HYDROLOGIC MONITORING FOR SHIRLEY BASIN'S TAILINGS
SEEPAGE CONTROL PLAN

C01

2004 Annual Hydrologic Report

HYDROLOGIC MONITORING FOR SHIRLEY BASIN'S TAILINGS SEEPAGE CONTROL PLAN

PREPARED FOR:

PATHFINDER MINES CORPORATION

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TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS - APPENDICES

TABLE OF CONTENTS - TABLES

Page Number

TABLE OF CONTENTS - FIGURES

TABLE OF CONTENTS - FIGURES
(continued)

TABLE OF CONTENTS - FIGURES
(continued)

Page Number

1.0 SUMMARY AND INTRODUCTION

1.1 SUMMARY

1. The recharge lines and fresh-water injection wells have created hydrologic mounds in the Surficial aquifer that have caused seepage gradient reversal toward the collection wells, as originally intended. The operation of fresh water injection wells along the No. 5 dam crest was terminated in late 2003 to allow construction work on the tailings to proceed. The gradient reversals can be measured along the northeastern and southeastern length of the Surficial aquifer where tailings seepage is primarily occurring. Reversal in this area has been enhanced by the use of water from wells WW20, WW23, WW22 and MC-2 (see Section 3). Gradient reversal was restored in late 1997 and was maintained through 2004, although gradient reversal for the area south of Mine Creek has weakened dramatically due to a reduction in the rate of fresh-water injection in this area.

2. Concentrations of seepage constituents in the Surficial aquifer in the Mine Creek area have improved upgradient of the recharge lines north and south of Mine Creek. Gradient reversal was maintained for the immediate Mine Creek area and north of Mine Creek during 2004. There was no substantial change in restoration for these areas during 2004. The seepage front has been pulled back to close proximity to the collection wells and the collection/recharge system is functioning as a seepage containment system.

3. Surface water monitoring in Spring Creek does not indicate measurable environmental impact from tailings seepage in 2004 because of improvement of water quality in the Surficial aquifer. Comparative data are included in Section 5.0.

4. White River aquifer monitoring continues to indicate no impacts that can be attributable to tailings seepage (see Section 6.0). However, current and previous years' monitoring data from well WH-9 has shown elevated TDS, Cl and SO_4 concentrations. This is thought to be a localized phenomenon.

5. There was no operation of the enhanced evaporation system during 2004 due to the rapidly declining volume in the evaporation ponds following termination of pumping of tailings wells. All transferable water on the tailings surface has been moved to the evaporation ponds in the northwestern part of Tailings Pond No. 5.

6. The tailings dewatering program was discontinued in late 2003 to allow tailings reclamation to proceed. A limited number of tailings wells have been preserved to allow future monitoring of tailings water level.

7. Surficial collection wells near the center of the tailings impoundment were pumped until late 2003. Extraction of the seepage-impacted water beneath the tailings reduces the migration of contaminants beyond the tailings area.

8. A significant portion of the Surficial collection water has been separated and discharged to the Industrial Pond for use within the restricted area. This has been done with rigorous monitoring of the water quality.

9. Water levels in the Surficial aquifer continue to decline. Although a portion of this decline can be attributed to reduced fresh-water injection, the decline also occurred in wells that are not affected by the corrective action efforts.

1.2 INTRODUCTION

Figure 1.2-1 presents the major tailings area features. These include the Mine Creek area, where the original recharge and collection systems were installed. The recharge system, installed during the summer of 1986, was constructed to supply water to insure continuous seepage gradient reversal in the Mine Creek area (see Figure 1.2-1). This has been accomplished and continues to contain tailings seepage close to the downgradient edge of the No. 5 tailings dam on the southeast end. Subsequent additions and modifications to the seepage containment and aquifer restoration system have continued and expanded restoration efforts. A number of reports have already been prepared and submitted to the NRC which document the purposes and development of the recharge and collection system. This is the latest in this series of reports, which is provided in accordance with SUA-442, Condition 47. The site standards for thirteen constituents are presented in Table 1.2-1. Site standards for uranium, thorium-230, selenium and Ra-226 +Ra-228 are adjusted to reflect pending approval of proposed ACL's at point-of-compliance wells RPI-19B and NP01. Proposed ACL's for chloride, TDS, and sulfate are also presented in Table 1.2-1. Table 1.2-1 also presents predicted maximum POE concentrations as well as Wyoming livestock standards and a listing of wells that exceed the site standards.

This report is divided into eight main sections. Section 2 discusses the Mine Creek area pumping operations. Sections 3, 4, 5, and 6 discuss various monitoring results. Section 7 addresses changes to the seepage containment and aquifer restoration system. Section 8 addresses tailings dewatering and evaporation of tailings solution. Section 9 addresses recommendations for continued aquifer restoration. Appendix A presents a tabulation of Surficial water quality data. Appendix B presents a tabulation of White River, Wind River, and Tailings water quality data. Appendix C presents a tabulation of Surface water quality data.

Pending approval of ACL's, Pathfinder will continue to monitor the efficiency of the recharge system and compile annual reports. These reports will document the previous year's results and describe any modifications to the system.

TABLE 1.2-1. GROUND-WATER PROTECTION STANDARDS FOR POINT-OF-COMPLIANCE WELLS NP01 AND RPI-19B.

CONSTITUENT	¶ POC WELL RPI-19B SITE STANDARD	¶ POC WELL NPO1 SITE STANDARD	CURRENT SITE STANDARD	PREDICTED POE CONCENTRATION FOR ACL's	WYOMING LIVESTOCK STANDARD	SURFICIAL AQUIFER WELLS THAT EXCEED SITE STANDARD
ARSENIC	0.05	0.05	0.05	—	0.2	*@
BARIUM	1.00	1.00	1.00	—	---	*
BERYLLIUM	0.02	0.02	0.02	—	---	*
CADMIUM	0.01	0.01	0.01	—	0.05	Concentration in a sample from well P-11 exceeds the site standard
CHROMIUM	0.05	0.05	0.05	—	0.05	*@
GROSS ALPHA	15	15	15	—	15	WWL-14B
LEAD	0.05	0.05	0.05	—	0.1	*@
MOLYBDENUM	0.10	0.10	0.10	—	---	*
NICKEL	0.05	0.05	0.05	—	---	P-11, WWL-4A and WWL-14B
RA-226 + RA-228	13.76	12.70	5	1.5	5	Concentration in eight wells exceeds the livestock standard, and concentration in five wells exceeds the ACL site standards and the livestock standard.
SELENIUM	0.158	0.163	0.01	0.0056	0.05	Concentration in seven wells exceeds the livestock standard and concentration in well WWL-13B exceeds the ACL site standards and the livestock standard.
THORIUM-230	5.76	5.53	0.3	0.3	---	Concentration in wells TW5-2B and TWI-8 exceeds the ACL site standards.
URANIUM	4.45	4.40	0.07	0.15	5	Concentration in well WWL-13B exceeds the ACL site standards and the livestock standard.
	ADDITIONAL ALTERNATE CONCENTRATION LIMIT CONSTITUENTS					
CHLORIDE	3712	3275	—	118	2000	Concentration in four wells exceeds the livestock standard, and concentration in five wells exceeds both the smaller ACL site standard and the livestock standard.
TDS	12641	11529	—	649	5000	Concentration in six wells exceeds the livestock standard, and concentration in seven wells exceeds both the smaller ACL site standard and the livestock standard.
SULFATE	5056	4612	—	183	3000	Concentration in two wells exceeds the livestock standard, and concentration in one well exceeds both the smaller ACL site standard and the livestock standard.

NOTE: ¶ = Standards based on the approval of ACL
• = All concentrations are below ACL site standard
@ = All concentrations are below Wyoming livestock standard
All concentrations in mg/l except for radium and thorium in pCi/l.

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SHIRLEY BASIN MINE

FIGURE 1.2-1. TAILINGS AREA LOCATION MAP

SCALE: 1" = 500'

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2.0 MINE CREEK AREA PUMPING OPERATIONS

2.1 COLLECTION WELL PUMPING

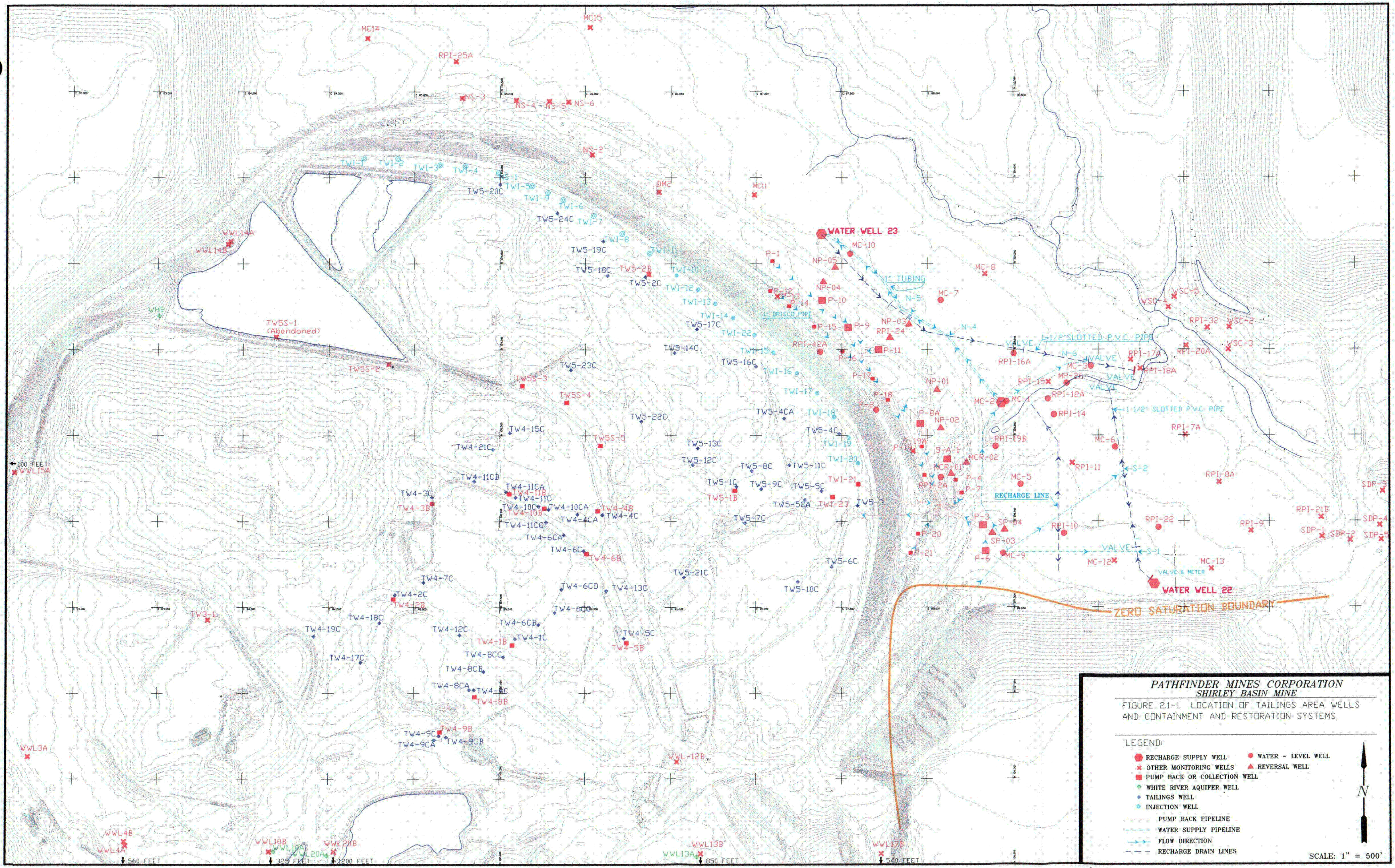
Nineteen pumpback (collection) wells, 5A-1, P1, P3, P4, P7, P6, P8A, P9, P10, P11, P12, P14, P15, P16, P17, P18, P19A, P20 and P21, were pumped during 2004. Table 2.1-1 shows the recommended water levels, locations of the pump intakes, and average discharge rates for each pumpback well. Figure 2.1-1 presents the locations of the wells and recharge lines.

