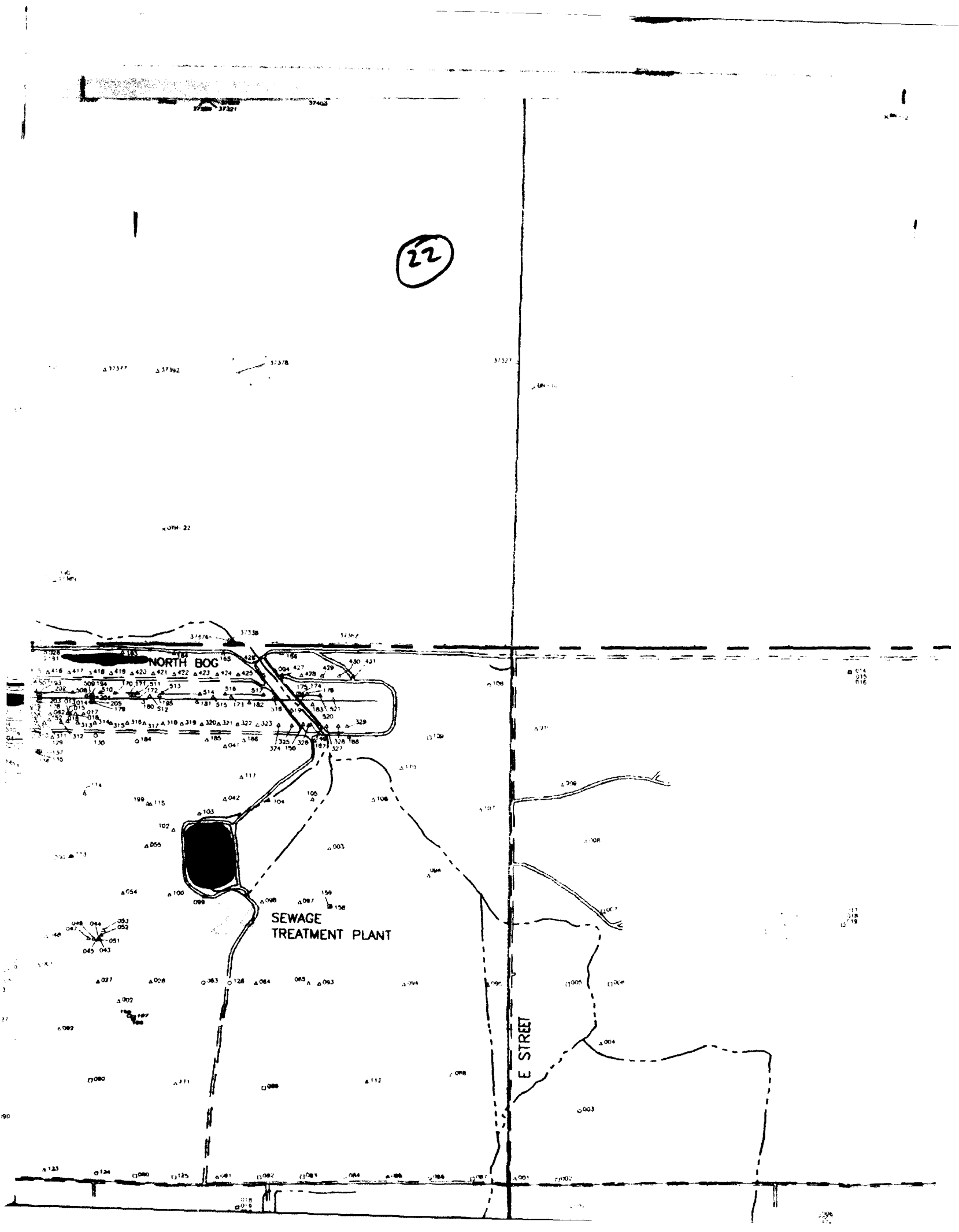

17
CHAMBERS ROAD
SECOND CREEK
23

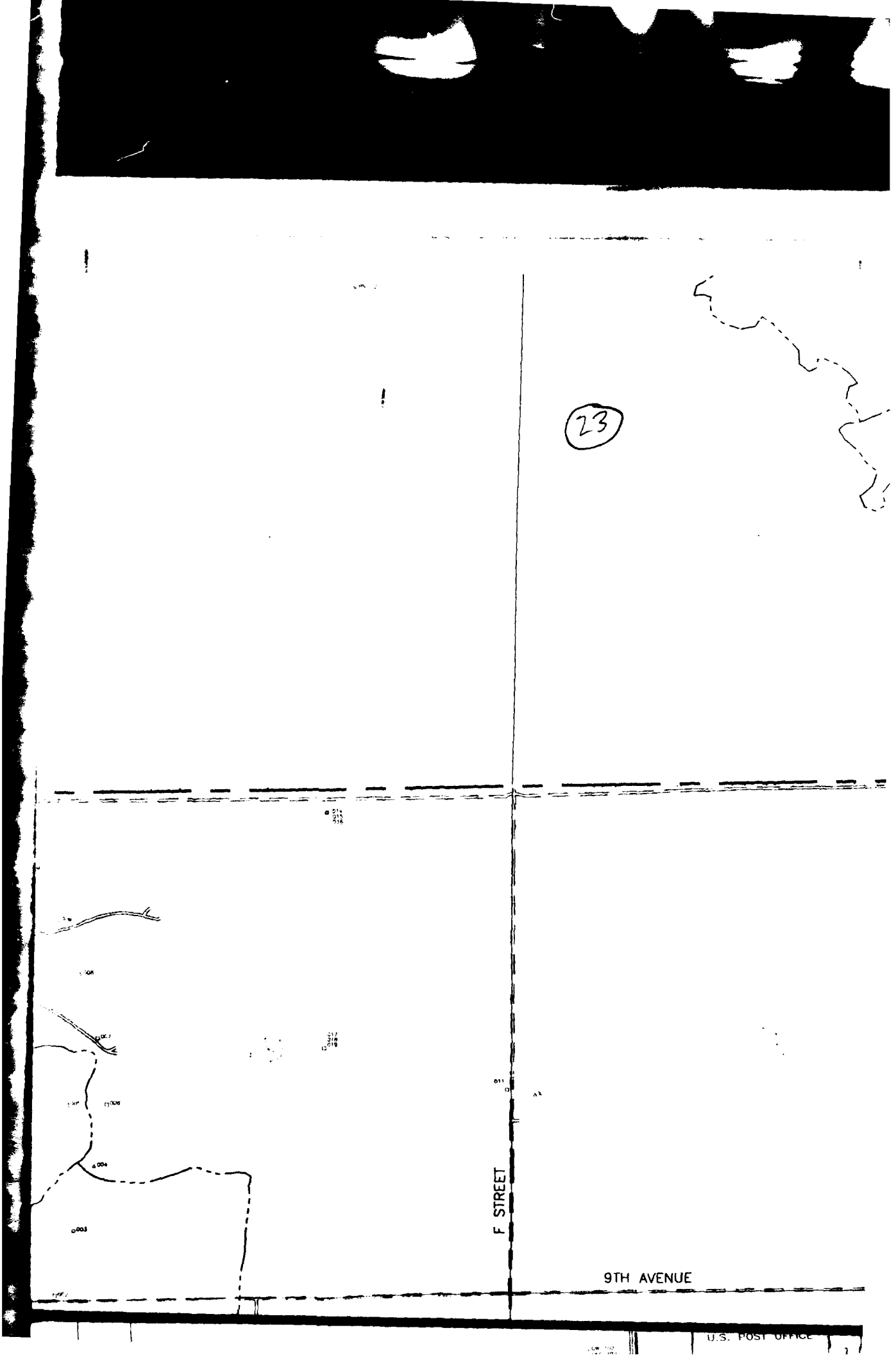
210000 N
205000 N
200000 N
SECOND CREEK
18
23
24

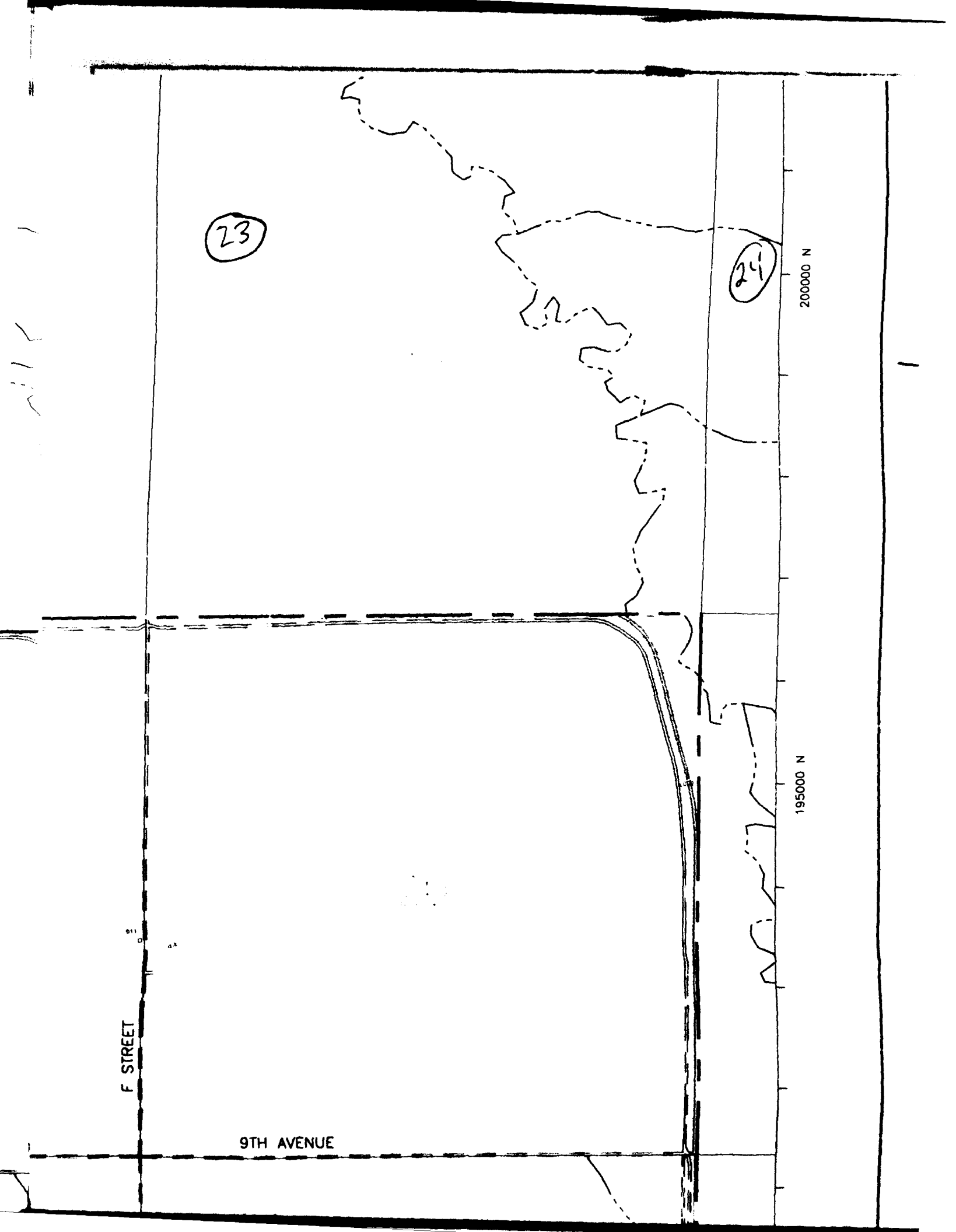

19
200000 N
195000 N
I-76

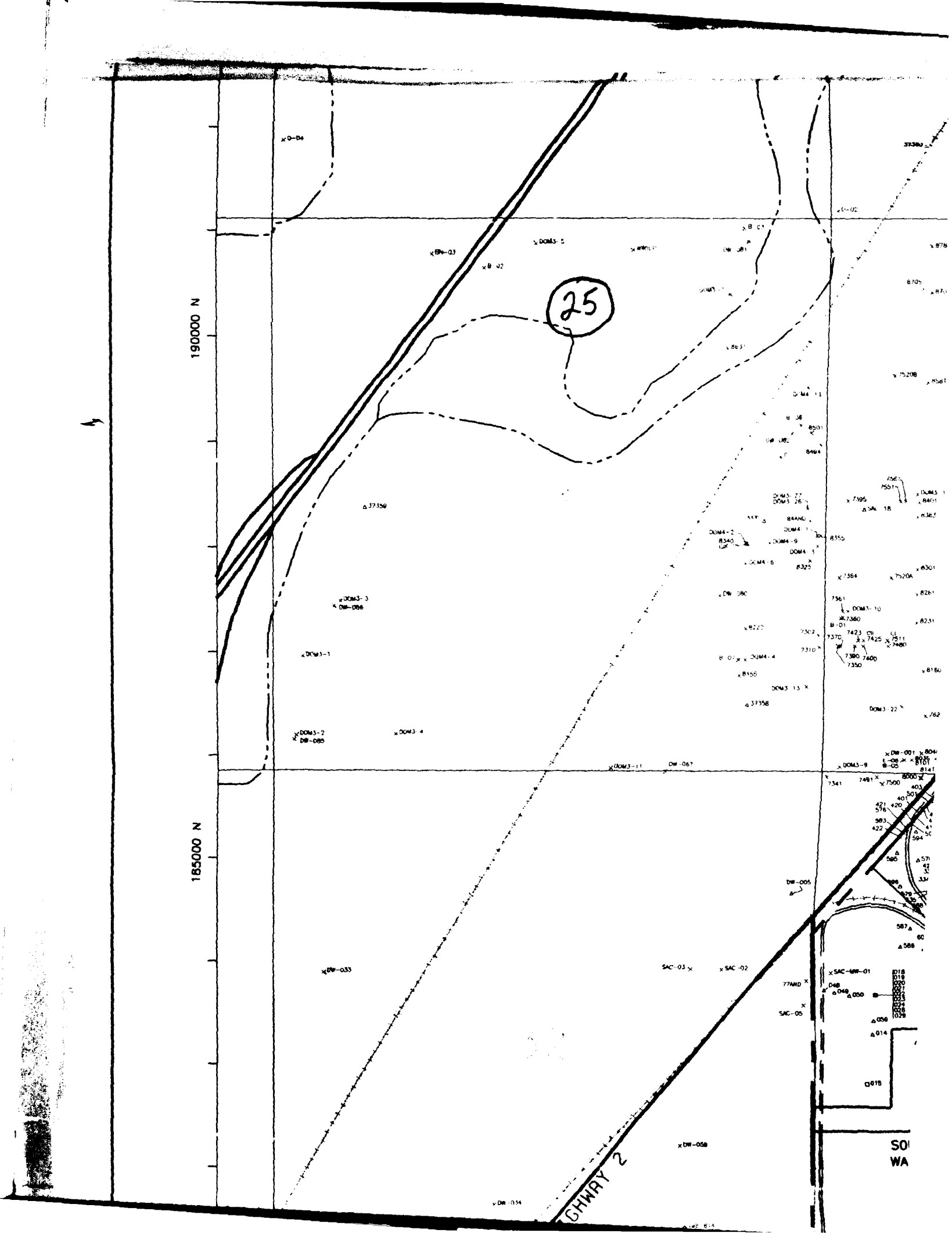

I-76
20
UNION PACIFIC RAILROAD
BURLINGTON DITCH
O'BRIAN CANAL
BURLINGTON NORTHERN RAILROAD
NORTHWEST BOU
CONTAINMENT /
TREATMENT SYST

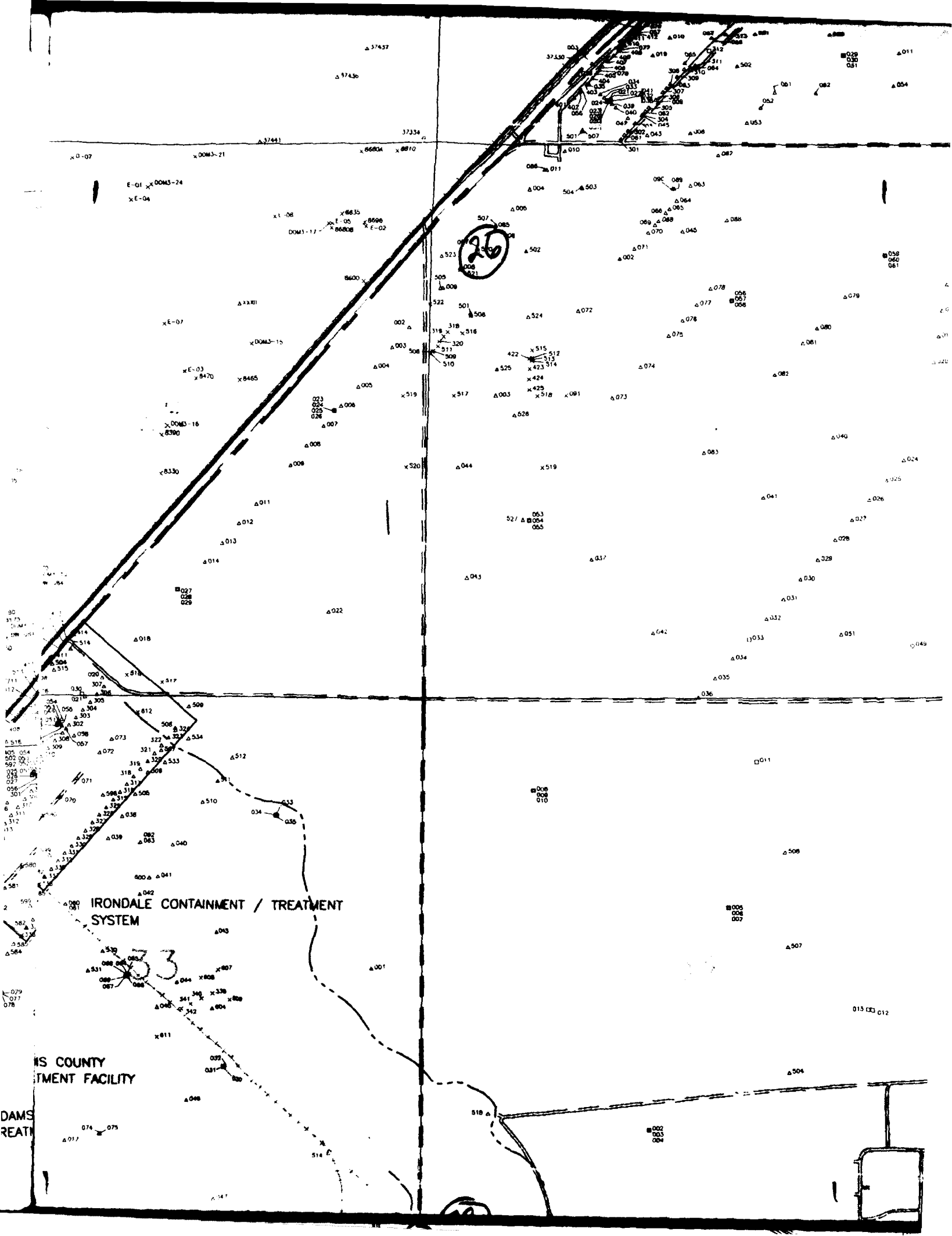

I-76
HIGHWAY 2
21
BURLINGTON NORTHERN RAILROAD
NORTH BOUNDARY CONTAINMENT / TREATMENT SYSTEM
NORTHWEST BOUNDARY CONTAINMENT / TREATMENT SYSTEM
C STREET
C STREET
D STREET
RY