TABLE 2.1-1. RECOMMENDED COLLECTION WELL PUMPING LEVELS AND OBSERVED RATES.

WELL NO.	RECOMMENDED PUMPING WATER LEVEL (FT-MP)	PUMP INTAKE LEVEL (FT-MP)	AVERAGE YEARLY DISCHARGE (GPM) 2004
5A-1	15.0	19.0	0.45
P1	30.0	36.7	0.23
P3	26.0	26.5	3.51
P4	--	--	0.71
P6	26.0	29.0	0.37
P7	15.5	27.0	0.69
P8A	25.0	28.7	5.36
P9	40.0	47.5	0.31
P10	36.5	37.1	0.42
P11	35.0	35.6	0.30
P12	32.0	--	0.40
P14	34.0	--	1.18
P15	38.0	--	0.22
P16	37.0	--	0.25
P17	33.0	--	0.55
P18	34.0	--	0.60
P19A	--	--	1.01
P20	32.0	--	0.44
P21	29.0	--	2.79
TOTAL GPM			19.79

Note: FT = feet
MP = measuring point
GPM = gallons per minute

The pumpback collection system has averaged about 19.8 gpm during the year. This is approximately a 21% reduction from the 2003 yield. There was no additional tailings area Surficial aquifer collection in 2004.


PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 2.1-1 LOCATION OF TAILINGS AREA WELLS AND CONTAINMENT AND RESTORATION SYSTEMS.
LEGEND:
RECHARGE SUPPLY WELL
OTHER MONITORING WELLS
PUMP BACK OR COLLECTION WELL
WHITE RIVER AQUIFER WELL
TAILINGS WELL
INJECTION WELL
WATER - LEVEL WELL
REVERSAL WELL
PUMP BACK PIPELINE
WATER SUPPLY PIPELINE
FLOW DIRECTION
RECHARGE DRAIN LINES
SCALE: 1" = 500'
N
WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY
RECHARGE LINE
1 1/2" SLOTTED P.V.C. PIPE
1" TUBING
VALVE
VALVE & METER
TW5S-1 (Abandoned)

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2.2 RECHARGE WELL PUMPING

Pathfinder Mines has injected White River water and Wind River water into the Surficial aquifer to aid the collection system and create a hydraulic barrier. White River wells WW23, WW22 and MC-2 and Wind River well WW20 are used to supply this injection water. The use of water from well WW20 was discontinued in 2003, and pumping was restarted in well WW22. Well MC-2 has also been pumped to supply additional injection water. Table 2.2-1 presents the recommended pumping levels for these recharge wells and some observed pumping rates to the recharge system for 2004. The tabulated discharges represent the average over the year rather than the typical instantaneous discharge.

TABLE 2.2-1. RECOMMENDED RECHARGE SUPPLY WELL PUMPING LEVELS AND OBSERVED RATES.

WELL NO.	RECOMMENDED MAX. WATER LEVEL (FT-MP)	PUMP INTAKE LEVEL (FT-MP)	OBSERVED DISCHARGE (GPM) JANUARY - DECEMBER 2004
WW22	150	158	5
WW23	183	185	12
WW20			--
MC-2			10
TOTAL GPM			27

NOTE: FT = feet
MP = measuring point
GPM = gallons per minute

3.0 TAILINGS AREA AQUIFERS

Table 3.0-1 presents well data for Surficial aquifer wells, Table 3.0-2 presents well data for tailings wells and Table 3.0-3 presents well data for White River aquifer wells in the tailings area. Table 3.0-4 presents well data for Wind River aquifer well WW20. A number of wells located on the tailings system were abandoned during 2004 due to the ongoing tailings reclamation. Abandoned wells were entirely backfilled with bentonite chips (clay).

TABLE 3.0-1. BASIC WELL DATA FOR THE SURFICIAL AQUIFER WELLS.

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
5A-1	108363	88117	21.7	5.0	2.1	7045.81	18-19	3-5
DM-2	109920	86340	46.0	2.0	3.1	7063.00	3-46	0-3
MC01	108702	88470	37.0	6.0	2.2	7043.80	0-37	0-11
MC03	108913	88962	41.5	6.0	3.5	7042.90	0-19	13-15
MC05	108216	88551	47.0	6.0	1.2	7053.10	37-48	25-26
MC06	108437	89107	44.0	6.0	1.7	7046.01	0-38	-
MC07	109296	88091	39.6	6.0	1.1	7049.61	0-40	-
MC08	109444	88336	28.7	6.0	1.1	7045.74	0-25	-
MC09	107818	88447	33.9	6.0	1.9	7056.81	10-37	0-4
MC10	109566	87557	35.5	6.0	1.5	7052.60	0-30	-
MC11	109895	87002	56.5	5.0	1.7	7056.51	0-48	-
MC12	107771	89094	38.0	5.0	1.8	7053.30	0-38	-
MC13	107728	89656	37.6	5.0	2.8	7047.40	0-37	-
MC14	110805	84735	60.1	5.0	2.5	7084.71	0-57	-
MC15	110868	86036	61.7	5.0	1.4	7060.51	0-68	-
MCR01	108275	88145	30.6	2.0	1.5	7042.55	26-29	23-24
MCR02	108349	88239	44.1	2.0	1.6	7046.16	39-42	37-38
MP-26	108783	89129	—	2.0	—	7033.59	-	-
NP01	108770	88056	26.9	2.0	2.1	7051.81	22-24	18-20
NP02	108540	88078	29.7	2.0	1.1	7052.88	21-27	22-23
NP03	109145	87894	23.0	2.0	1.0	7051.07	19-21	16-17
NP04	109392	87392	39.1	2.0	2.3	7055.87	24-27	19-21
NP05	109475	87460	28.9	2.0	2.4	7055.37	21-25	18-21
NS-1	110023	85504	98.1	5.0	1.7	7107.60	76-96	30-58
NS-2	110128	86051	48.8	5.0	1.4	7067.00	8-47	0-5
NS-3	110459	85290	81.0	4.0	1.7	7080.90	39-79	0-53
NS-4	110445	85606	41.9	2.0	1.7	7070.30	20-40	0-10
NS-5	110440	85801	52.5	4.0	1.4	7066.60	11-51	0-10
NS-6	110436	85912	41.9	2.0	2.0	7065.20	20-40	0-25
P-1	109319	87107	37.1	5.0	1.6	7058.12	25-27	21-22
P-10	109289	87383	39.5	5.0	1.3	7055.30	36-37	28-29
P-11	108997	87715	38.5	5.0	0.8	7052.40	33-36	22-23
P-12	109340	87084	36.4	5.0	1.5	7060.69	16-36	0-11
P-13	109311	87125	41.1	2.0	1.2	7059.41	20-40	0-10
P-14	109254	87192	37.6	5.0	1.3	7059.07	16-36	0-11
P-15	109134	87340	41.0	5.0	1.4	7056.96	21-41	0-10
P-16	108991	87503	39.9	5.0	1.7	7055.87	18-38	0-9
P-17	108830	87679	36.3	5.0	1.2	7057.25	25-35	0-10
P-18	108707	87772	37.2	4.0	1.4	7056.77	16-36	0-10
P-19	108408	87919	25.3	4.0	1.1	7055.66	14-34	0-5
P-19A	—	—	—	—	—	—	-	-
* P-2	108657	87704	40.9	5.0	1.3	7054.10	38-39	34-35
P-20	107927	87947	34.5	5.0	1.8	7053.14	12-32	0-10
P-21	107817	87904	32.3	5.0	2.2	7056.14	10-30	0-8
P-3	107975	88315	29.6	5.0	1.7	7056.30	25-27	14-15
P-4	108239	88172	—	—	—	—	-	-
P-6	107846	88346	29.9	5.0	1.8	7058.20	28-30	19-21

TABLE 3.0-1. BASIC WELL DATA FOR THE SURFICIAL AQUIFER WELLS. (cont'd.)