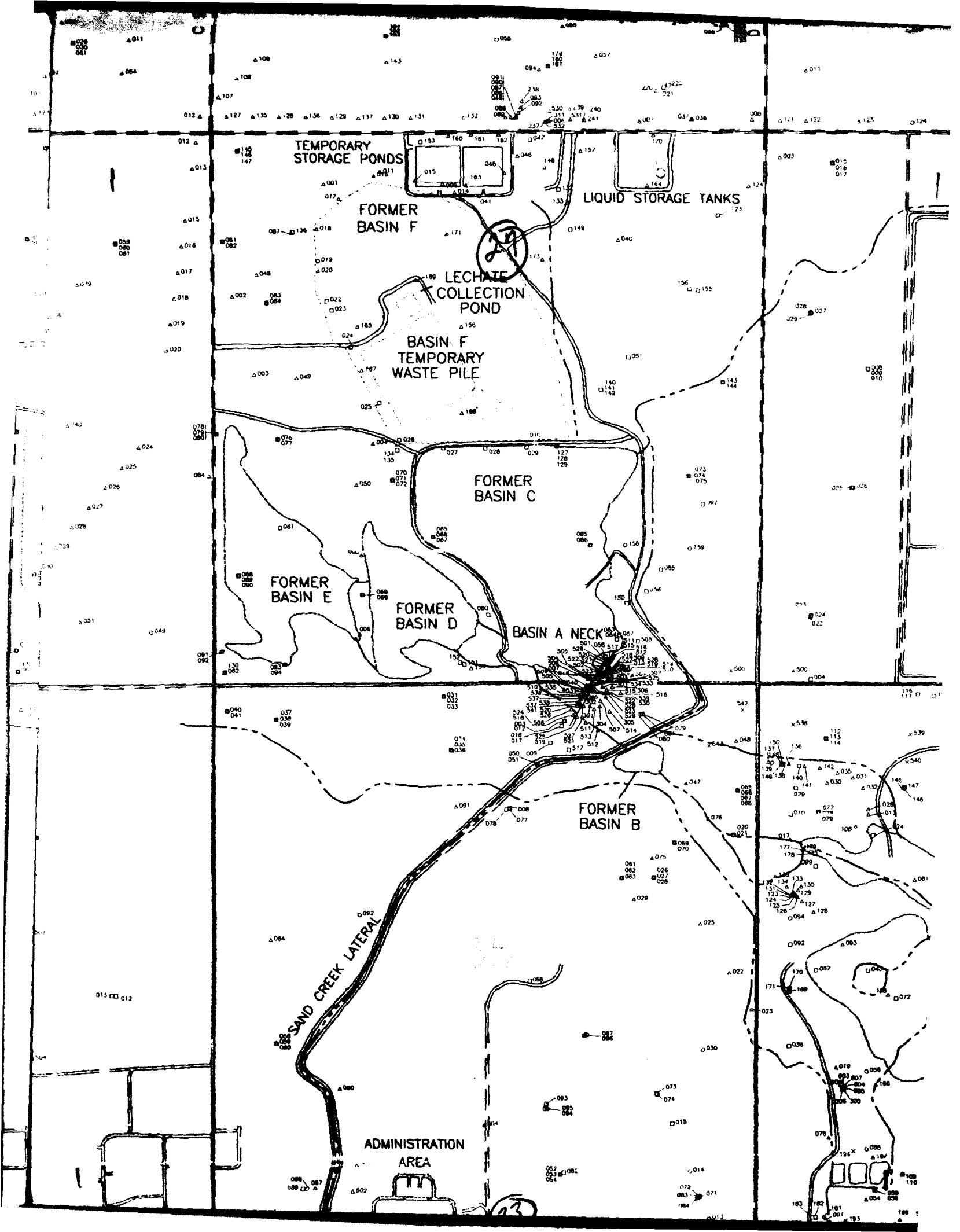

22
NORTH BOG
SEWAGE
TREATMENT PLANT
E STREET

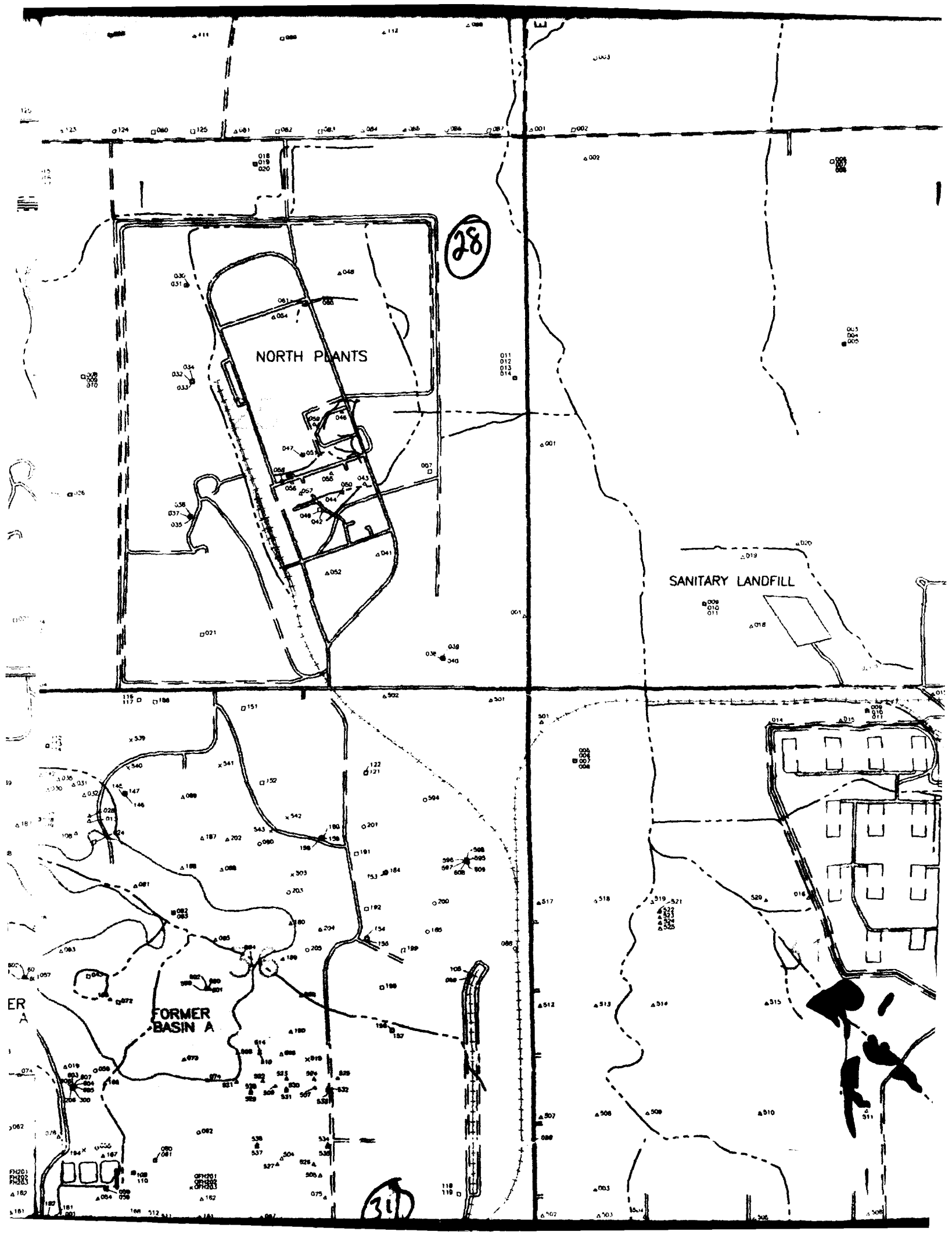

23
F STREET
9TH AVENUE
U.S. POST OFFICE

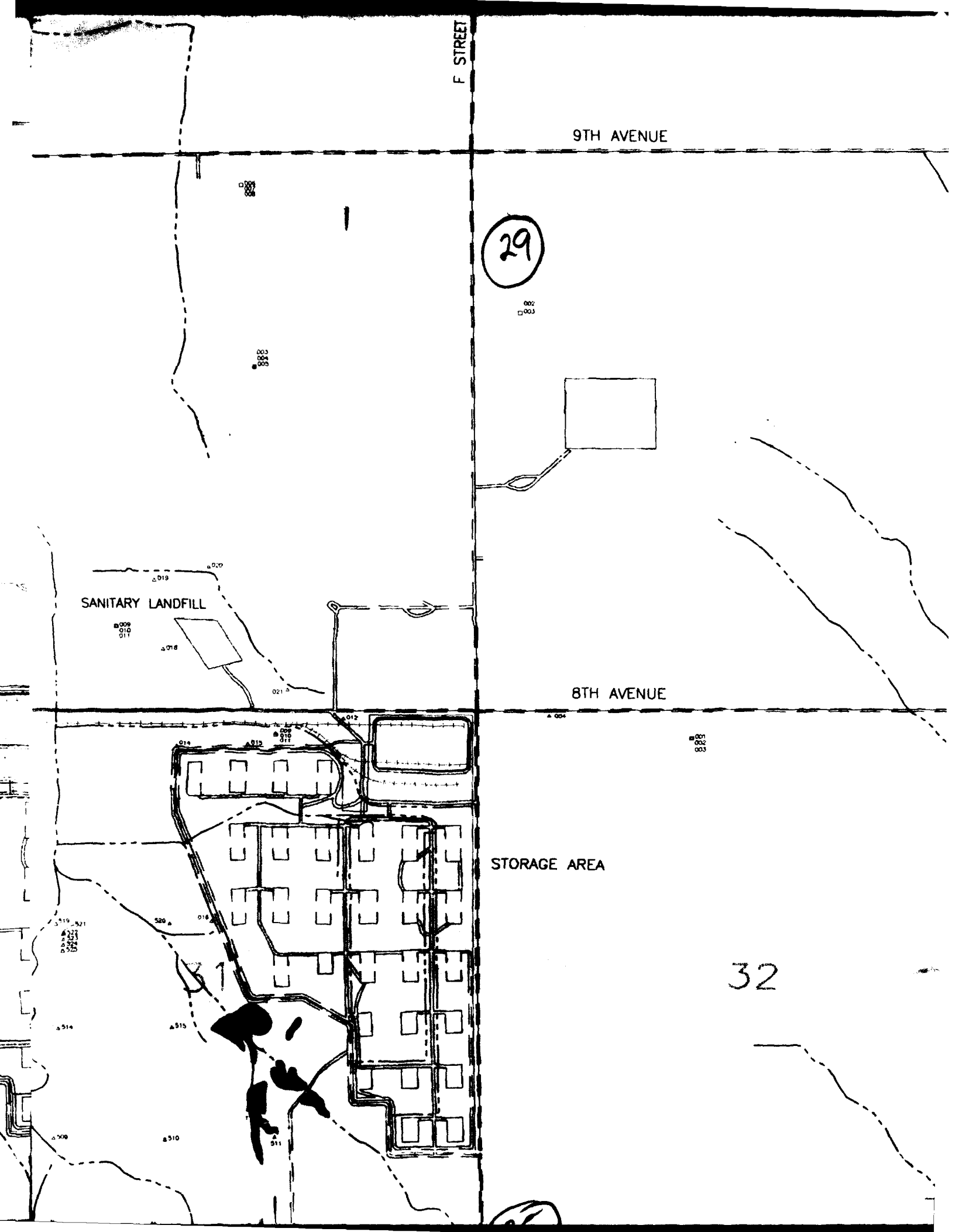

23
24
200000 N
195000 N
F STREET
9TH AVENUE

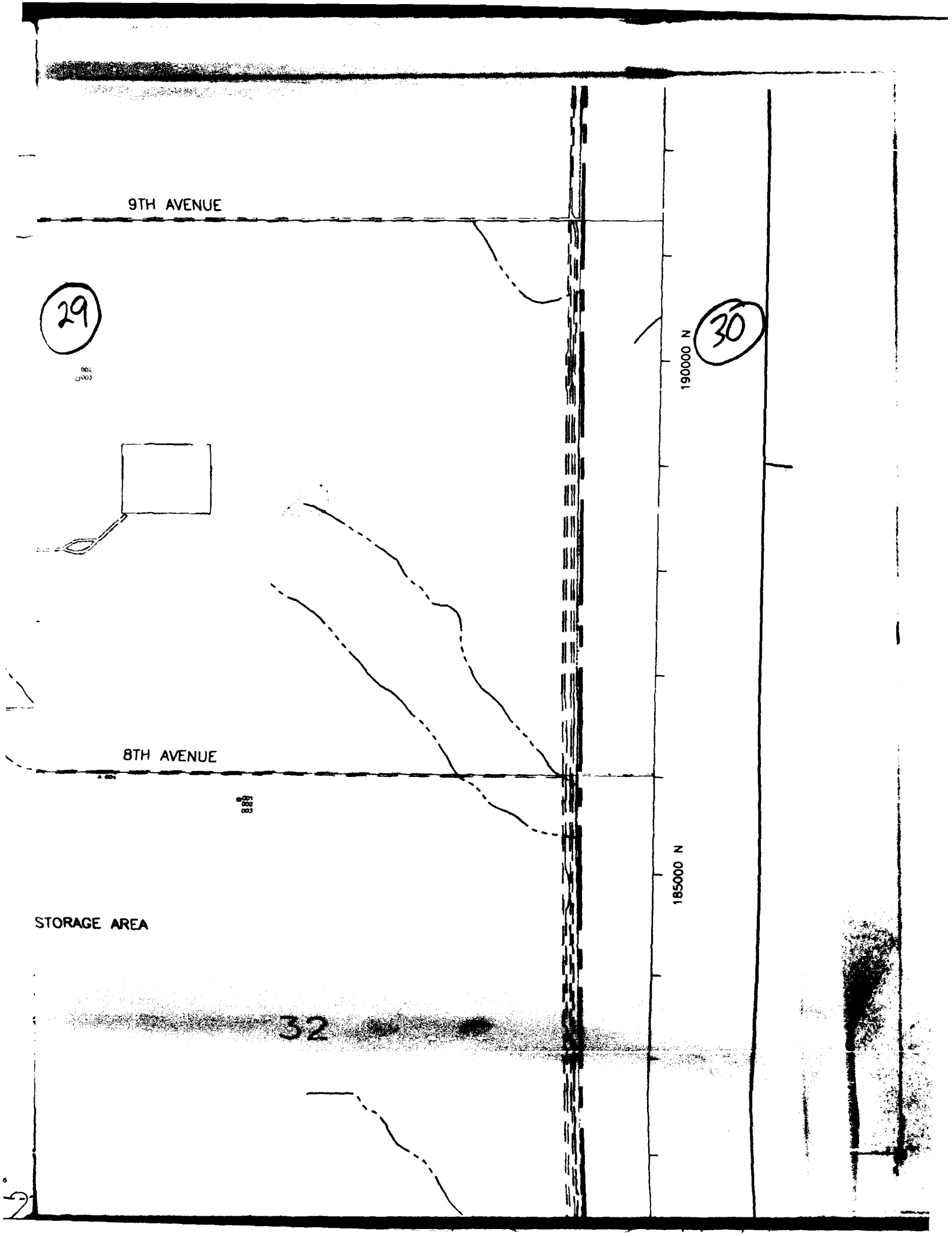

190000 N
185000 N
25
HIGHWAY 2

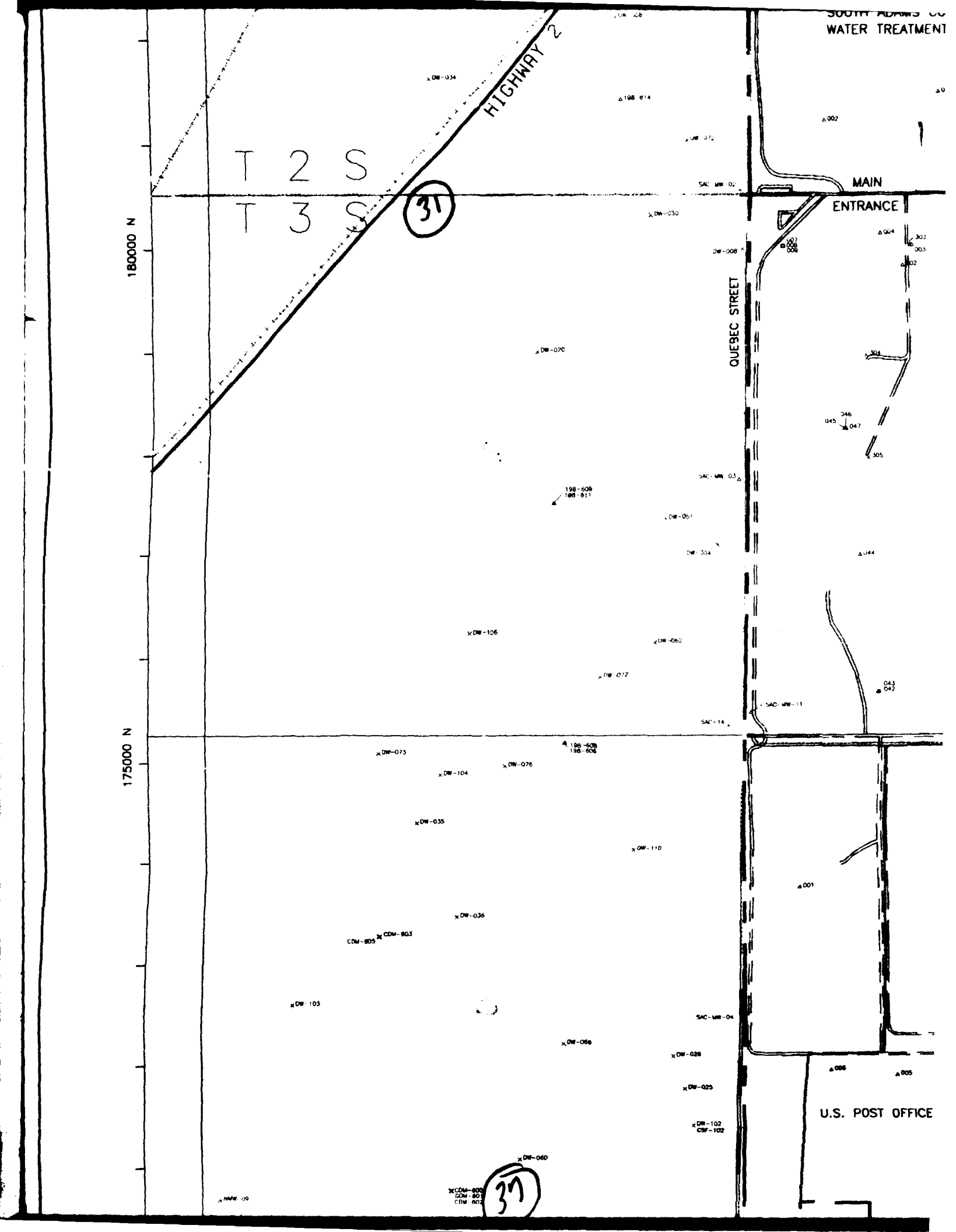

IRONDALE CONTAINMENT / TREATMENT SYSTEM
IS COUNTY
TMENT FACILITY
DAMS
REATI

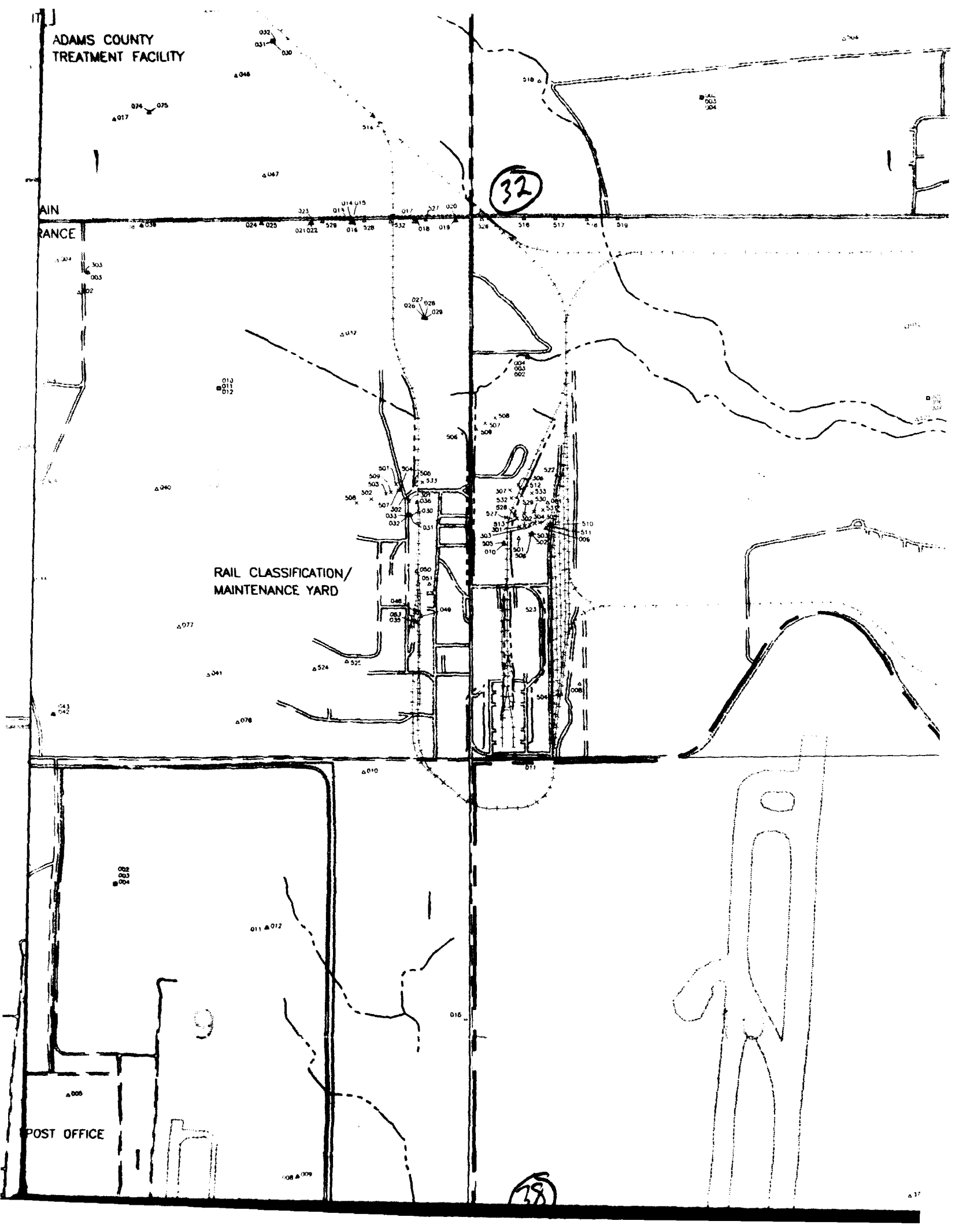

TEMPORARY STORAGE PONDS
FORMER BASIN F
LIQUID STORAGE TANKS
LECHATE COLLECTION POND
BASIN F TEMPORARY WASTE PILE
FORMER BASIN C
FORMER BASIN E
FORMER BASIN D
BASIN A NECK
FORMER BASIN B
SAND CREEK LATERAL
ADMINISTRATION AREA