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
P-7	108169	88203	32.2	5.0	1.2	7047.10	28-30	24-26
P-8A	108571	87957	30.3	5.0	1.0	7051.40	27-29	22-24
P-9	109127	87537	48.7	5.0	0.9	7053.90	46-48	41-42
RPI-10	107396	88813	25.4	1.3	0.7	7049.41	23-26	14-15
RPI-11	108339	88850	32.4	1.3	1.2	7049.70	29-31	22-24
RPI-14	108625	88752	11.8	1.3	0.4	7041.90	9-11	6-7
RPI-15	108812	88708	20.0	1.3	1.3	7039.60	18-20	15-17
RPI-15A	108000	88700	8.0	1.3	1.1	7040.10	6-8	3-4
RPI-16A	109000	88514	21.0	1.3	1.1	7047.60	31-33	28-29
RPI-17A	108960	89190	13.5	1.3	1.4	7037.00	10-12	9-10
RPI-18A	108895	89253	10.7	1.3	1.2	7031.85	8-10	5-6
RPI-19B	108455	88402	15.3	1.3	1.7	7046.81	11-14	8-10
RPI-20A	109030	89512	7.8	1.3	1.0	7031.61	5-7	2-3
RPI-21B	108018	90329	16.1	1.3	1.3	7036.64	11-14	9-10
RPI-22	107962	89356	20.4	1.3	1.1	7047.48	19-21	14-15
RPI-24	109073	87790	30.4	1.3	1.9	7052.15	28-30	25-26
RPI-24A	109070	87790	20.0	1.3	1.9	7052.30	18-20	15-16
RPI-32	109125	89635	20.0	1.3	—	7036.64	18-20	16-17
RPI-42A	108997	87390	14.3	1.3	1.5	7061.17	14-16	15-16
RPI-44A	109530	87095	18.0	1.3	—	7059.15	16-18	13-14
RPI-5A	108105	87882	15.0	1.3	—	7051.10	11-14	6-8
RPI-7A	108509	89500	21.8	1.3	1.5	7042.90	19-21	13-15
RPI-8	108230	89709	21.0	1.3	—	7039.40	17-20	12-18
RPI-8A	108225	89700	14.4	1.3	1.2	7039.40	11-13	9-10
RPI-9	107947	89891	21.3	1.3	1.1	7041.10	18-21	15-17
SCDIV-1	108473	91560	35.2	2.0	1.4	7046.93	24-34	0-12
SCDIV-2	108401	90834	41.3	2.0	2.1	7041.38	29-39	3-12
SCDIV-3	108257	91509	37.6	2.0	1.2	7038.97	26-36	0-8
SDP-1	107911	90307	—	1.3	—	7038.40	-	-
SDP-2	107891	90470	—	1.3	—	7044.15	-	-
SDP-3	108175	90661	24.1	1.3	2.8	7038.80	-	-
SDP-4	107976	90644	24.1	1.3	3.1	7046.04	-	-
SDP-5	107890	90652	22.8	1.3	3.2	7046.75	-	-
SP03	107932	88383	33.7	2.0	1.3	7056.09	30-31	27-28
SP04	107953	88452	34.4	2.0	1.7	7054.72	31-32	27-28
TW3-1	107430	82380	76.8	5.0	1.8	7096.00	35-75	6-24
* TW4-10B	108077	85760	74.9	5.0	1.7	7112.41	53-73	38-58
TW4-11B	108162	85557	78.7	5.0	1.4	7112.26	57-77	30-49
TW4-1B	107287	85575	62.3	5.0	1.0	7114.58	40-60	39-45
* TW4-2B	107547	84878	94.1	5.0	0.8	7110.03	72-92	42-62
TW4-3B	108104	85108	91.6	5.0	1.6	7112.47	69-89	49-65
TW4-4B	108062	86075	67.2	5.0	1.8	7112.44	46-66	27-39
TW4-5B	107293	86238	60.8	5.0	1.1	7115.66	39-59	31-42
TW4-6B	107813	86009	75.9	5.0	1.8	7114.32	54-74	34-60
* TW4-8B	106979	85355	61.5	5.0	1.5	7117.89	50-60	14-47
* TW4-9B	106776	85152	78.4	5.0	1.2	7115.06	57-77	30-50
* TW5-1B	108180	86876	90.8	5.0	1.4	7105.56	70-90	54.5-65

TABLE 3.0-1. BASIC WELL DATA FOR THE SURFICIAL AQUIFER WELLS. (cont'd.)

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
TW5-2B	109441	86369	73.5	5.0	0.6	7103.61	52-72	38-53
TW5S-1	109064	84203	94.5	5.0	1.7	7111.70	53-93	11-42
* TW5S-2	108917	84849	100.0	5.0	1.0	7112.20	59-99	12-49
TW5S-3	109108	83745	94.0	5.0	1.2	7112.76	53-93	18-37
TW5S-4	109065	84203	100.9	5.0	1.7	7111.69	59-99	20-49
TW5S-5	108916	84849	84.7	5.0	1.0	7107.79	44-84	15-43
TWI-1	110109	84716	96.5	5.0	1.2	7106.50	55-95	23-53
TWI-10	109429	86546	70.4	5.0	1.7	7106.60	39-69	13-49
TWI-11	109554	86386	99.8	5.0	2.0	7106.60	58-98	19-57
TWI-12	109349	86662	83.6	5.0	1.0	7106.26	53-83	0-10
TWI-13	109267	86763	88.7	5.0	0.8	7107.62	68-88	0-22
TWI-14	109186	86867	86.2	5.0	1.8	7108.08	55-85	0-51
TWI-15	108982	87103	75.1	5.0	1.2	7107.51	54-74	0-52
TWI-16	108862	87237	89.3	5.0	1.4	7107.58	58-88	0-18
TWI-17	108746	87355	80.6	5.0	1.0	7107.12	60-80	28-57
TWI-18	108608	87457	87.0	5.0	1.3	7107.79	66-86	0-56
TWI-19	108488	87540	81.7	5.0	1.0	7107.47	61-81	24-55
TWI-2	110106	84916	87.0	5.0	1.7	7106.70	55-85	0-44
TWI-20	108338	87597	86.5	5.0	1.2	7107.85	55-85	0-16
* TWI-21	108219	87597	80.7	5.0	1.1	7107.51	49-79	0-50
TWI-22	109086	86993	88.1	5.0	1.3	7107.75	57-87	0-18
* TWI-23	108142	87445	82.2	5.0	1.2	7107.64	61-81	0-57
TWI-3	110059	85162	104.8	5.0	1.7	7106.60	63-103	8-54
TWI-4	110063	85309	97.5	5.0	1.7	7107.10	56-96	0-55
TWI-5	109947	85701	93.7	5.0	2.0	7107.40	52-92	8.5-47
TWI-6	109866	85882	91.8	5.0	1.7	7106.60	50-90	7-53
TWI-7	109774	86060	91.5	5.0	2.1	7107.50	49-89	8-53
TWI-8	109668	86227	93.1	5.0	1.2	7106.60	62-92	8-55
TWI-9	109908	85792	104.8	5.0	2.3	7107.10	62-102	24-57
WSC-2	109129	89765	24.2	—	2.5	7045.62	12-17	13-17
WSC-3	109000	89760	13.8	—	2.5	7036.73	6.5-11.5	6-12
WSC-4	109246	89409	15.0	—	2.5	7034.82	8-12.5	6-12
WSC-5	109304	89444	15.3	—	3.1	7043.60	2-12	3.5-12
WWL-10B	105744	84168	68.6	5.0	1.4	7125.10	54-74	22-28
WWL-12B	106598	86537	71.1	5.0	1.1	7118.57	54-74	6-13
WWL-13B	105205	86689	57.2	5.0	1.1	7141.20	40-60	7-17
WWL-14A	109620	83937	95.8	4.0	0.8	7113.00	79-99	44-51
WWL-14B	109609	83923	38.0	5.0	1.9	7113.70	18-38	0-12
WWL-15A	108284	82559	120.0	4.0	1.1	7144.40	110-120	99-107
* WWL-19B	104375	87698	56.0	4.0	2.5	7138.50	34-54	27-29
WWL-20B	104861	84544	60.2	4.0	1.4	7139.00	39-59	33-35
WWL-3A	106626	50744	99.3	4.0	1.7	7114.20	81-101	60-70
WWL-4A	105555	83331	95.8	4.0	1.8	7129.90	76-96	62-71
WWL-4B	105575	83322	47.7	4.0	0.7	7127.20	30-50	20-27

* = Abandoned Well

TABLE 3.0-2. BASIC WELL DATA FOR THE TAILINGS WELLS.

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
* TW4-10C	108089	85727	56.8	5.0	1.7	7112.64	15-55	5-11
TW4-10C	108070	85787	56.4	4.0	1.1	7112.54	15-55	0-9
* TW4-11C	108140	85593	57.3	5.0	1.7	7112.71	15-55	7-12
TW4-11C	108173	85537	60.0	4.0	1.8	7112.53	18-58	2-10
TW4-11C	108233	85351	20.5	4.0	1.4	7112.10	0-20	0-0
TW4-11C	107995	85771	34.6	4.0	1.5	7112.64	13-33	0-5
TW4-12C	107338	85268	35.0	2.0	—	—	-	-
* TW4-13C	107596	86124	32.6	2.0	—	—	-	-
TW4-15C	108516	85559	37.2	5.0	1.9	7110.38	15-35	7-11
* TW4-17C	107180	84690	33.6	5.0	0.9	—	13-33	-
TW4-18C	107410	84800	44.3	5.0	0.6	—	4-44	-
* TW4-19C	107330	84415	25.8	5.0	0.8	—	6-25	-
* TW4-1C	107317	85592	49.8	5.0	0.3	7112.44	8-48	4.5-6
TW4-1C1	107287	85575	26.2	2.0	1.7	7118.02	15-25	11-15
TW4-1C2	107288	85576	41.7	2.0	1.1	7121.33	29-39	25-30
* TW4-21C	108420	85460	80.0	5.0	—	—	20-80	-
* TW4-2C	107573	84890	46.0	5.0	1.0	7109.30	4-44	1.5-4
* TW4-2C1	107547	84878	19.5	2.0	1.3	7109.55	8-18	0-7
* TW4-3C	108142	85105	33.0	5.0	2.0	7112.26	9-49	1.5-5
TW4-3C1	108104	85108	34.7	2.0	1.7	7112.03	22-32	20-22
TW4-3C2	108105	85109	22.3	2.0	1.6	7111.81	10-20	7-9
* TW4-4C	108038	86101	33.0	5.0	1.6	7111.82	12-32	4-6
TW4-4CA	108041	85956	57.6	4.0	1.5	7112.25	-	0-9
* TW4-5C	107319	86227	42.0	5.0	1.3	7115.37	21-41	0-5
* TW4-6C	107828	85993	47.7	5.0	1.4	7113.93	6-46	4-11
* TW4-6CA	107921	85875	35.3	4.0	1.1	7113.37	14-34	0-6
* TW4-6CB	107398	85728	26.4	4.0	1.6	7110.73	5-25	1-4
* TW4-6CC	107469	85824	40.1	4.0	1.0	7108.15	19-39	0-2
* TW4-6CD	107604	85863	40.6	4.0	1.4	7107.91	19-39	17-18
* TW4-7C	107645	85057	52.0	5.0	1.1	7113.42	11-51	5-9
* TW4-8C	107020	85352	50.5	5.0	1.3	7116.62	9-49	1-13
* TW4-8CA	107021	85324	45.4	4.0	1.7	7117.84	24-44	0-24
TW4-8CB	107126	85407	48.1	4.0	1.5	7118.12	27-47	0-31
* TW4-8CC	107211	85522	40.3	4.0	1.6	7115.64	19-39	0-2
* TW4-9C	106750	85147	40.6	5.0	1.6	7115.35	19-39	0-12
TW4-9CA	106728	85121	39.7	4.0	1.1	7115.61	18-38	0-12
* TW4-9CB	106744	85190	20.0	2.0	1.3	7117.10	0-20	0-0
TW4-9CC	106776	85152	—	1.3	—	—	-	-
* TW5-10C	107649	87244	19.2	2.0	—	—	-	-
* TW5-12C	108330	86630	22.0	2.0	1.8	7101.28	-	-
* TW5-13C	108426	86659	23.4	2.0	1.0	7101.54	-	-
* TW5-14C	108984	86518	25.3	2.0	4.1	7097.96	-	-
TW5-16C	108901	87001	41.3	5.0	1.5	7104.21	20-40	11-14
TW5-17C	109118	86653	41.7	5.0	1.9	7103.69	20-40	11-15
TW5-18C	109429	86130	42.1	5.0	2.6	7100.55	20-40	9-13
TW5-19C	109629	86106	41.7	5.0	2.0	7105.72	20-40	6-12
TW5-1C	108203	86887	58.8	5.0	2.0	7107.58	17-57	1.5-6

TABLE 3.0-2. BASIC WELL DATA FOR THE TAILINGS WELLS. (cont'd.)

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
* TW5-1C1	108180	86876	32.3	2.0	2.8	---	9-29	0-5
* TW5-1C2	108200	86940	54.9	2.0	2.6	---	36-52	29-31
* TW5-20C	109959	85500	36.0	5.0	1.7	7106.62	14-34	9-13
TW5-21C	107674	86580	54.8	5.0	1.9	7114.04	33-53	16-20
* TW5-22C	108583	86326	37.1	5.0	1.8	7104.30	15-35	7-10
TW5-23C	108881	85916	41.4	5.0	1.5	7104.53	20-40	7-11
TW5-24C	109793	85836	40.0	4.0	1.8	7105.53	18-38	16-18
TW5-2C	109423	86350	38.9	5.0	1.6	7104.04	0-38.4	0-2
TW5-2C1	109441	86369	9.2	2.0	2.3	---	0-9.2	-
* TW5-3	108091	87593	43.6	5.0	2.0	7108.50	22-42	2-4
* TW5-4C	108510	87485	50.4	5.0	1.6	7108.30	9-49	0-8
* TW5-4CA	108600	87163	36.0	4.0	1.7	7108.68	13-33	0-0
* TW5-5C	108177	87383	52.3	5.0	1.7	7108.20	21-51	0-8
* TW5-5CA	108125	87285	35.5	4.0	1.7	7108.20	14-34	0-2
* TW5-6C	107736	87442	47.3	5.0	1.8	7108.40	16-46	0-10
* TW5-7C	107991	86938	56.5	5.0	2.8	7108.15	14-54	6-12
TW5-8C	108294	86976	44.2	5.0	1.6	7106.17	3-43	4-5
* TW5-9C	108189	87031	34.0	4.0	1.3	7106.57	13-33	0-5

* = Abandoned Well

TABLE 3.0-3. BASIC WELL DATA FOR THE WHITE RIVER AQUIFER WELLS.

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
MC02	108693	88431	165.0	6.0	0.0	7045.21	70-160	28-30
WH-9	109197	83514	190.0	5.0	2.7	7119.80	130-190	113-121
WW-22	107600	89330	184.6	6.0	1.0	7051.00	64-184	21-28
WW-23	109674	87393	193.5	5.0	2.1	7054.40	113-194	70-75
WWL-10A	105745	84187	133.6	4.0	0.7	7125.00	114-134	108-112
WWL-16A	102228	85174	187.2	4.0	2.8	7172.08	165-185	139-145
WWL-18A	103861	83301	171.5	4.0	1.3	7163.10	151-171	124-132
WWL-20A	104821	84547	140.3	4.0	0.8	7139.34	122-142	119-128

TABLE 3.0-4. BASIC WELL DATA FOR THE WIND RIVER AQUIFER WELLS

WELL NAME	NORTH. COORD.	EAST. COORD.	TOTAL DEPTH (ft-mp)	CASING DIAMETER (in)	STICKUP (ft)	MP ELEV. (ft-msl)	CASING PERFORATIONS (ft-lsd)	BENTONITE SEAL (ft-lsd)
WW-20	107450	82240	430.0	7.0	0.3	7114.99	410-425	350-360

3.1 RATE AND DIRECTION OF GROUND-WATER MOVEMENT

Water-level elevations define the gradient and direction of ground-water flow in the Surficial aquifer. Figure 3.1-1 presents the water-level elevation of the Surficial aquifer in the tailings area for 2004. Prior to discontinuation of pumping from or injection into wells that are within the bounds of the tailings, the water levels in these wells reflected the ongoing operation as collection or injection wells. Available recent water levels were used in developing the contours presented in Figure 3.1-1, and the cones of depression or water-level mounds around formerly active Surficial aquifer wells were expected to have completely decayed over 2004.

The general shape of the piezometric surface indicates the complexity of the containment and restoration systems, as well as past artificial and natural recharge. The operation of the collection and recharge system downgradient of the No. 5 Dam will be discussed in more detail in subsequent sections. In the immediate tailings area, the recharge to the Surficial aquifer comes from surface runoff, seepage from the industrial pond, recharge to overburden piles south of the tailings area, and seepage from the tailings. To the east, the known outlet is the Mine Creek channel where the primary restoration effort has been directed. The Surficial aquifer in this area discharges to Spring Creek east of the tailings.

Past Surficial aquifer collection and injection operations within the perimeter of the No. 5 Dam had created a depression in the piezometric surface in the middle of the tailings, with a hydraulic ridge along the line of injection wells. These low and high areas in the piezometric surface have largely decayed since collection and injection within the immediate tailings area was discontinued.

Hydraulic gradient times the horizontal permeability divided by the effective porosity yields the ground-water velocity. The ground water in the south Mine Creek recharge line is presently moving downgradient toward Spring Creek at a rate of 1.25 ft/day based on the present hydraulic gradient and aquifer properties. An average permeability of 25 ft/day, gradient of 0.005 ft/ft and effective porosity of 0.1 were used in this estimate. The gradient on the west side of the south recharge line ranges from no measurable gradient to approximately

0.001ft/ft, and there has been a considerable decay in the ground-water mound over the recharge lines. The decay in the ground-water mound and the reduction in the gradient reversal to the collection system in the south Mine Creek area has occurred because the delivery of injection water to the south recharge lines has been dramatically reduced since well WW-20 can no longer be used as a fresh-water supply.

The gradient in the north Mine Creek recharge area between wells MC-7 and MC-8 (northeast of the north recharge line) is 0.0012 ft/ft. The piezometric surface between the wells is very flat and appears to steepen dramatically near Spring Creek. Based on water quality measurements, this area has been restored and remains so. The gradient reversal between reversal wells NP04 and NP05 was maintained and there was a substantial restoration of water quality in these wells following operational downtime in 1996 and 1997.

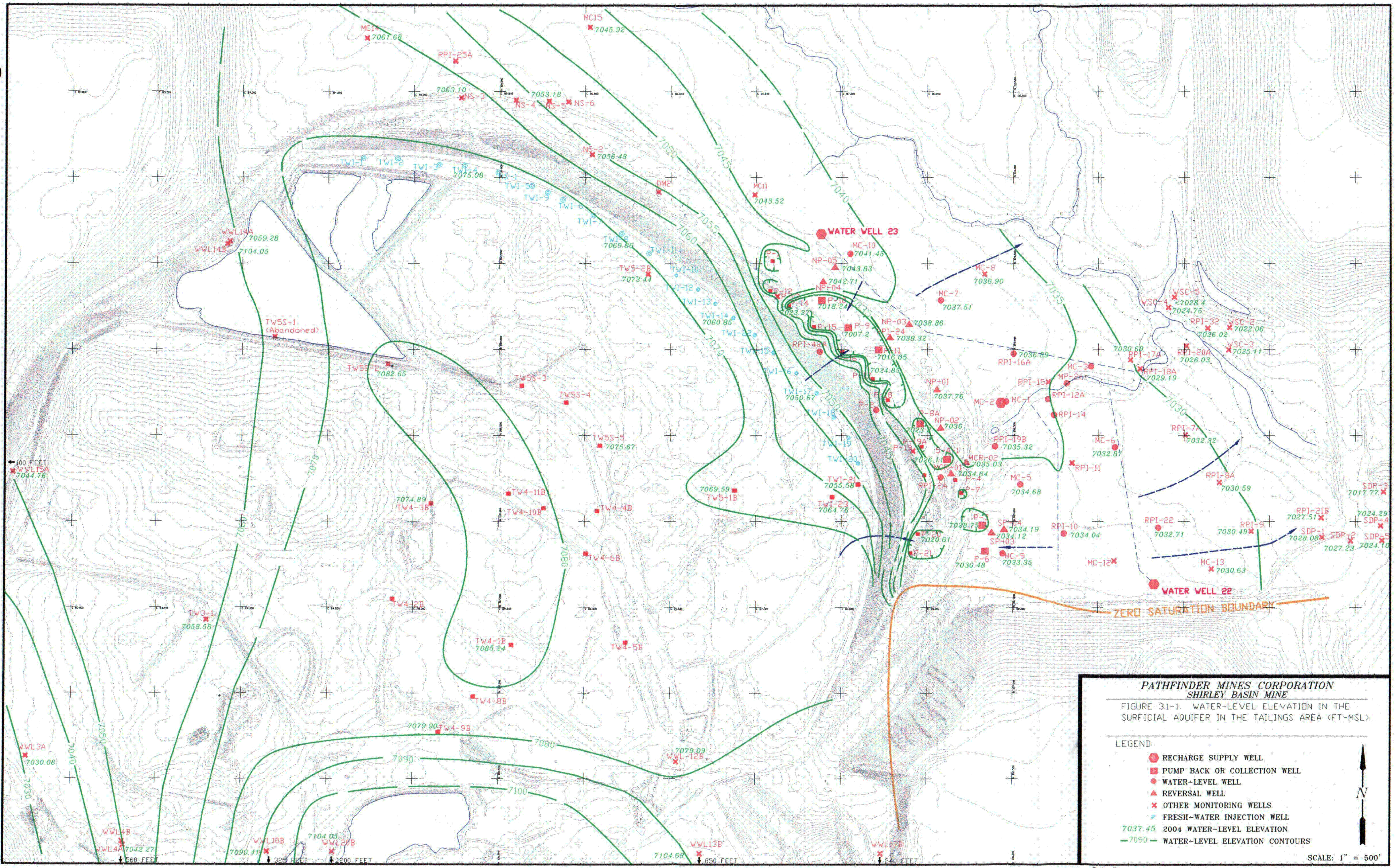

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FIGURE 3.1-1. WATER-LEVEL ELEVATION IN THE SURFICIAL AQUIFER IN THE TAILINGS AREA (FT-MSL).