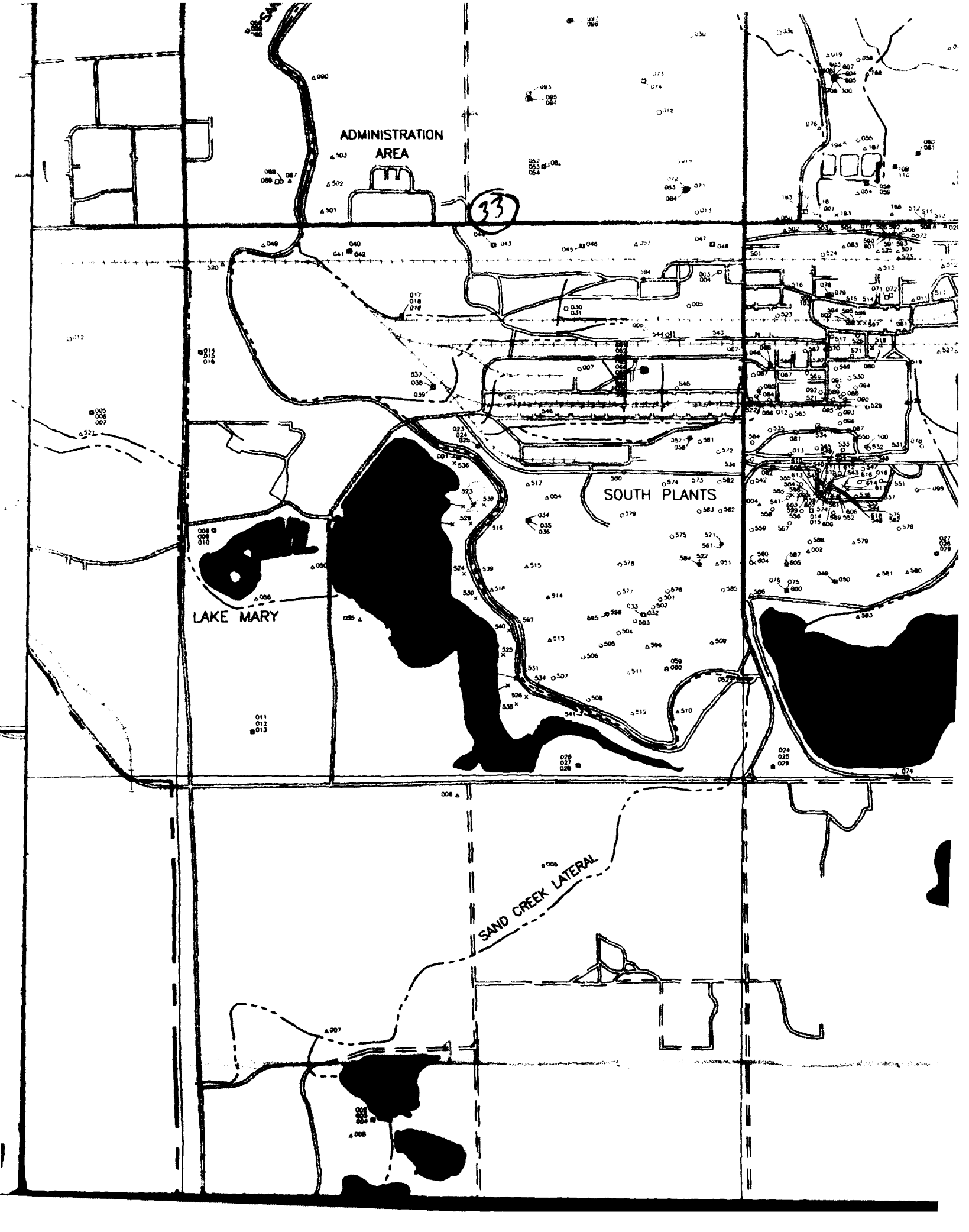

28
NORTH PLANTS
SANITARY LANDFILL
FORMER BASIN A
30

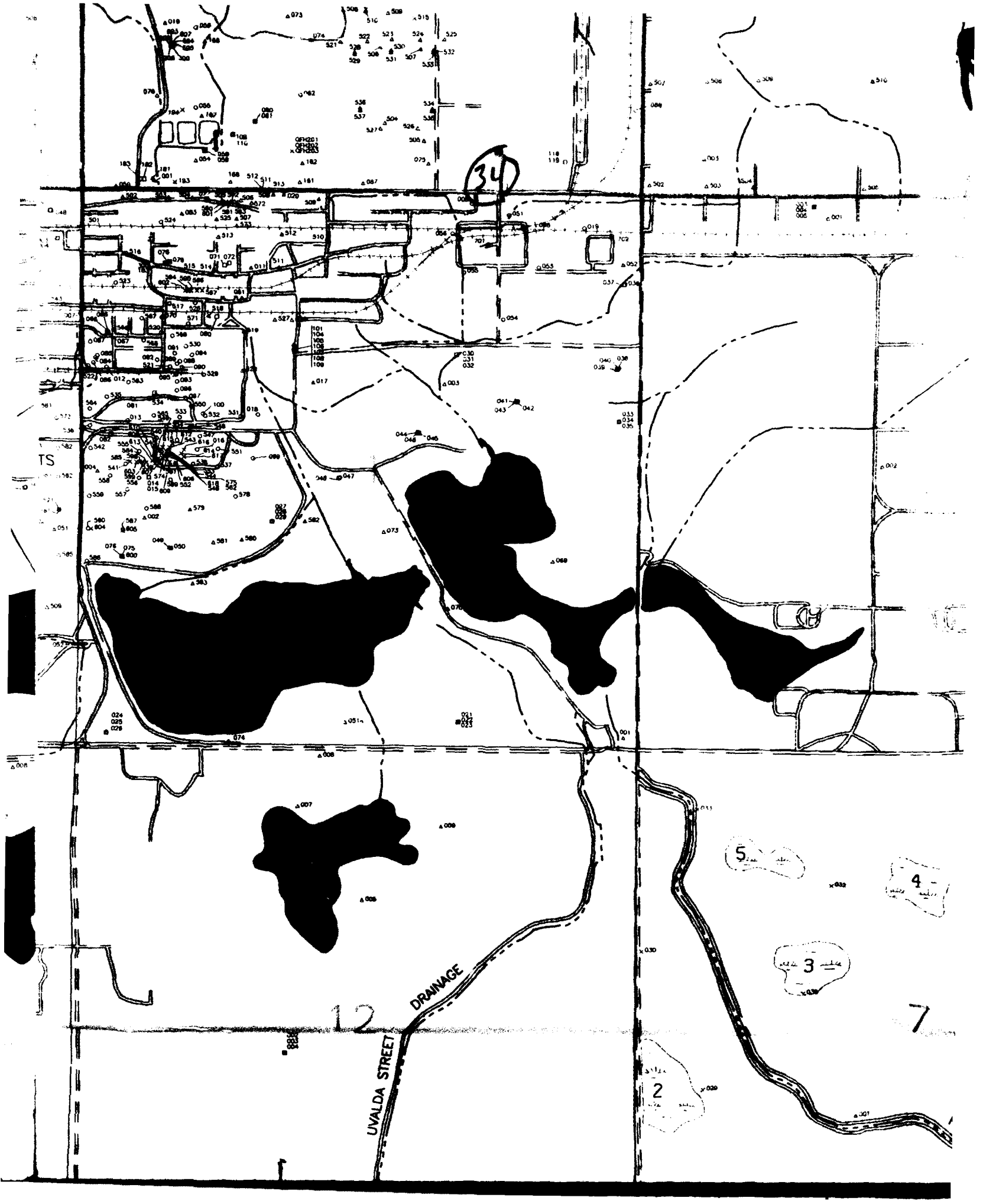

F STREET
9TH AVENUE
29
SANITARY LANDFILL
8TH AVENUE
STORAGE AREA
31
32

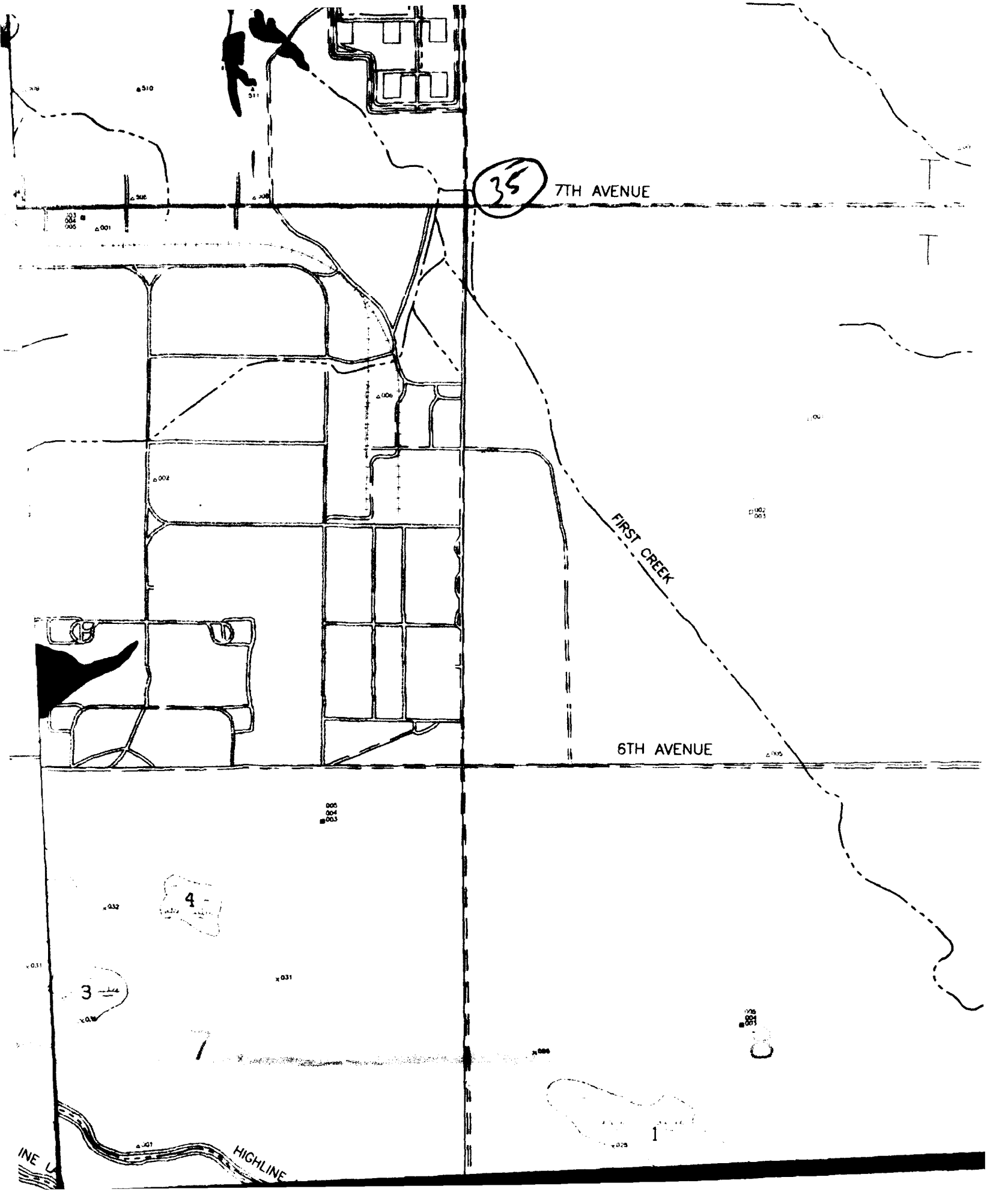

9TH AVENUE
29
30
190000 N
8TH AVENUE
185000 N
STORAGE AREA
32

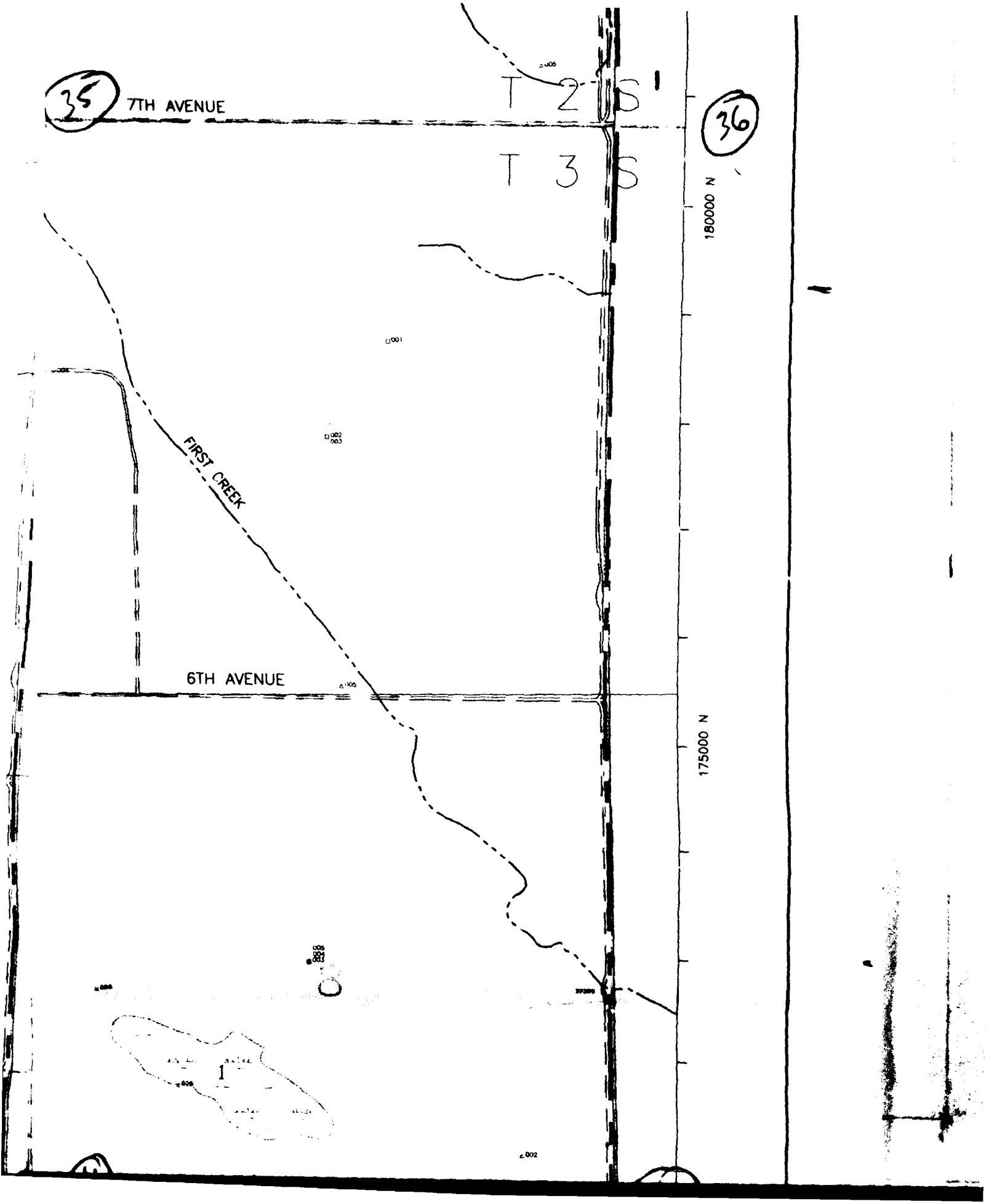

WATER TREATMENT
HIGHWAY 2
T 2 S
T 3 S
31
MAIN
ENTRANCE
QUEBEC STREET
180000 N
175000 N
U.S. POST OFFICE
31

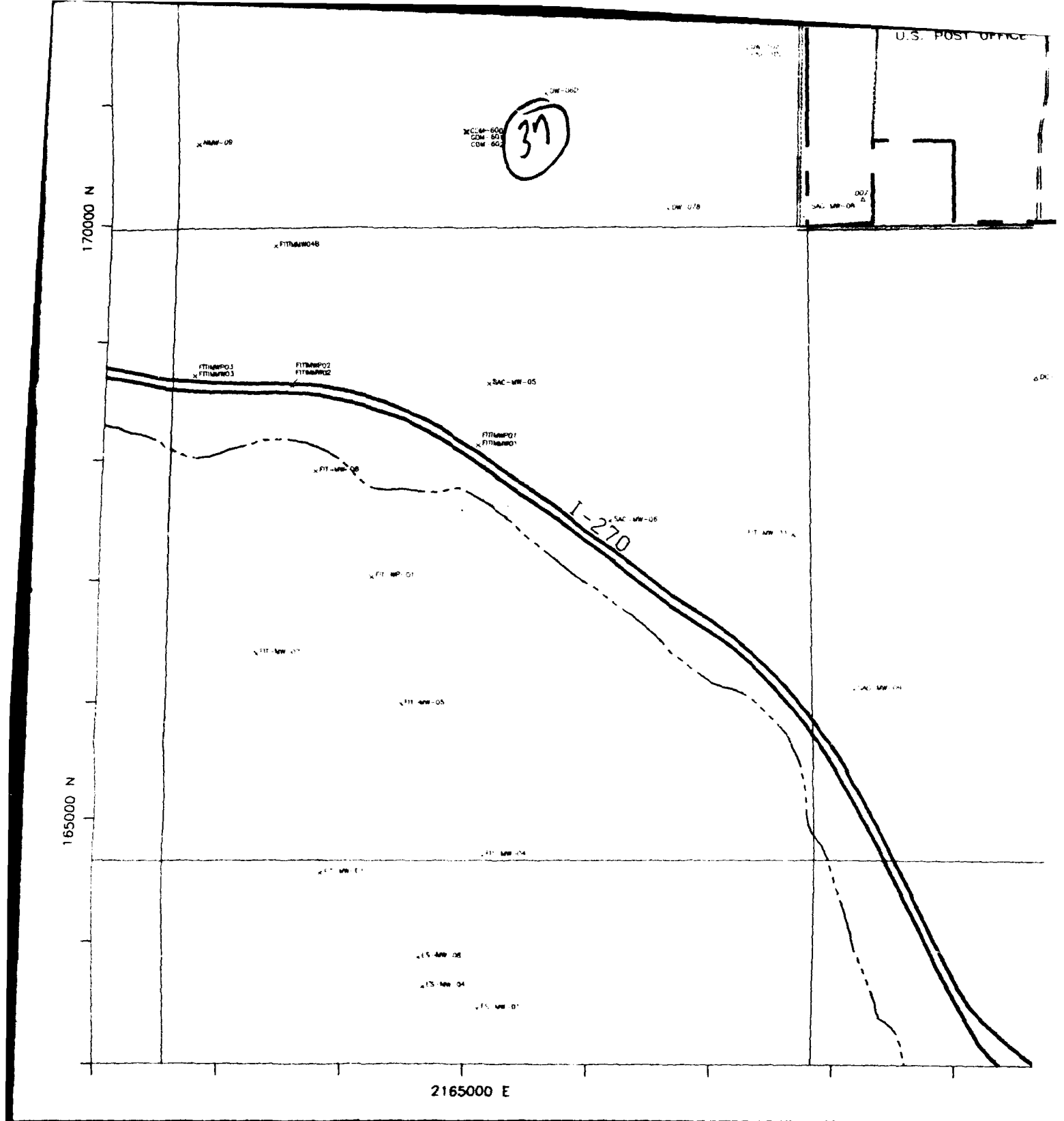

ADAMS COUNTY
TREATMENT FACILITY
RAIL CLASSIFICATION/
MAINTENANCE YARD
POST OFFICE
32
28

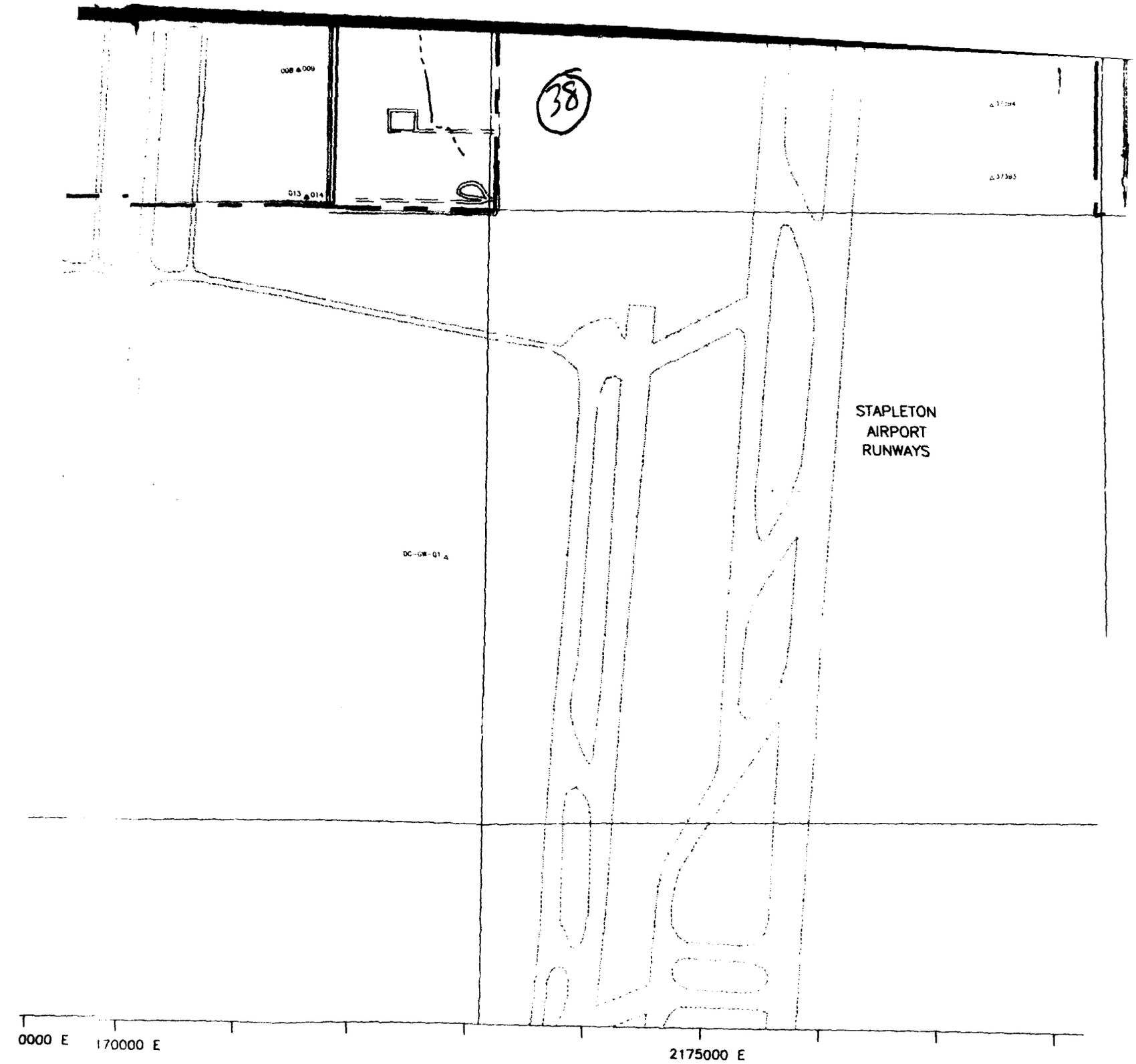

ADMINISTRATION
AREA
33
SOUTH PLANTS
LAKE MARY
SAND CREEK LATERAL


34
5
4
3
2
12
7
UVALDA STREET
DRAINAGE


35
7TH AVENUE
FIRST CREEK
6TH AVENUE
4
3
7
8
1
HIGHLINE

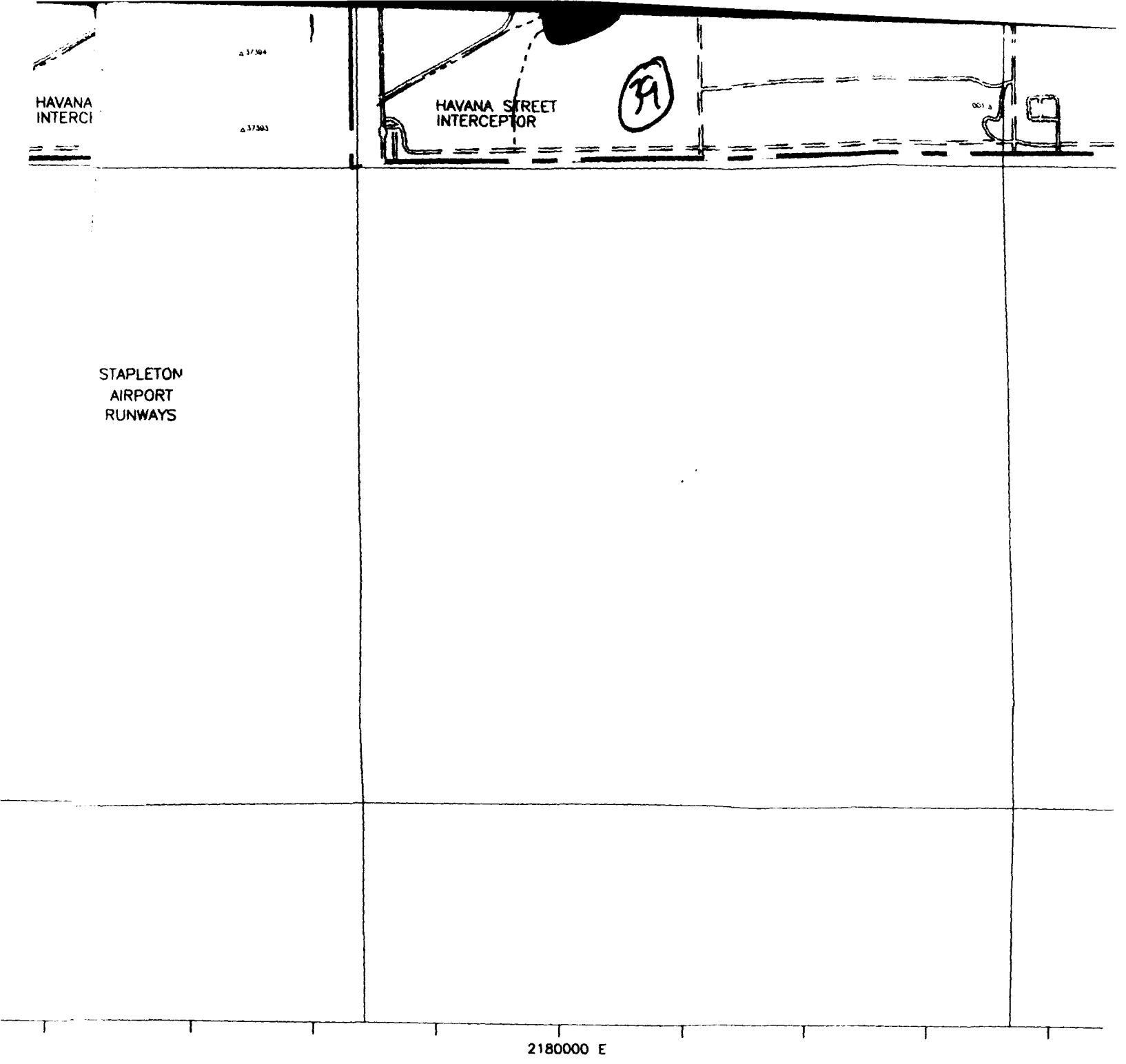

35
7TH AVENUE
T 2 S
T 3 S
36