C04

3.2 GRADIENT REVERSAL

Pumping of the collection wells is used to establish and maintain gradient reversal in the Surficial aquifer in the Mine Creek area. A gradient reversal exists when the water level elevation of monitor wells closest to the recharge line is higher than water level elevations of monitor wells closest to the collection wells. This is an important measurement because the lack of reversal for a long period of time lessens the chance of containing tailings seepage. Ten reversal wells are used to evaluate gradient reversal. The following listing is from the north end of the seepage area to the south end. The reversal monitoring wells closest to the recharge lines are: NP05, NP03, NP01, MCR02, and SP04 (see Figure 3.1-1). Paired with these wells are NP04, RPI-24, NP02, MCR01, and SP03, respectively.

Table 3.2-1 presents the monitoring dates and elevations during 2004. Comparison of water-level elevations for these wells indicates continuous reversal in reversal well pairs MCR02-MCR01, SP04-SP03, NP01-NP02, NP03-RPI24 and NP05-NP04, (see Figures 3.2-1, 3.2-2, 3.2-3, 3.2-4 and 3.2-5 respectively). Gradient reversal was maintained in 2004 with the exception of one no gradient reversal measurement for well pair SP04-SP03 during September.

TABLE 3.2-1. REVERSAL WELL MONITORING 2004

DATE	01/02/04	02/02/04	03/04/04	04/01/04	05/03/04	06/07/04	07/06/04	08/02/04	09/10/04	10/01/04	11/01/04	12/01/04
WELL												
NP02	7035.94	7035.67	7035.97	7037.1	7036.59	7036.21	7037.02	7036.4	7036.49	7035.8	7035.7	7035.66
7052.88	-1.89	-2.06	-1.84	-1.17	-1.71	-1.95	-1.24	-1.83	-1.72	-1.99	-1.96	-1.77
NP01	7037.83	7037.73	7037.81	7038.27	7038.3	7038.16	7038.26	7038.23	7038.21	7037.79	7037.66	7037.43
7051.81												
RPI24	7038.08	7038.17	7038.15	7038.77	7038.86	7038.68	7038.7	7038.6	7038.57	7038.32	7038.24	7037.97
7052.15	-0.38	-0.45	-0.45	-0.19	-0.26	-0.23	-0.37	-0.42	-0.38	-0.41	-0.44	-0.42
NP03	7038.46	7038.62	7038.6	7038.96	7039.12	7038.91	7039.07	7039.02	7038.95	7038.73	7038.68	7038.39
7051.07												
NP04	7042.29	7041.92	7041.91	7042.54	7042.84	7042.87	7042.76	7042.71	7042.69	7042.05	7042.01	7041.79
7055.87	-1.36	-1.41	-1.51	-1.42	-0.94	-0.92	-1.11	-1.12	-1.14	-1.21	-1.21	-1.64
NP05	7043.65	7043.33	7043.42	7043.96	7043.78	7043.79	7043.87	7043.83	7043.83	7043.26	7043.22	7043.43
7055.37												
MCR01	7035.45	7035.06	7035.36	7036.04	7035.31	7034.8	7036.68	7035.05	7034.64	7034.64	7034.62	7034.48
7042.55	-0.38	-0.47	-0.27	-0.09	-0.33	-0.45	-0.51	-0.37	-0.39	-0.37	-0.37	-0.39
MCR02	7035.83	7035.53	7035.63	7036.13	7035.64	7035.25	7037.19	7035.42	7035.03	7035.01	7034.99	7034.87
7046.16												
SP03	7035.12	7035.11	7034.36	7034.26	7034.14	7033.85	7033.91	7034.12	7034.14	7033.82	7033.77	7033.51
7056.09	-0.52	-0.25	-0.41	-0.4	-0.48	-0.44	-1.4	-0.07	0	-0.13	-0.15	-0.19
SP04	7035.64	7035.36	7034.77	7034.66	7034.62	7034.29	7035.31	7034.19	7034.14	7033.95	7033.92	7033.7
7054.72												

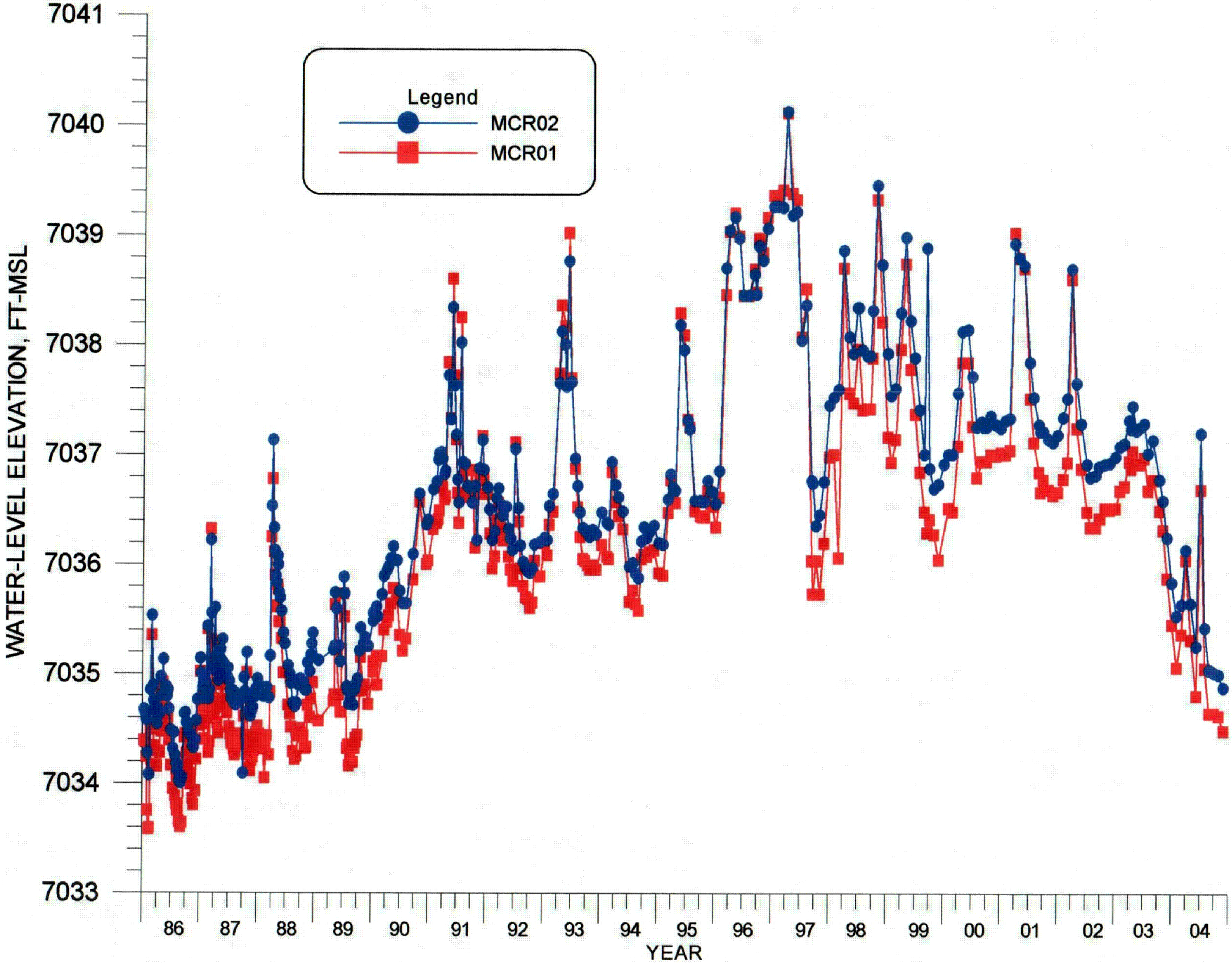


FIGURE 3.2-1. WATER-LEVEL ELEVATION FOR REVERSAL WELLS MCR02 AND MCR01.

C05

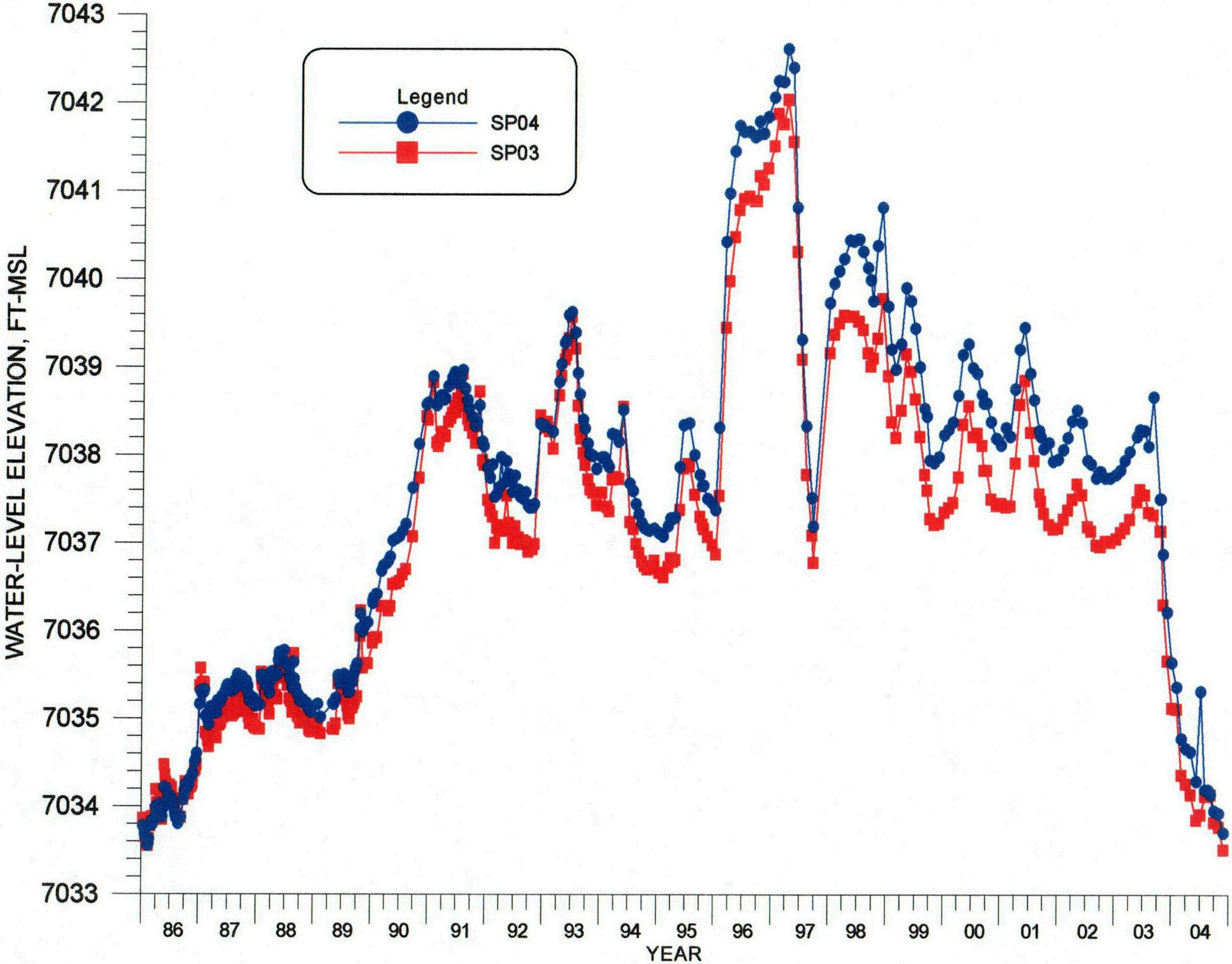


FIGURE 3.2-2. WATER-LEVEL ELEVATION FOR REVERSAL WELLS SP04 AND SP03.