180000 N
FIRST CREEK
6TH AVENUE
175000 N
1


U.S. POST OFFICE
37
170000 N
165000 N
2165000 E
I-270
Wetlands
Ditch or Stream
Paved Road
Unpaved Road



EXPLANATION

Se — Section Number	▲101 Alluvial Well
Ar — Arsenal Boundary	◆101 Arapahoe Well
Ra — Railroad	●102 Unconfined Denver Formation Well
	■103 Confined Denver Formation Well
	Not Classified (DP Associates, October



Containment systems

Physical barrier

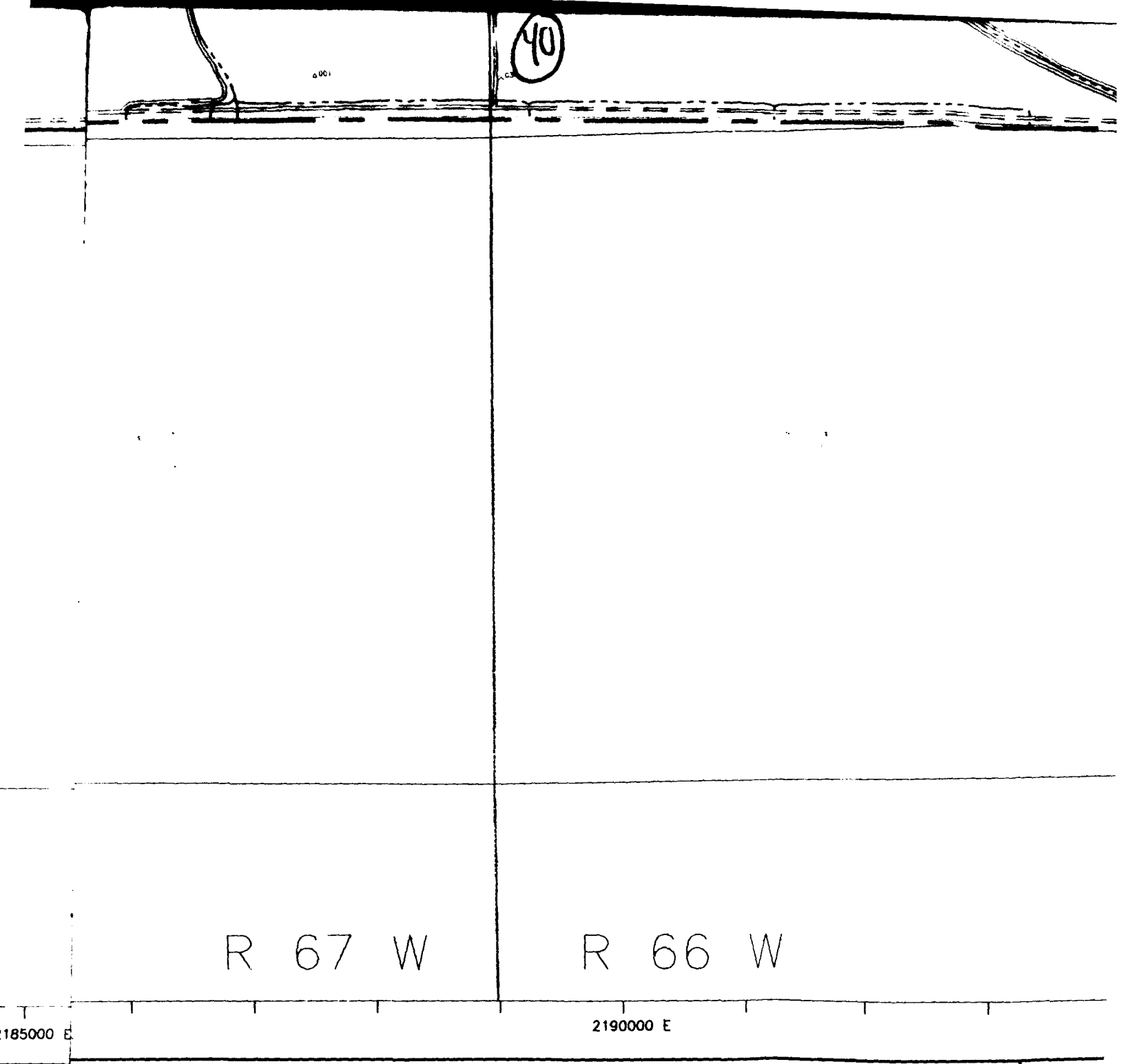
Hydraulic barrier

Recharge trenches

er Formation Well

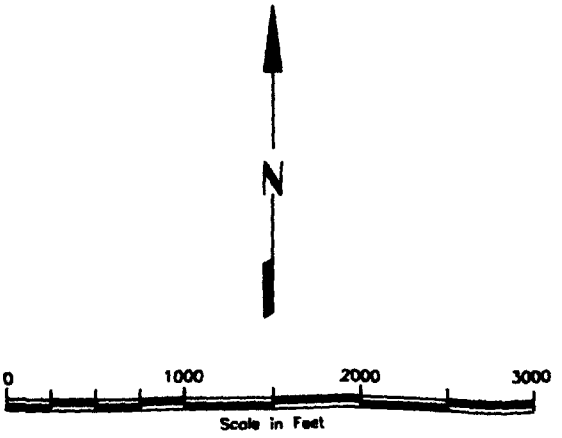
Formation Well

P Associates, October 1991)



Note:

The onpost well identification number shown have been abbreviated. The full well identification number contains the section number before the number shown on this map. For example, the complete well identification number for well 012 in onpost section 3 is 3012.

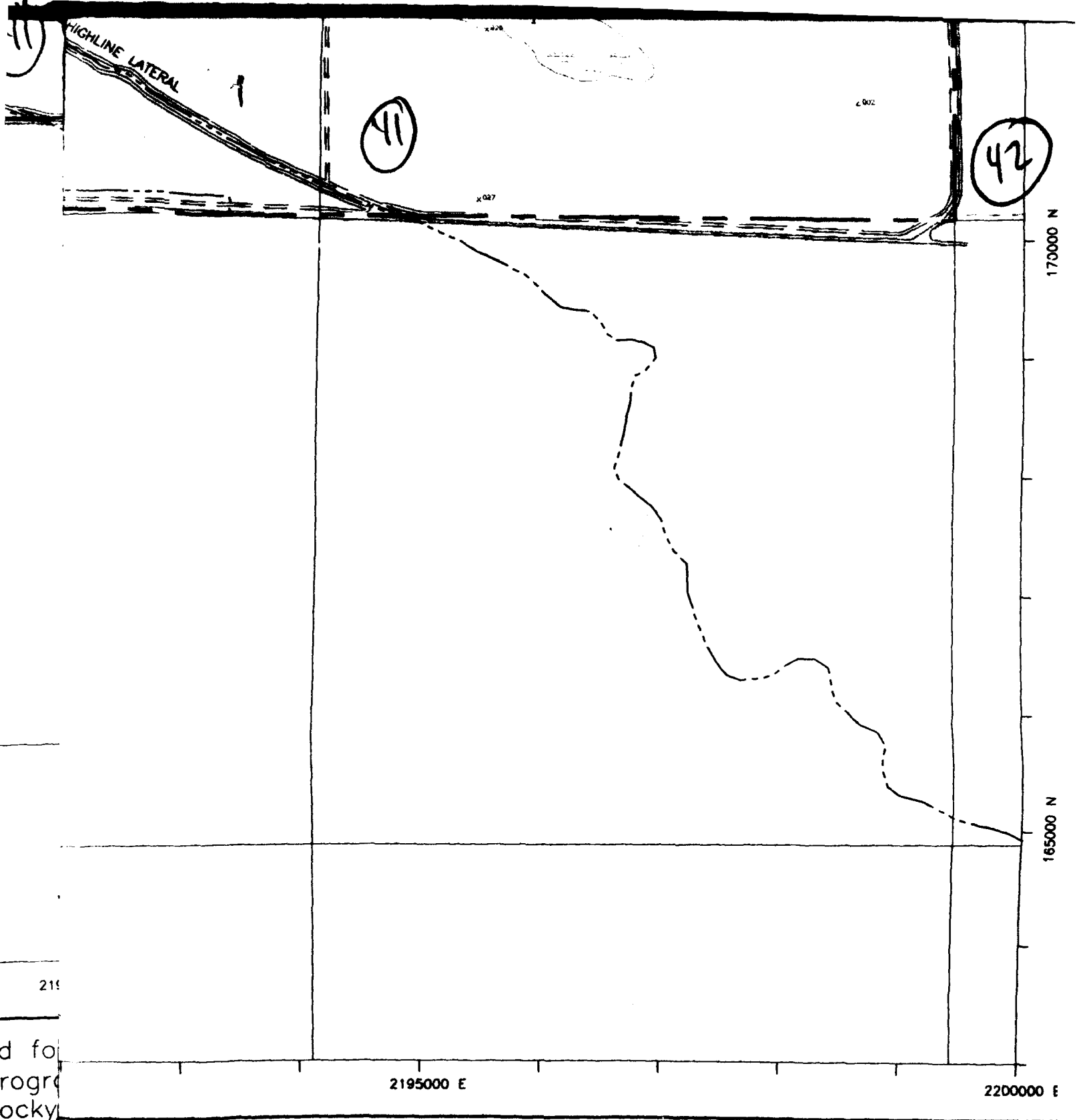


Prep

Pre

Pla

GWA

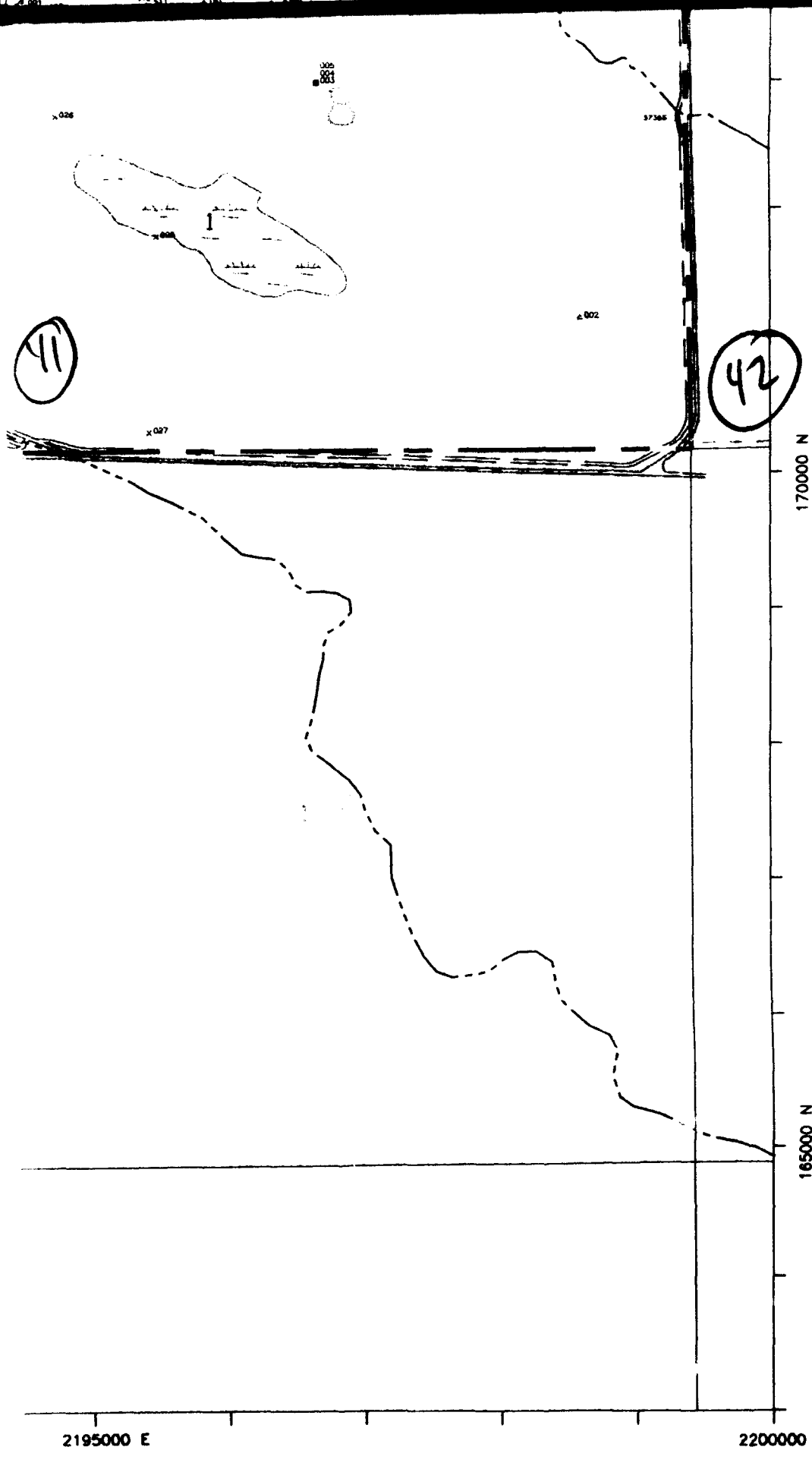


Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

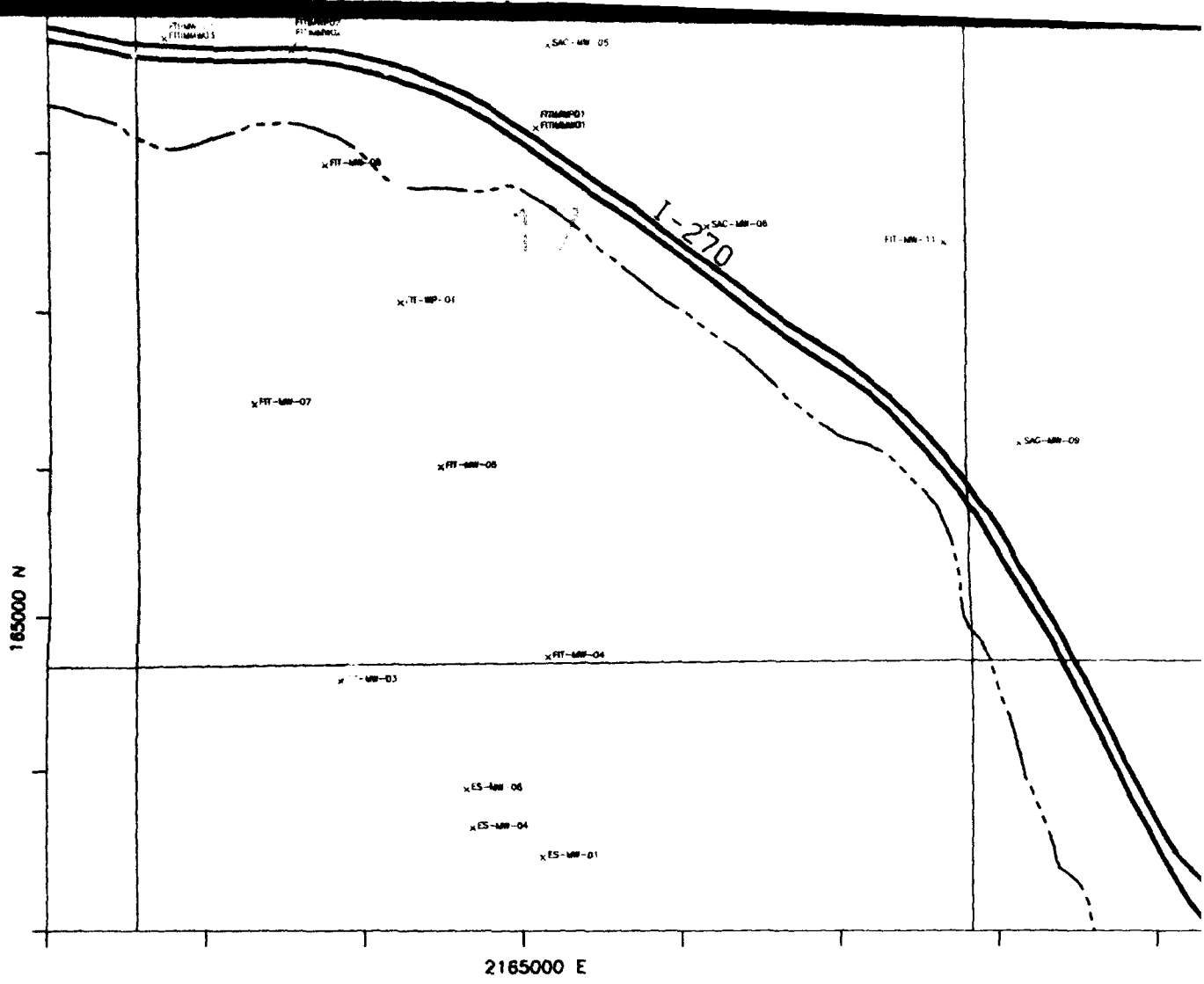
Prepared by:
Harding Lawson Associates

Plate 1

Comprehensive Monitoring Program



for:
ogram Manager for
ocky Mountain Arsenal



Wetlands

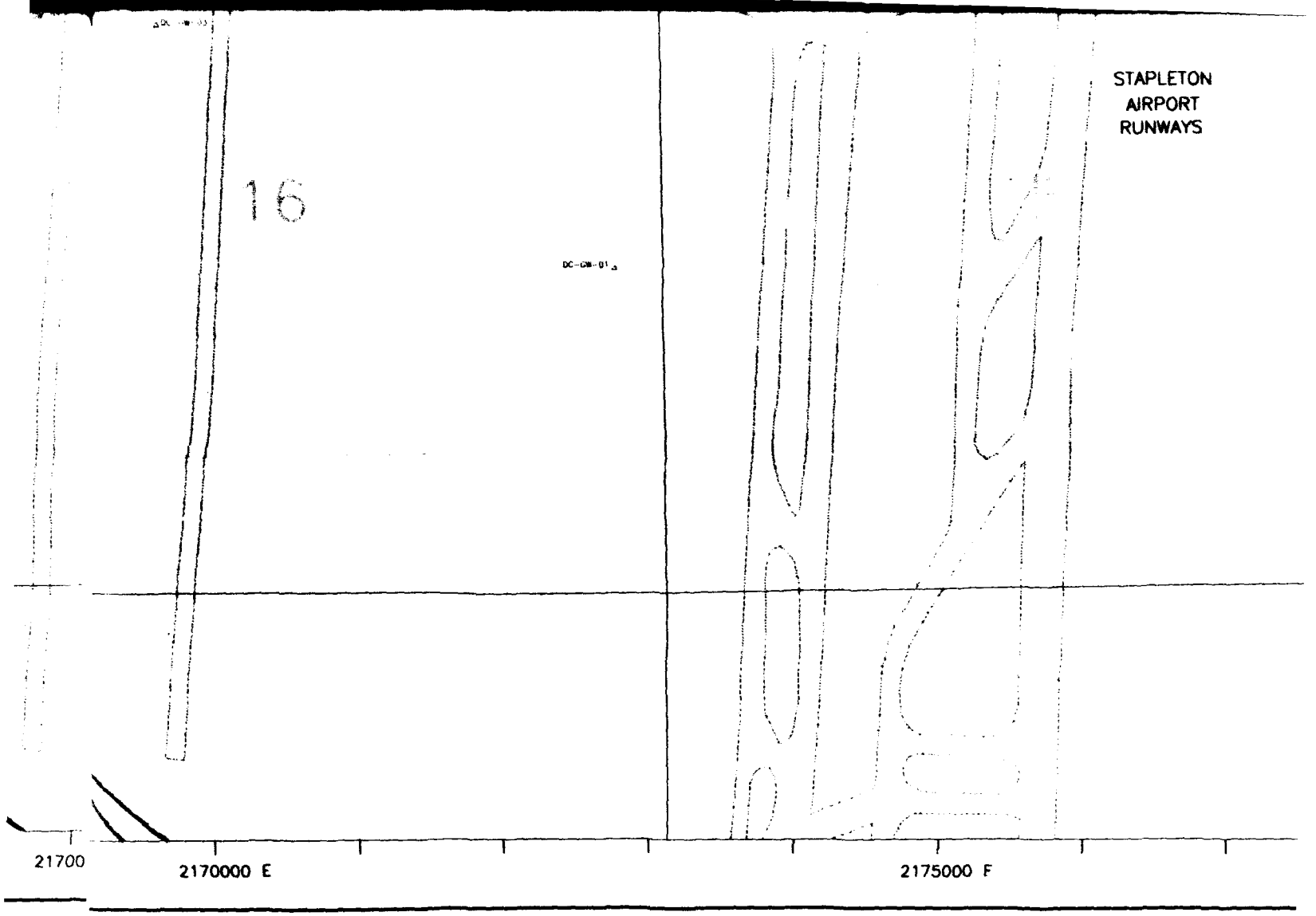
Ditch or Stream

Paved Road

Unpaved Road

Modified from R. L. Stollar & Associates, 1989.
Contributed to by D. P. Associates and TENTIME.

9/3/92 rma\newplate.dwg



EXPLANATION

Section Number

Arsenal Boundary

Railroad

△101 Alluvial Well

◊101 Arapahoe Well

○102 Unconfined Denver Formation We

□103 Confined Denver Formation Well

×104 Not Classified (DP Associates, O

44

STAPLETON
AIRPORT
RUNWAYS

2180000 E

Containment systems

Physical barrier

Hydraulic barrier

nver Formation Well

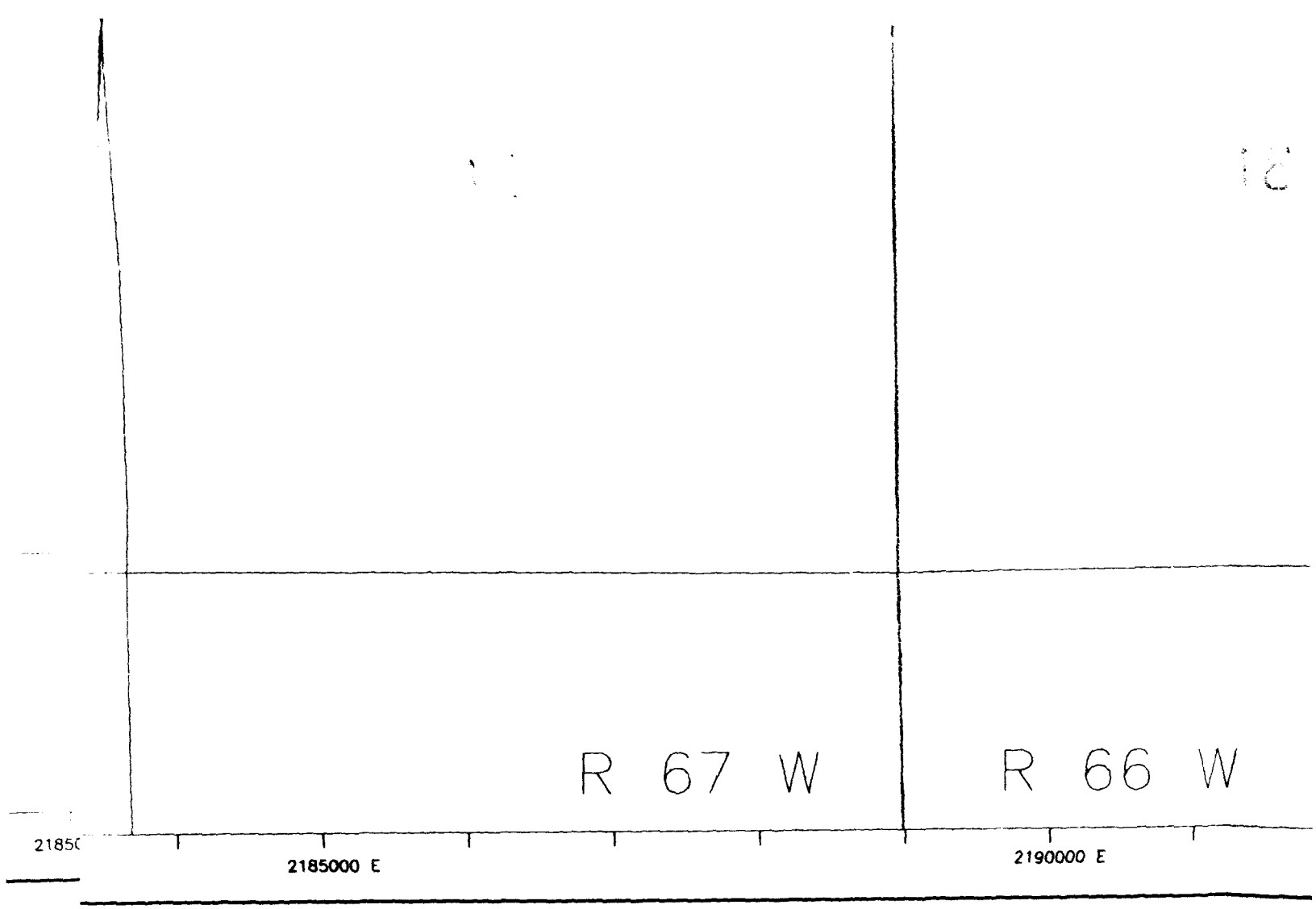
er Formation Well

Recharge trenches

(DP Associates, October 1991)