C06

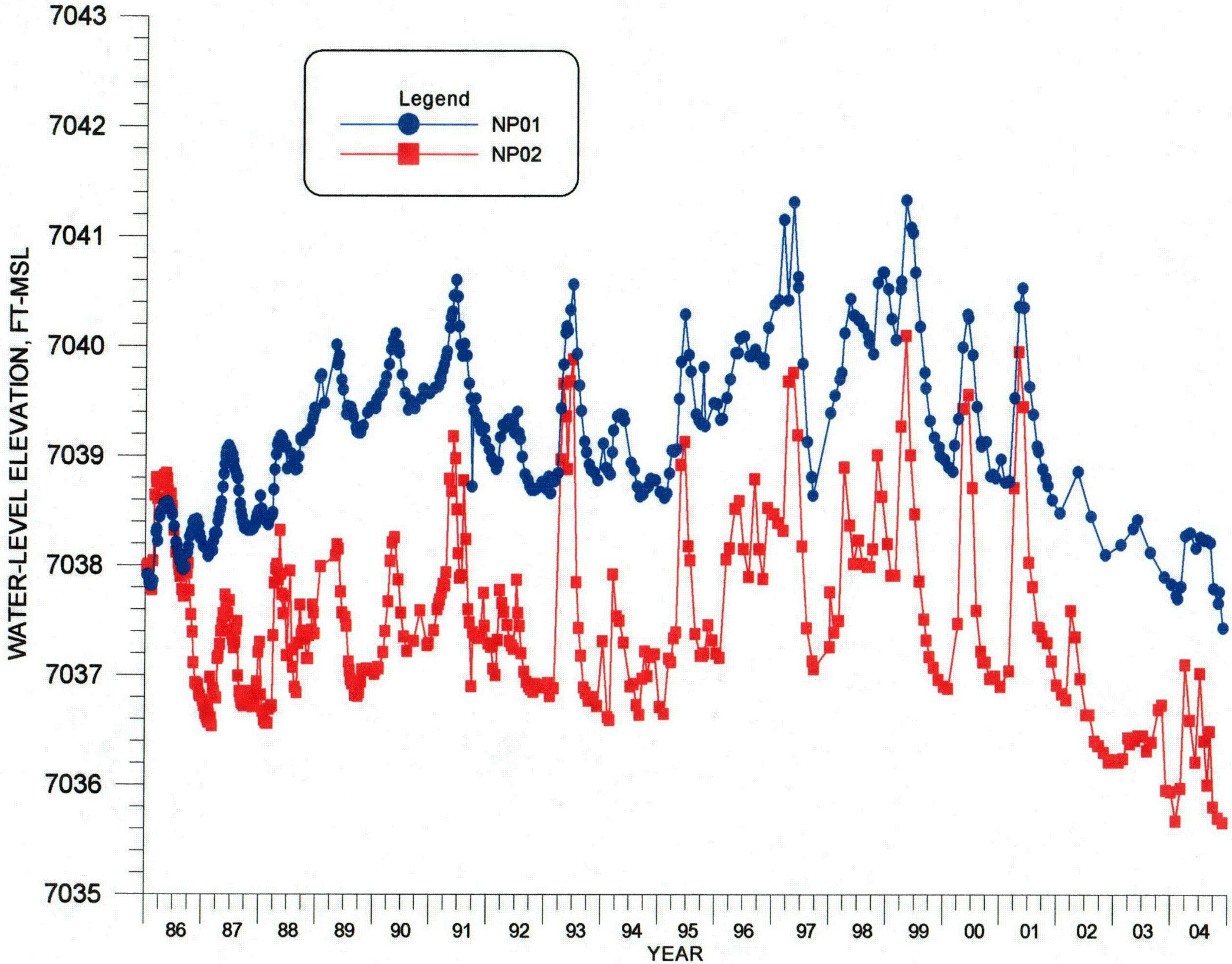


FIGURE 3.2-3. WATER-LEVEL ELEVATION FOR REVERSAL WELLS NP01 AND NP02.

C07

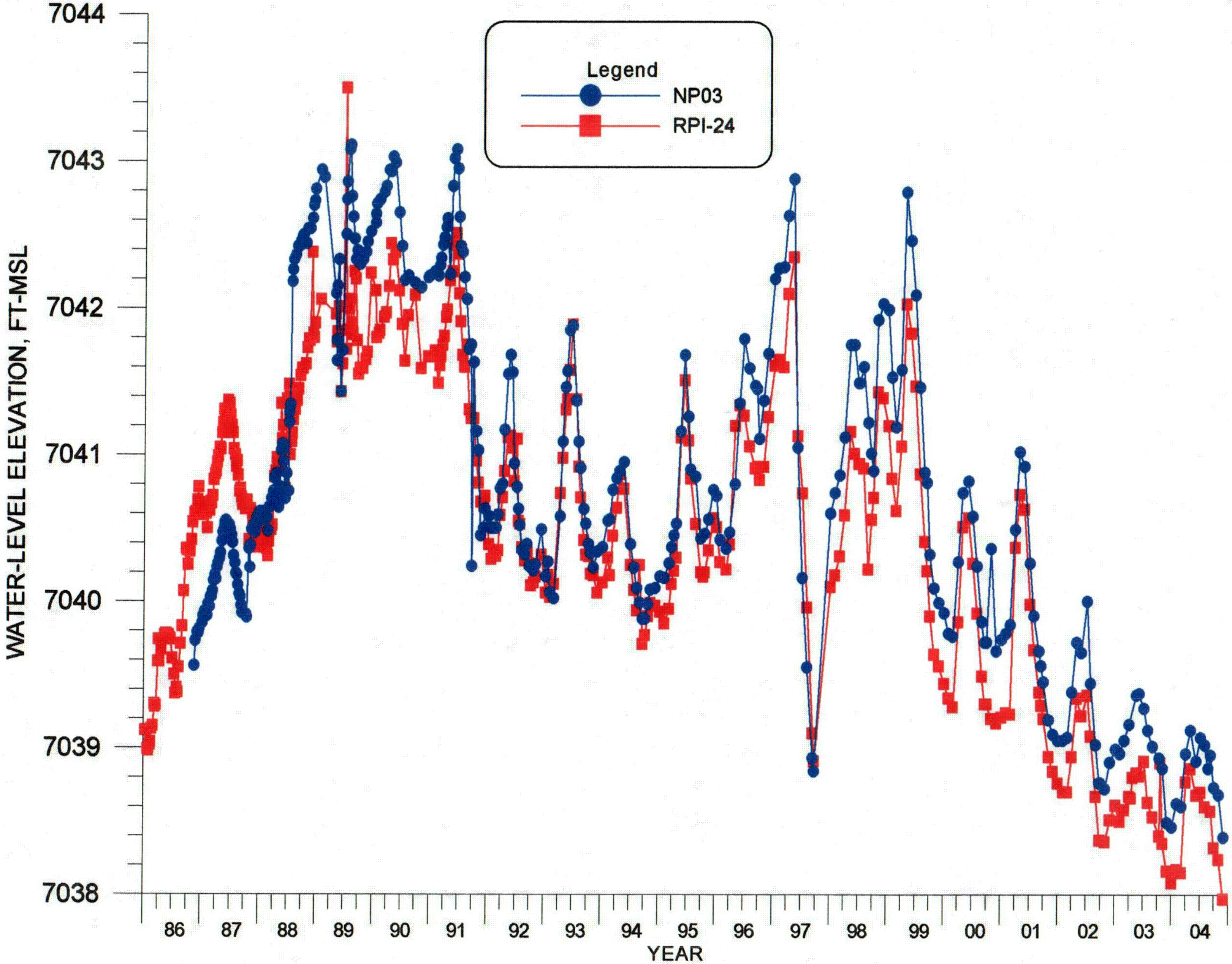


FIGURE 3.2-4. WATER-LEVEL ELEVATION FOR REVERSAL WELLS NP03 AND RPI-24.

C08

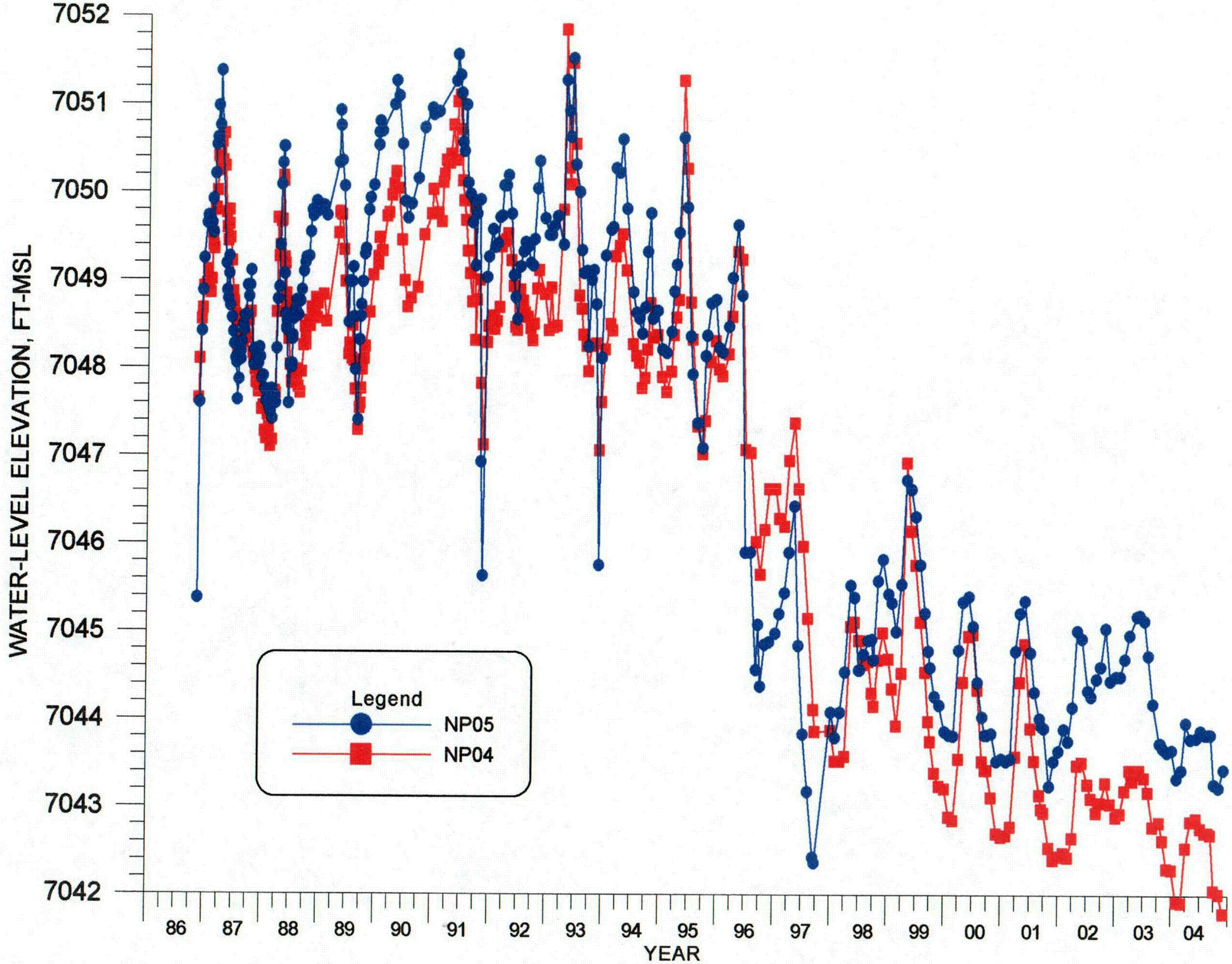


FIGURE 3.2-5. WATER-LEVEL ELEVATION FOR REVERSAL WELLS NP05 AND NP04.

c09

3.3 WATER-LEVEL CHANGES

Water levels are monitored in numerous wells in the Surficial aquifer to define the water level changes from the collection pumping and the injection into the recharge lines and injection wells. Section 3.2 presents the changes in water level in the reversal wells. Water-level changes in several Surficial aquifer wells are discussed and presented in this section.

Figure 3.3-1 presents the water-level plots for south area Surficial wells RPI-10, MC-13, and RPI-22 (see Figure 3.1-1 for the locations of these wells with respect to the south drain). Figure 3.3-2 presents the water-level changes in wells MC-6 and RPI-18A. Both of these figures reveal a rather dramatic drop in water levels during 2004 for wells that are affected by the fresh-water injection in the south recharge line. With the cessation of pumping from WW-20 the rate of fresh-water injection in the south recharge lines has been reduced dramatically. This same reduction in recharge is also reflected in the water levels of the south reversal pair SP04-SP03 presented in Figure 3.2-2.

The water-level response between the south recharge line and the Mine Creek collection wells is shown in Figure 3.3-3 for wells RPI-19B, RPI-14, and RPI-20A. Water levels in RPI-20A increased in 1998 but subsequently dropped and have shown a modest decrease since 2001. Water level in well RPI-19B dropped significantly since mid-2003, and although there was no 2004 water level measurement in RPI-14, the response in the area represented by this well is expected to be similar. The declining water levels are attributed to the reduction in the fresh water supply to the south recharge lines. Water levels have responded significantly to recharge into the north Mine Creek recharge line. Magnitude of water-level rises has been a function of the distance from the recharge line in the north area with much greater initial rises close to the line. There has been no significant change in the recharge line or collection well configuration for several years, so the recent decline in water level likely reflects minor operational adjustments (reduced injection rate) and variations in natural recharge. Figure 3.3-4 presents the water levels in wells RPI-16A, MC-7, and MC-11. Wells RPI-16A, MC-7, and MC-11 have shown a decline in water level over the last six years.

There have been no changes in water level in this area that have appreciably changed the ground-water mound over the north recharge line (see Figure 3.1-1). This mound is forcing seepage to the collection system (P wells) on the upgradient side of the north recharge line, but the mound in the vicinity of the south recharge lines has decayed dramatically during 2004, and the gradient reversal in the south area is very weak.

Water-level changes in the area north of the No. 5 Dam include a significant downward trend in recent years. The north injection system consisted of 22 injection wells prior to discontinuation of well injection in 2003. Figures 3.3-5 and 3.3-6 present the water level elevations for the NS series monitoring wells and well MC-15, which is located farther from the injection wells. The initial rapid water-level change in some wells as a result of injection is evident in Figures 3.3-5 and 3.3-6, but the water levels have since dropped with the gradual loss of injectivity and the eventual discontinuation of injection in the wells.

Surficial and tailings collection wells within the tailings impoundment area were made operational during 1994. Surficial wells TW4-1B, TW4-2B, TW4-3B, TW4-4B, TW4-5B, TW4-6B, TW4-8B, TW4-9B, TW4-10B, TW4-11B, TW5-1B, TW5-2B, TWI-21, TWI-23, TW5S-2, TW5S-3, TW5S-4 and TW5S-5 have been pumped. Many of the wells were pumped nearly continuously for up to ten years, while others were installed as late as 1995 and were pumped intermittently. Well TW4-5B was listed as destroyed in 2000 but has subsequently been located, and well TW5S-1 was abandoned in 2000 because it interfered with the evaporation pond construction. Other wells within the tailings area have been or will be abandoned in conjunction with the tailings reclamation. The piezometric surface for the Surficial aquifer beneath the tailings shows a radially outward flow pattern to the east and northeast. The tailings dewatering is discussed in Section 8.0.

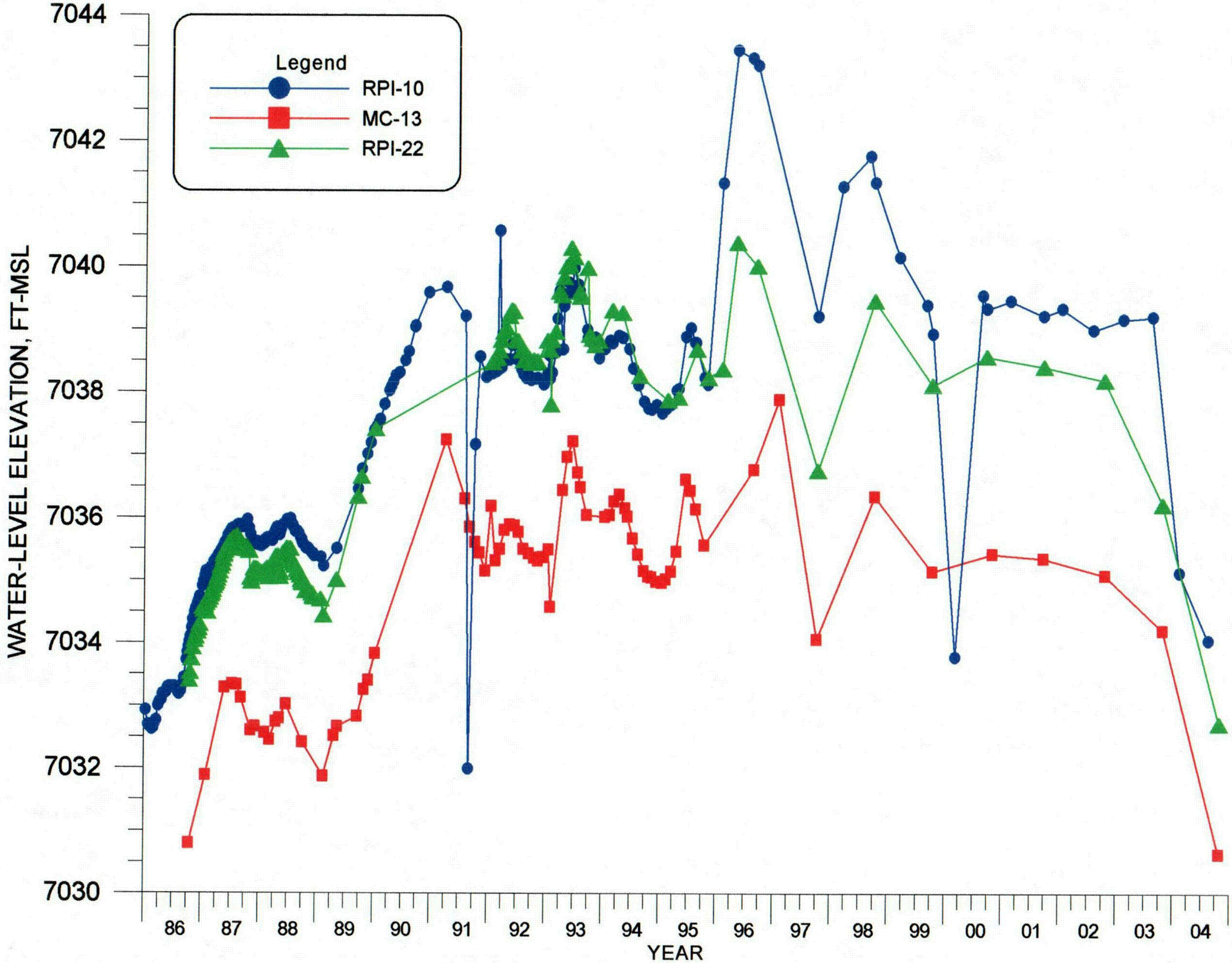


FIGURE 3.3-1. WATER-LEVEL ELEVATION FOR WELLS RPI-10, MC-13 AND RPI-22.