Barrier wall

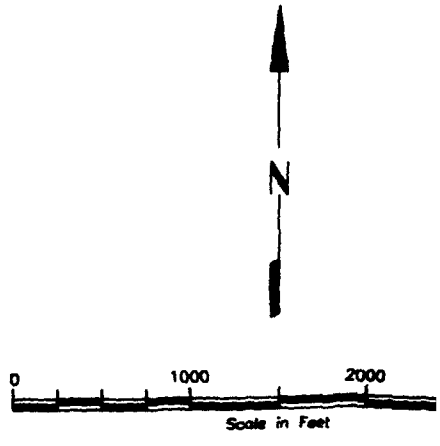
45



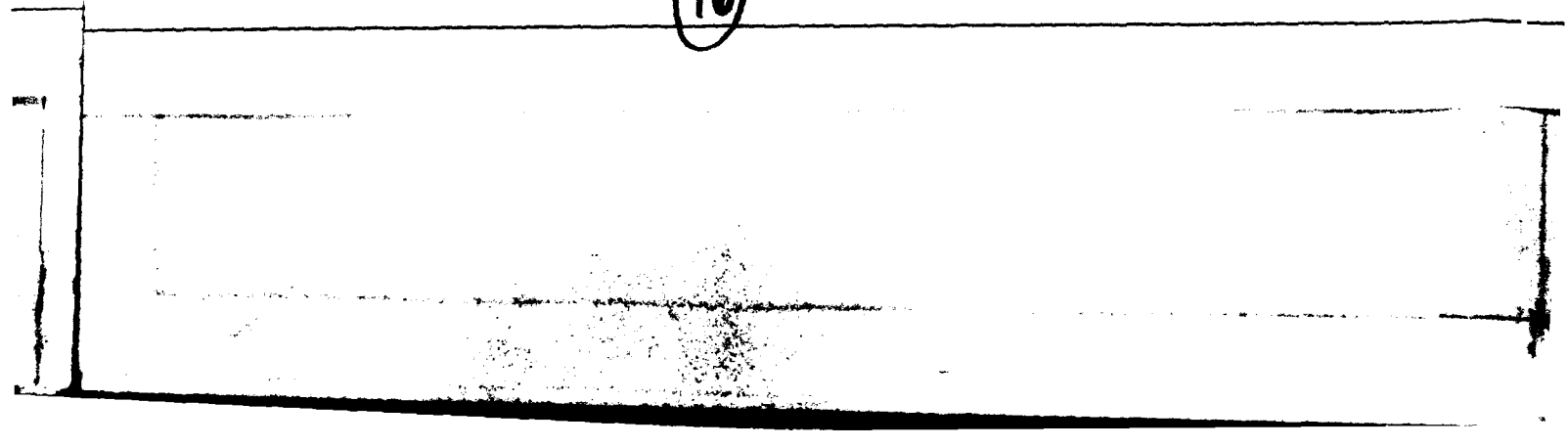
tems

Note:

The onpost well identification number shown have been abbreviated. The full well identification number contains the section number before the number shown on this map. For example, the complete well identification number for well 012 in onpost section 3 is 03012.



16

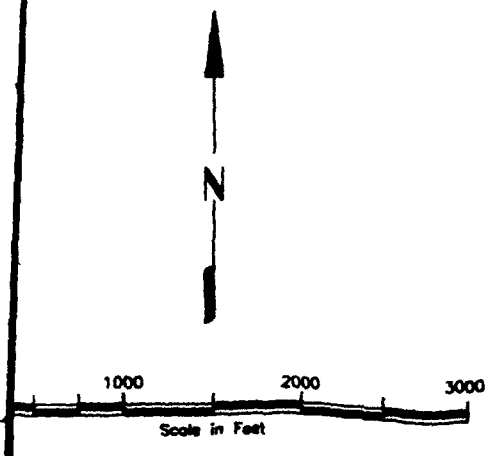


18

66 W

190000 E

2195000 E

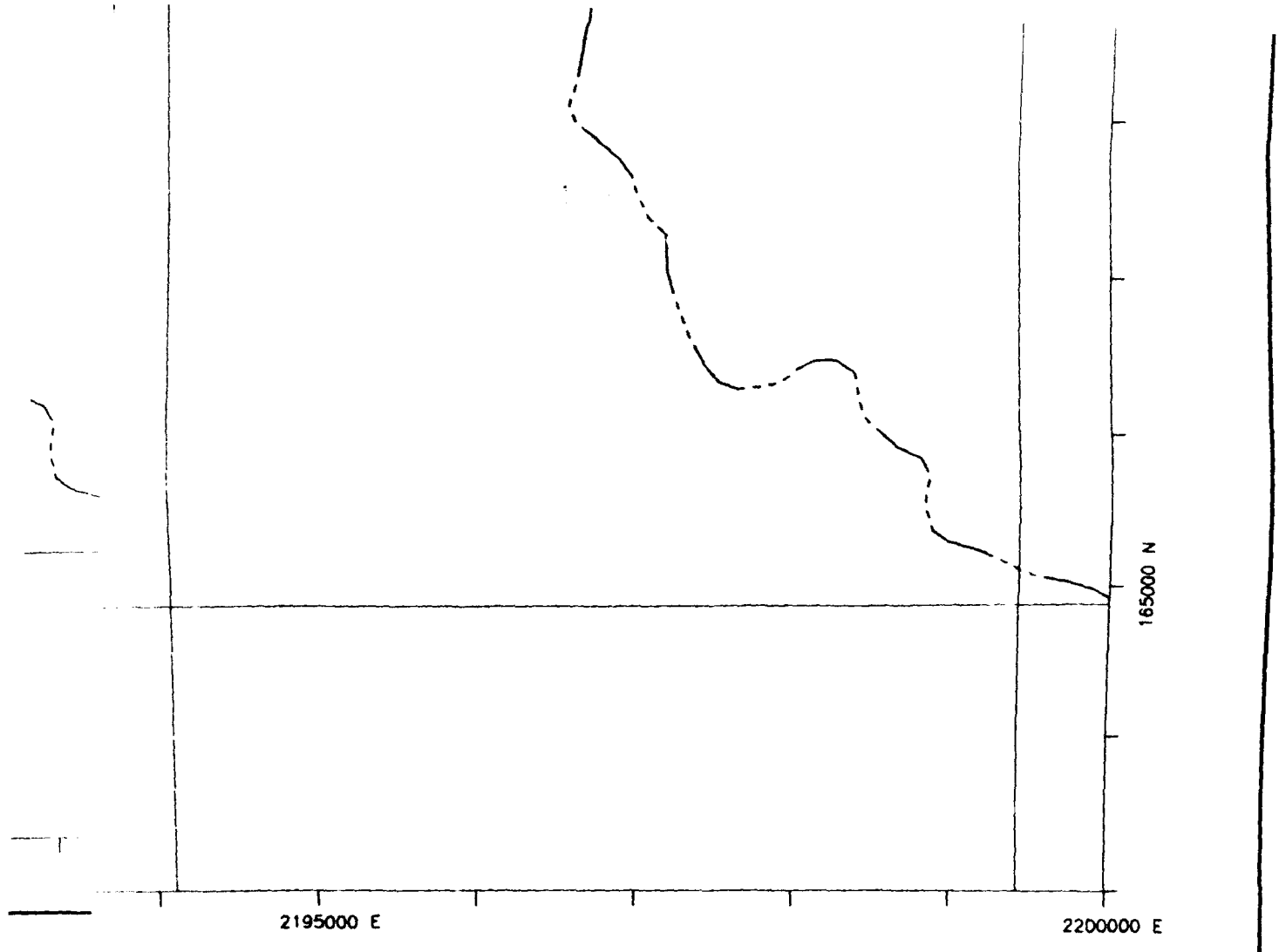


Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
Harding Lawson Associates

Plate 1

Comprehensive Monitoring Program
Regional Rocky Mountain Arsenal
Well Location Map, September 19

GWAR FY91



Prepared for:
Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

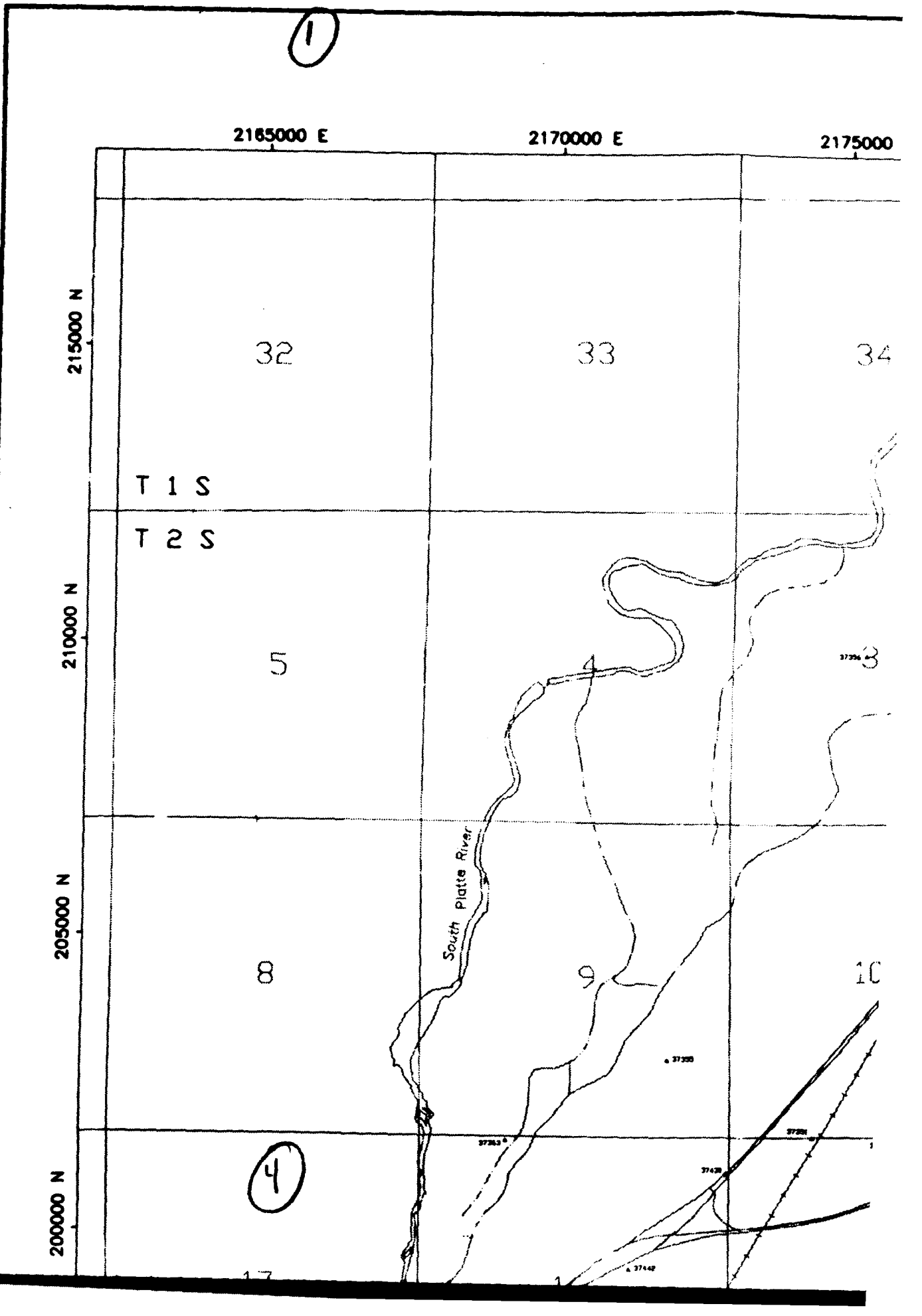
Prepared by:
Harding Lawson Associates

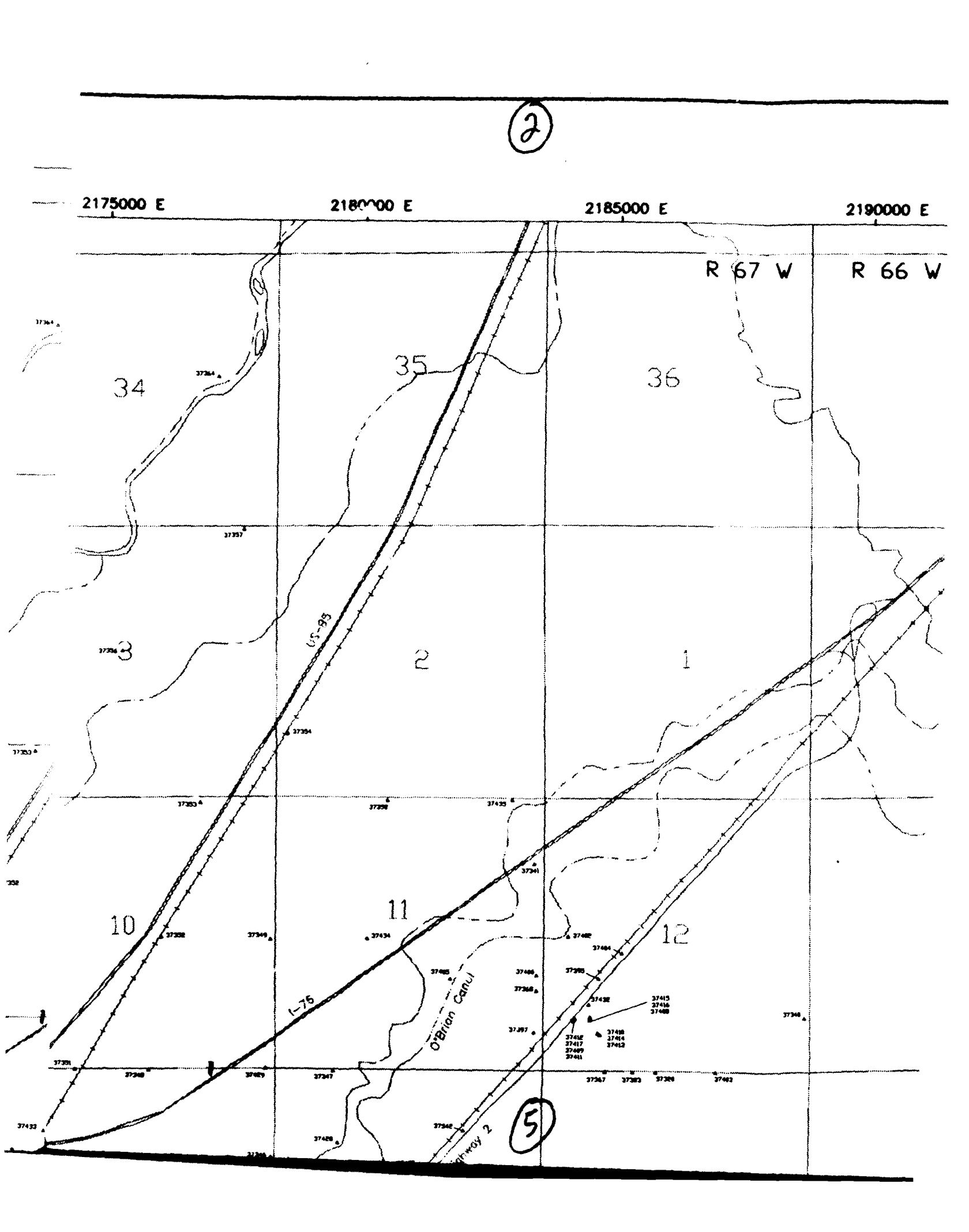
Plate 1

Comprehensive Monitoring Program
Regional Rocky Mountain Arsenal
Well Location Map, September 1992

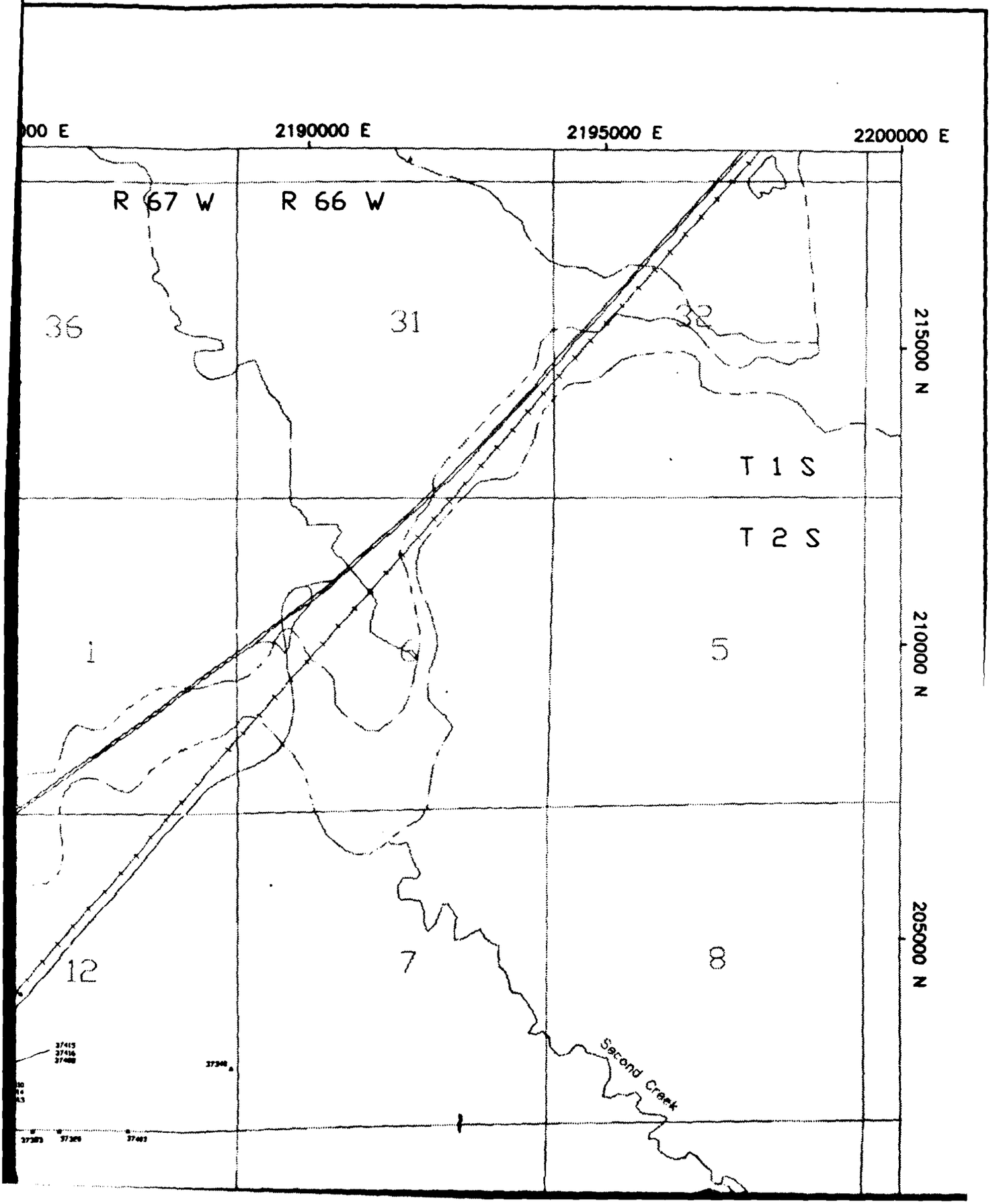
GWAR FY91

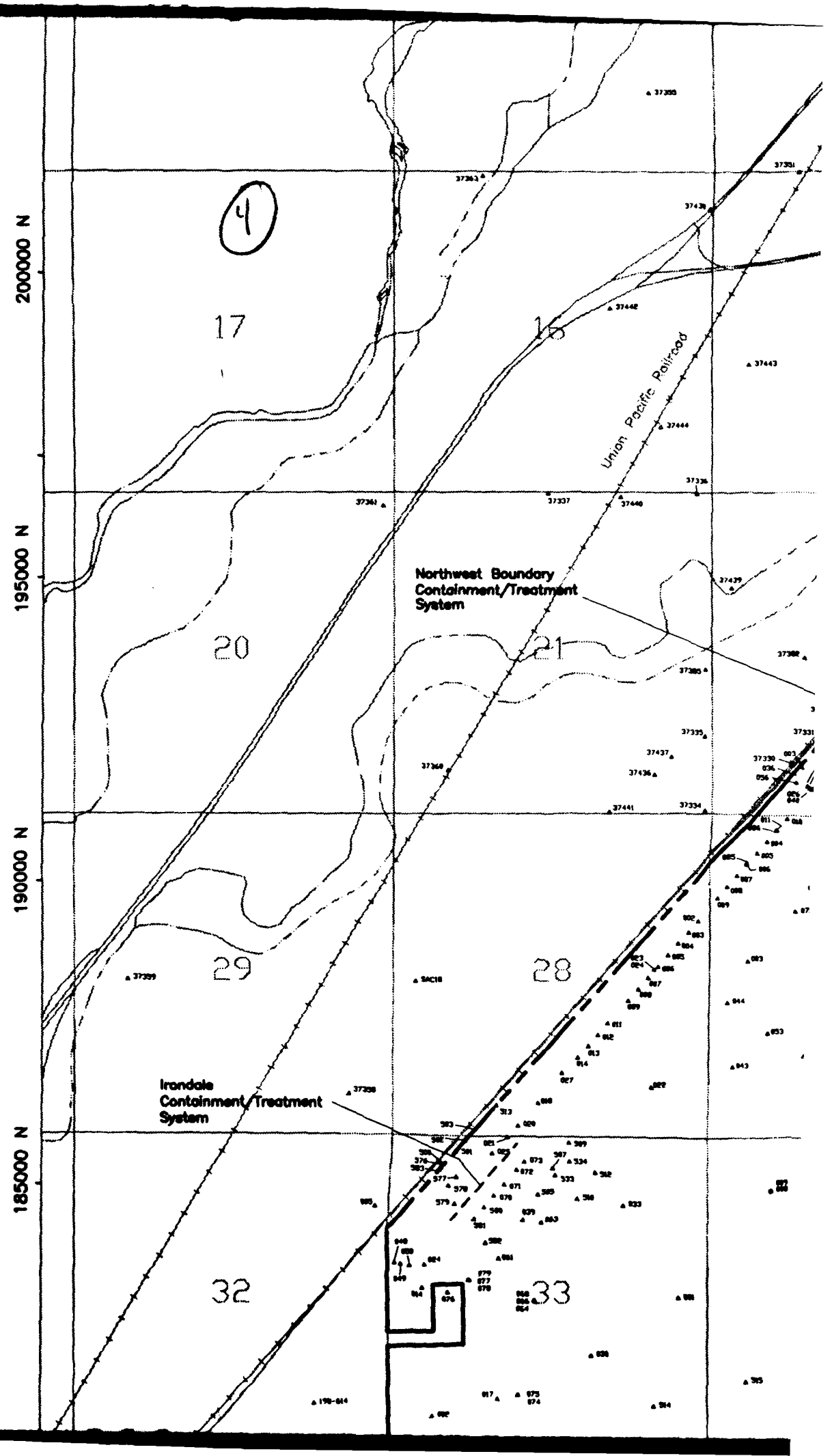
48

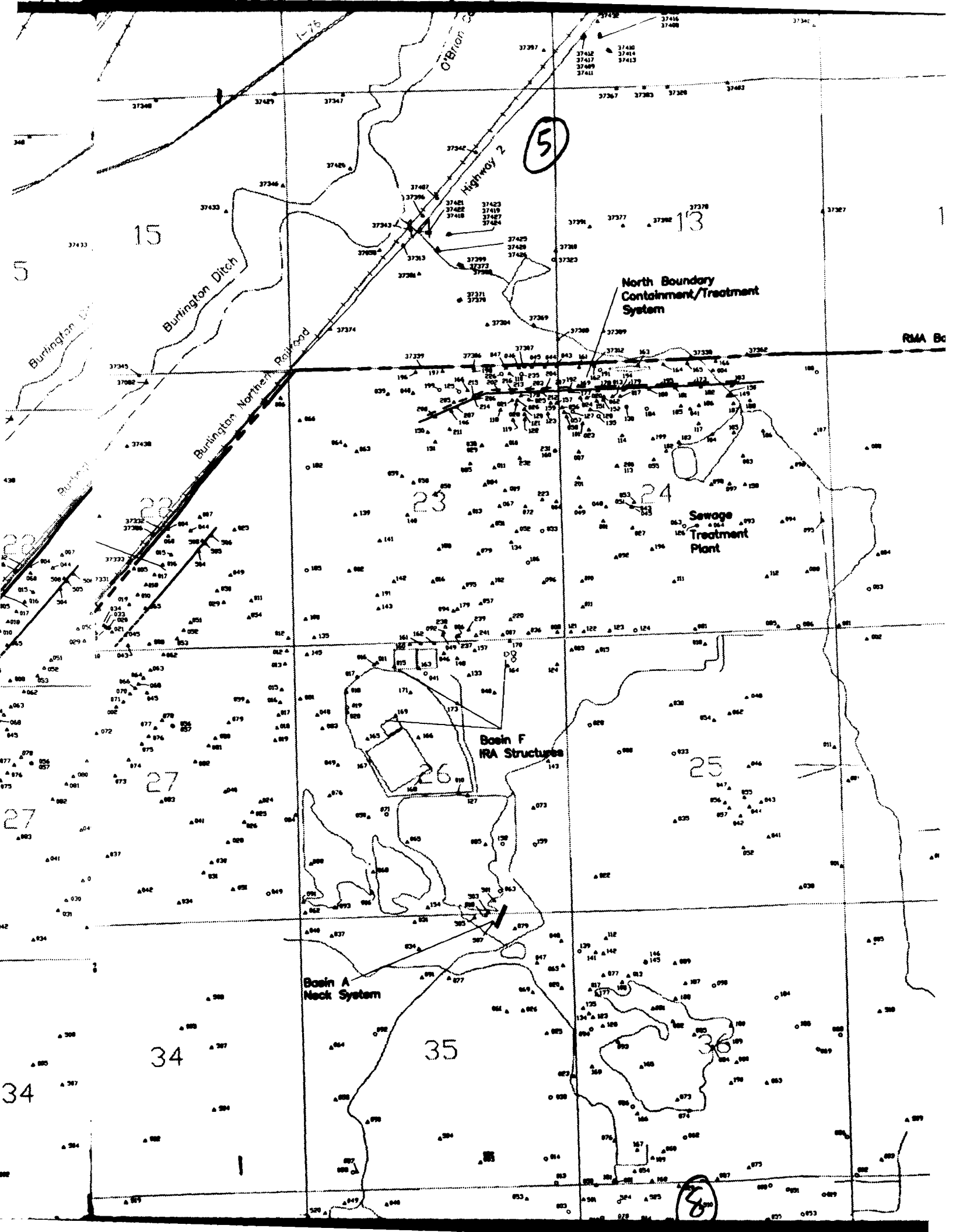

1
2165000 E
2170000 E
2175000
215000 N
210000 N
205000 N
200000 N
32
33
34
T 1 S
T 2 S
5
8
9
South Platte River
4

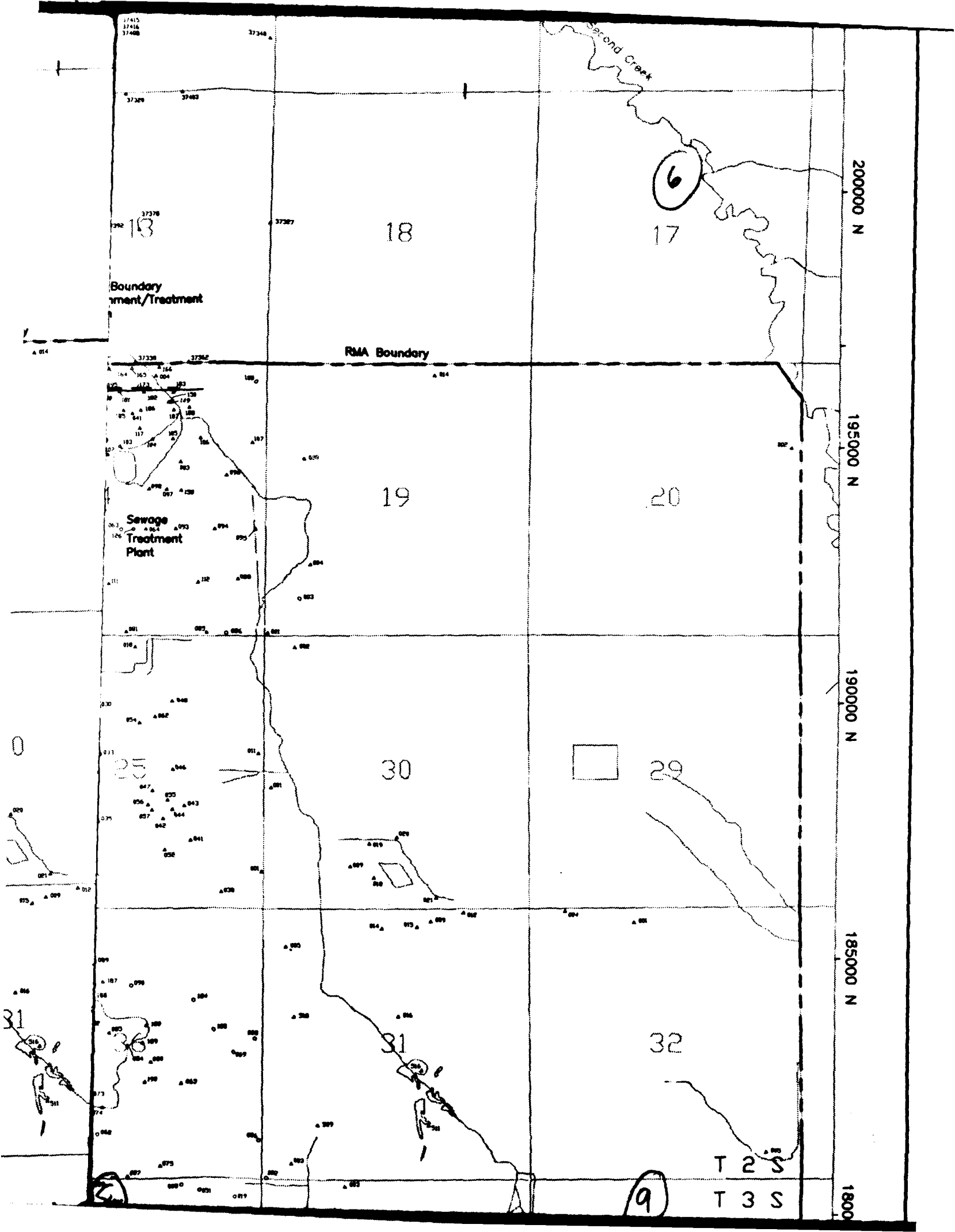

2175000 E
2180000 E
2185000 E
2190000 E
R 67 W
R 66 W
34
35
36
3
2
1
10
11
12
US-95
I-75
O'Brian Canal
2
5

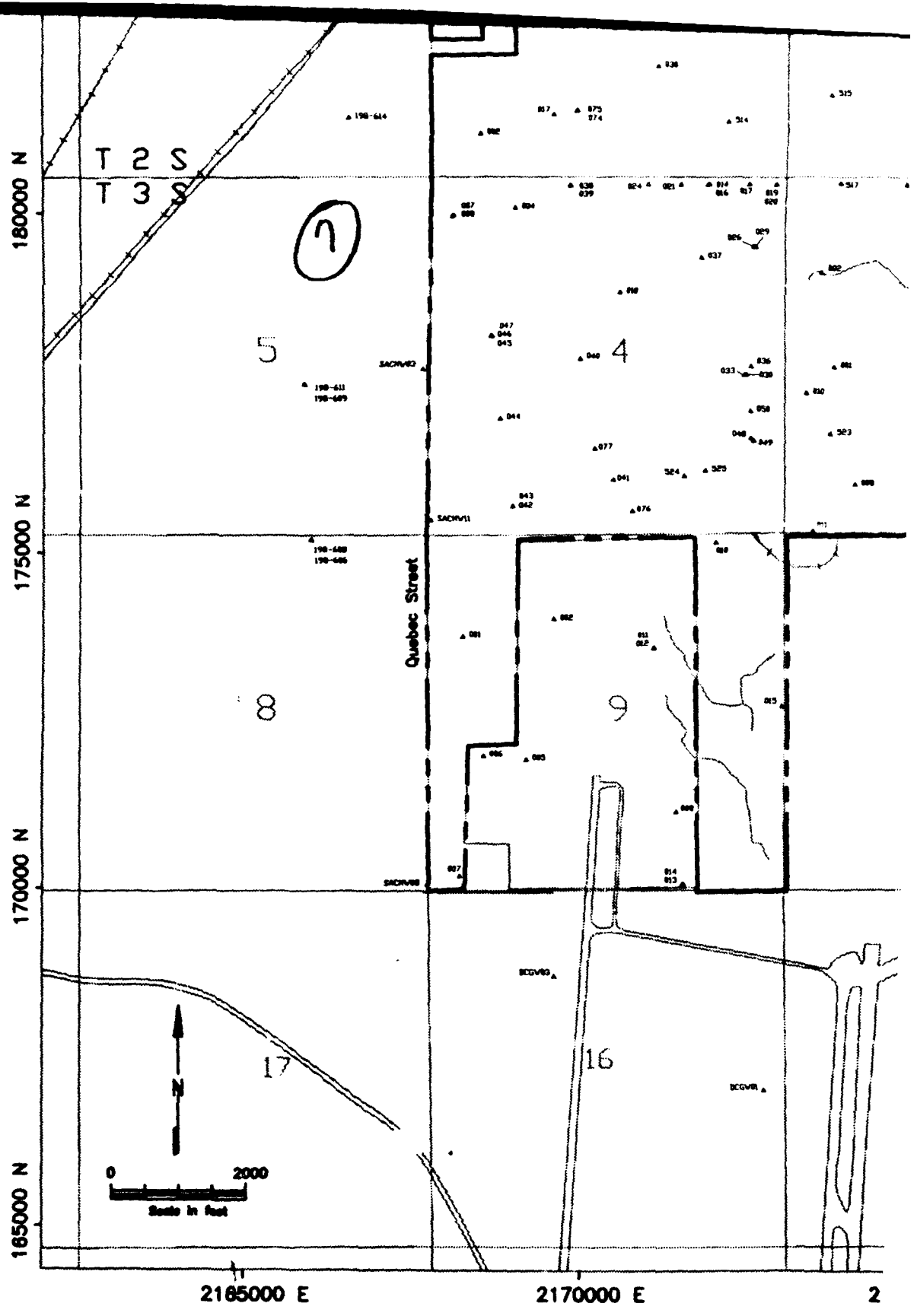
(3)


2190000 E
2195000 E
2200000 E
R 67 W
R 66 W
36
31
32
T 1 S
T 2 S
1
6
5
12
7
8
215000 N
210000 N
205000 N
Second Creek


4
200000 N
195000 N
190000 N
185000 N
17
16
20
21
29
28
32
33
Union Pacific Railroad
Northwest Boundary
Containment/Treatment
System
Irondale
Containment/Treatment
System

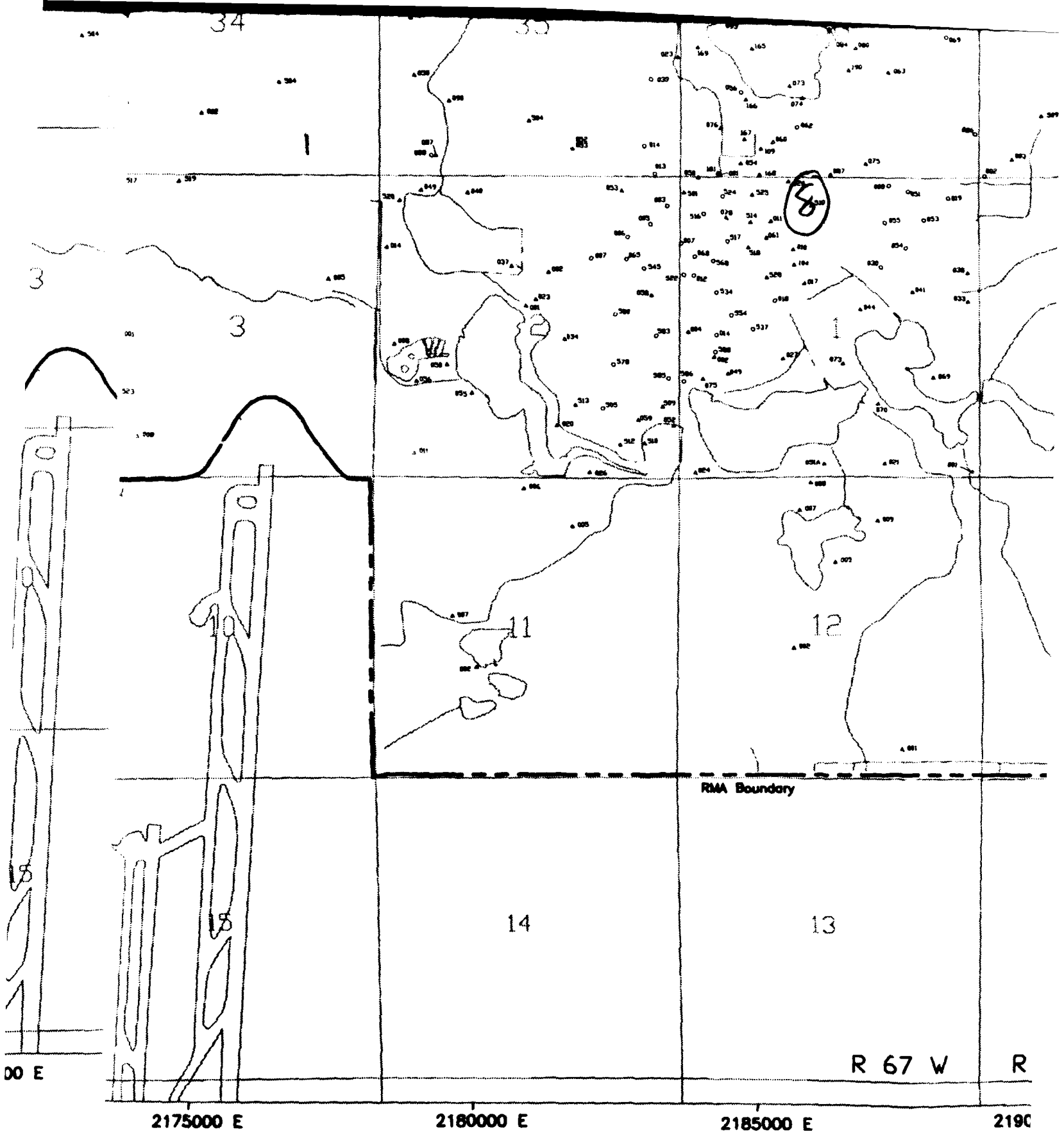

I-76
O'Brian Ditch
Highway 2
Burlington Ditch
Burlington Northern Railroad
North Boundary
Containment/Treatment
System
RMA Bo
Sewage
Treatment
Plant
Basin F
IRA Structures
Basin A
Neck System
15
13
23
24
22
27
26
25
34
35
36
1
5
8


Second Creek
18
17
19
20
30
29
32
31
RMA Boundary
Sewage
Treatment
Plant
200000 N
195000 N
190000 N
185000 N
T 2 S
T 3 S



EXPLA

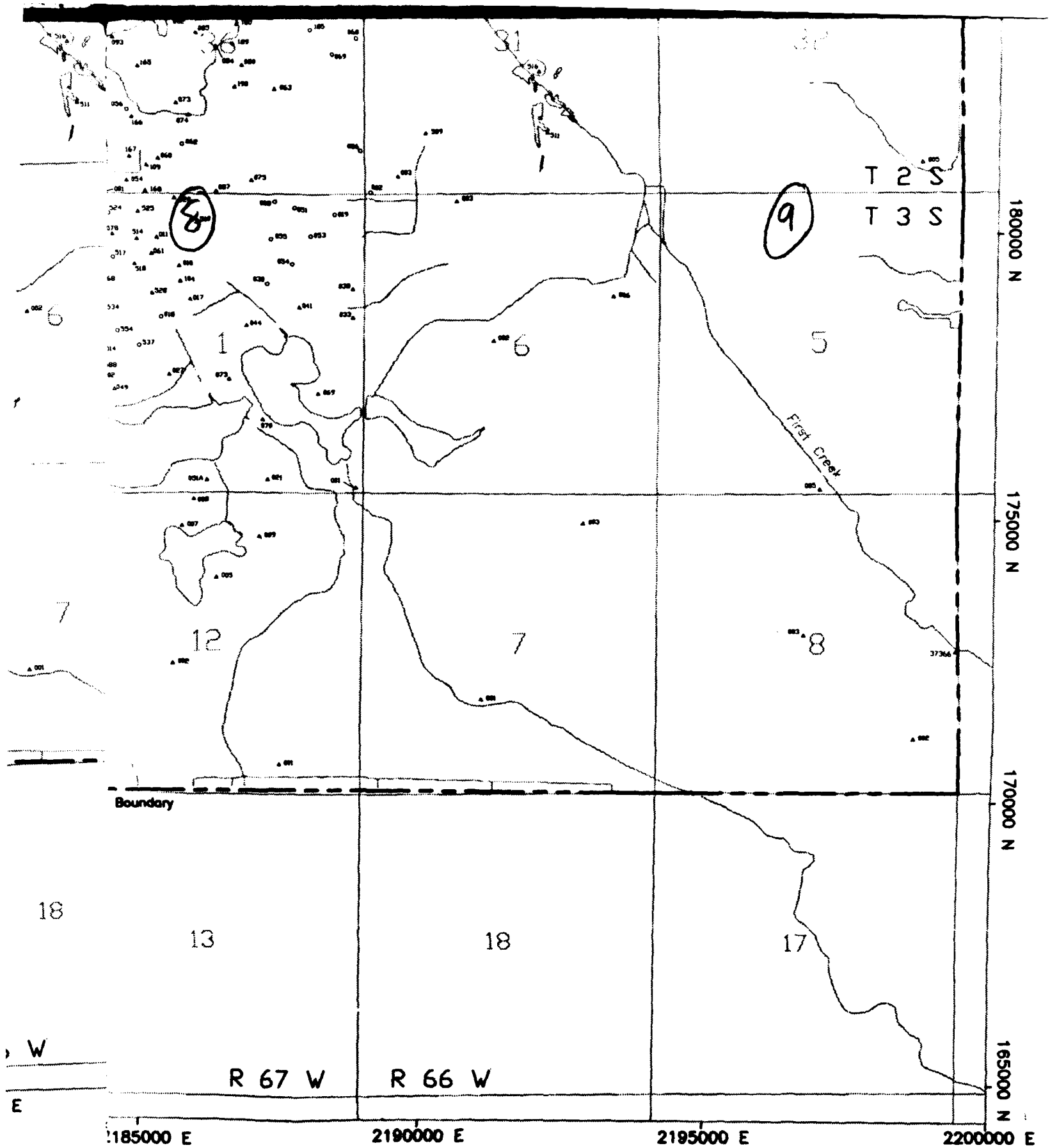
Unconfined flow system



ATION

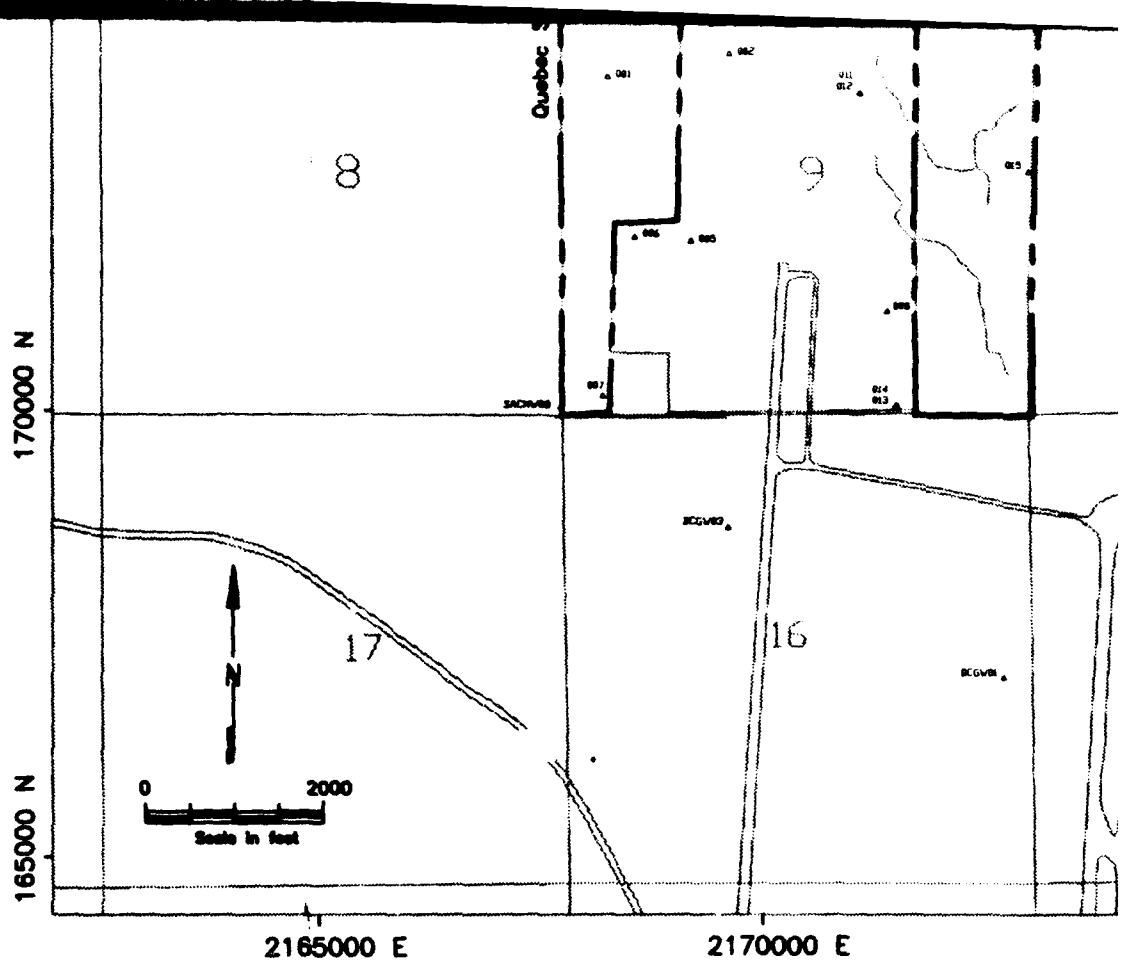
PLANATION

Containment system



Prep

Prepared for:
Program Manager for
Rocky Mountain Arsenal

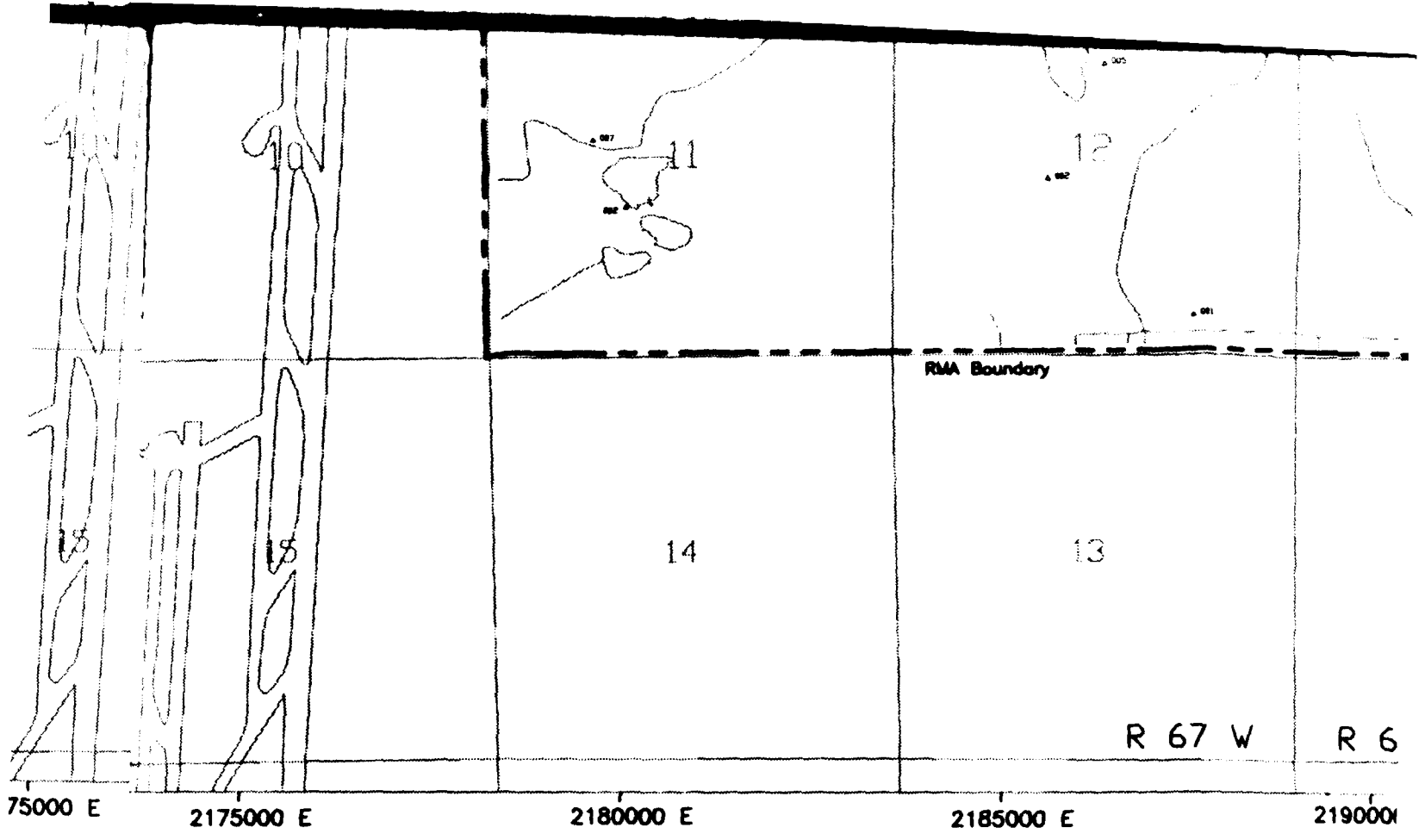


EXPL

Unconfined flow system

- Alluvial wells
- Denver wells
- × Not classified (D.P. Associates, October 1991)

Note: For onpost wells, the section number the three-digit well number shown (i.e., wells in Section 3 – 03001)



NATIPLANATION

Containment system

Physical barrier

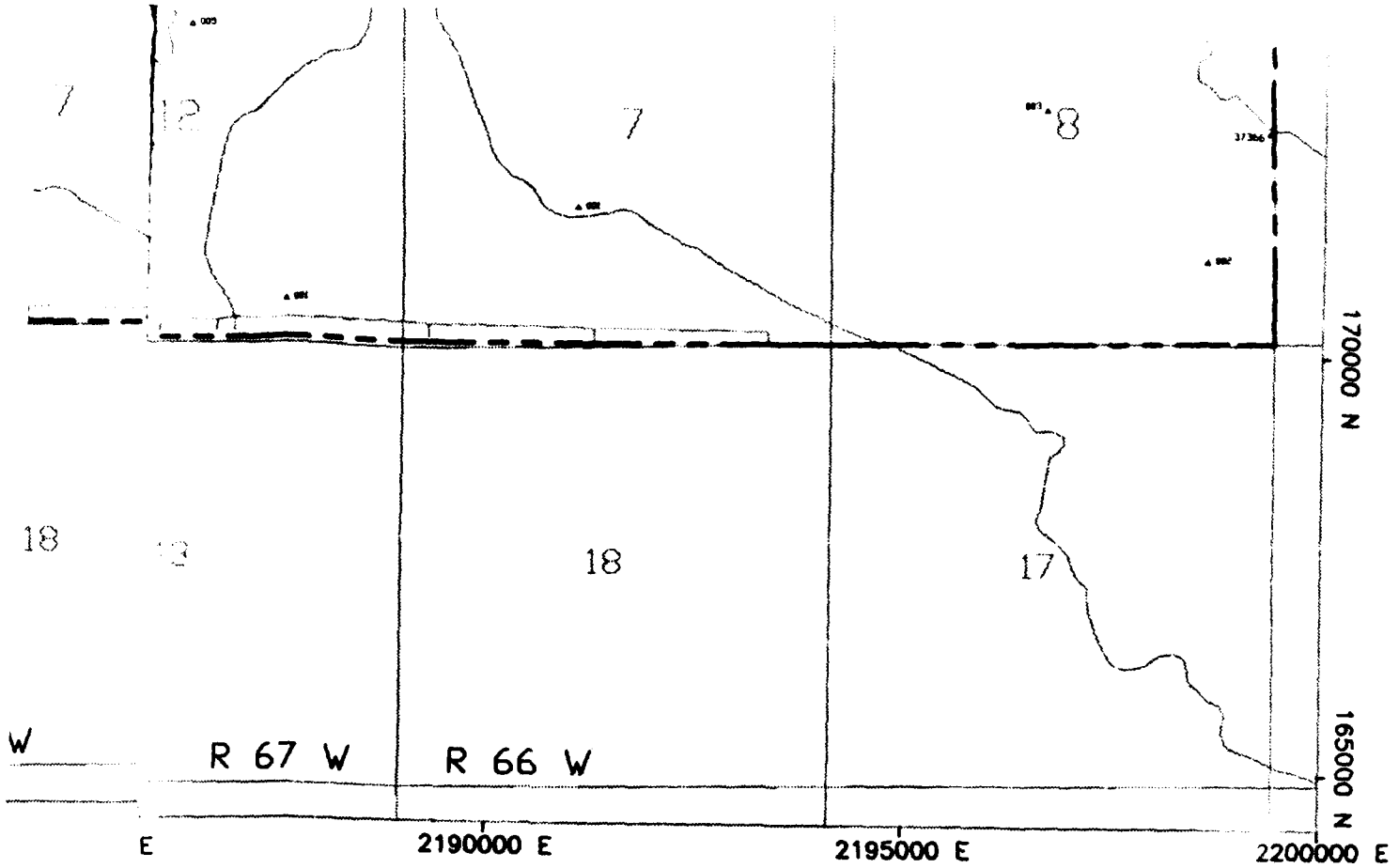
Hydraulic barrier

Recharge trenches

Barrier wall

cedes r precedes

11



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Prepa

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nches

Plate

Winter
Monito
Groun

GWAR F

Prepared for:

Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by:

Harding Lawson Associates

Plate 2

Winter 1990/1991 Water-level Monitoring Network, Unconfined Groundwater Flow System

GWAR FY91

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