C10

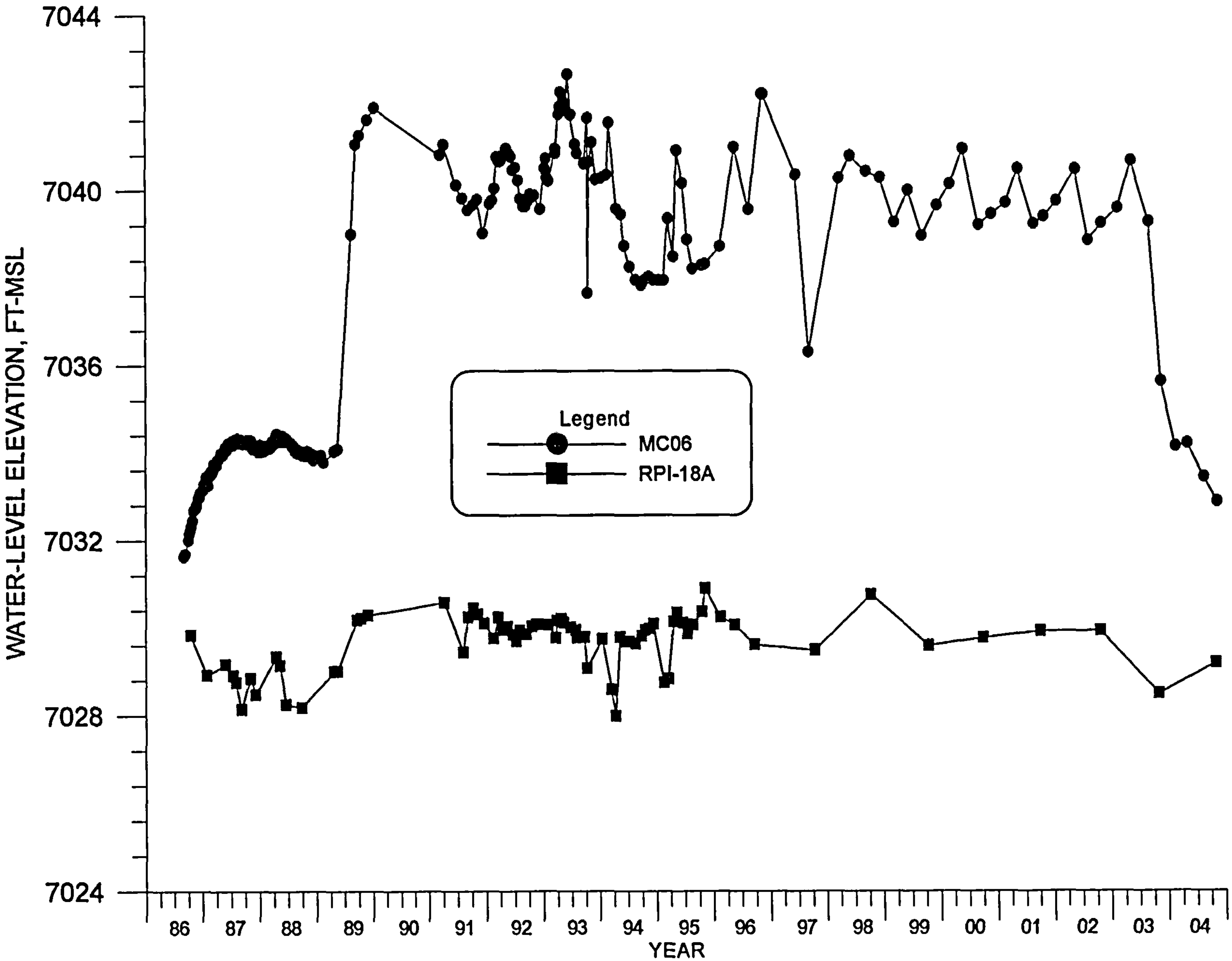


FIGURE 3.3-2. WATER-LEVEL ELEVATION FOR WELLS MC06 AND RPI-18A.

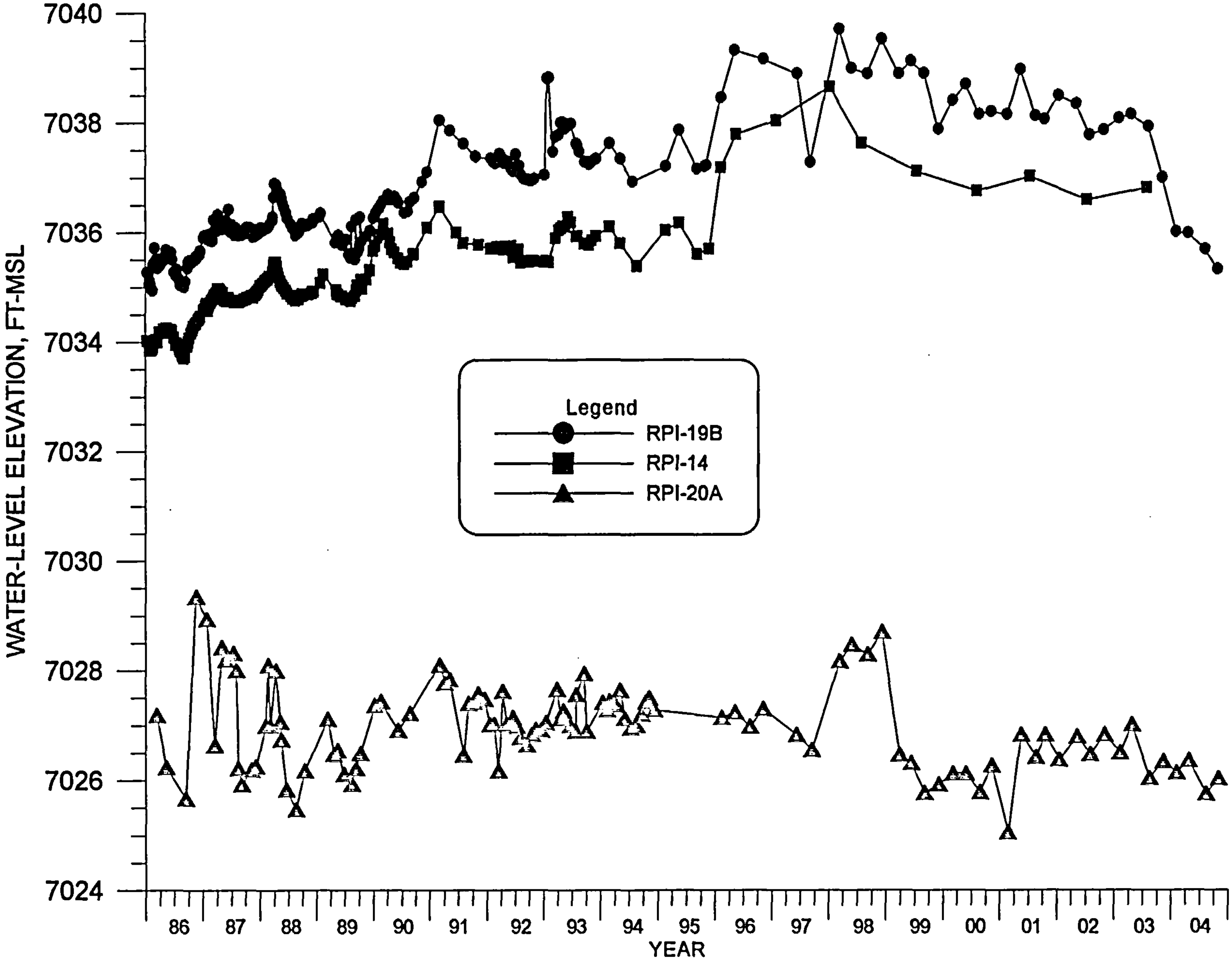


FIGURE 3.3-3. WATER-LEVEL ELEVATION FOR WELLS RPI-19B, RPI-14 AND RPI-20A.

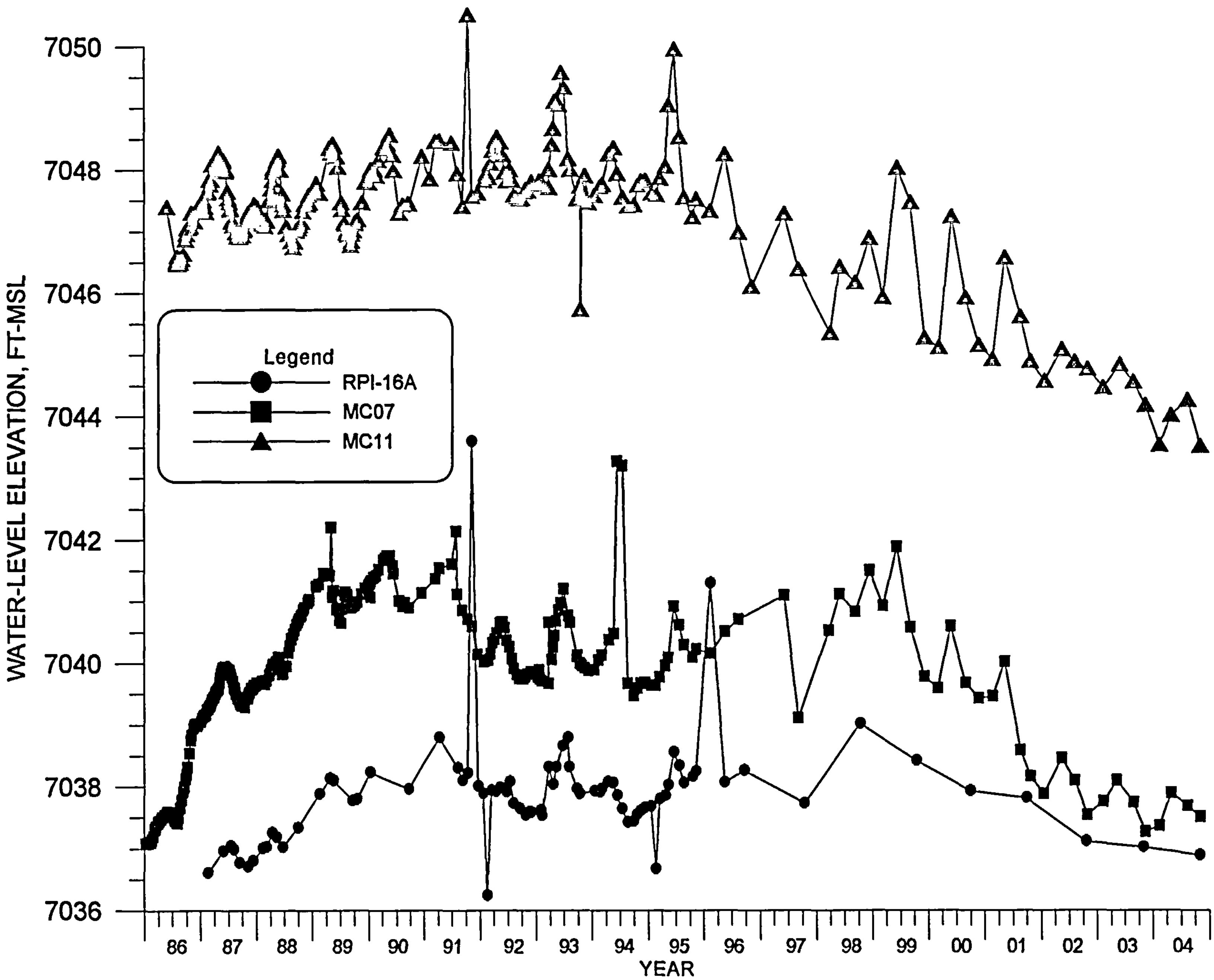


FIGURE 3.3-4. WATER-LEVEL ELEVATION FOR WELLS RPI-16A, MC07 AND MC11.

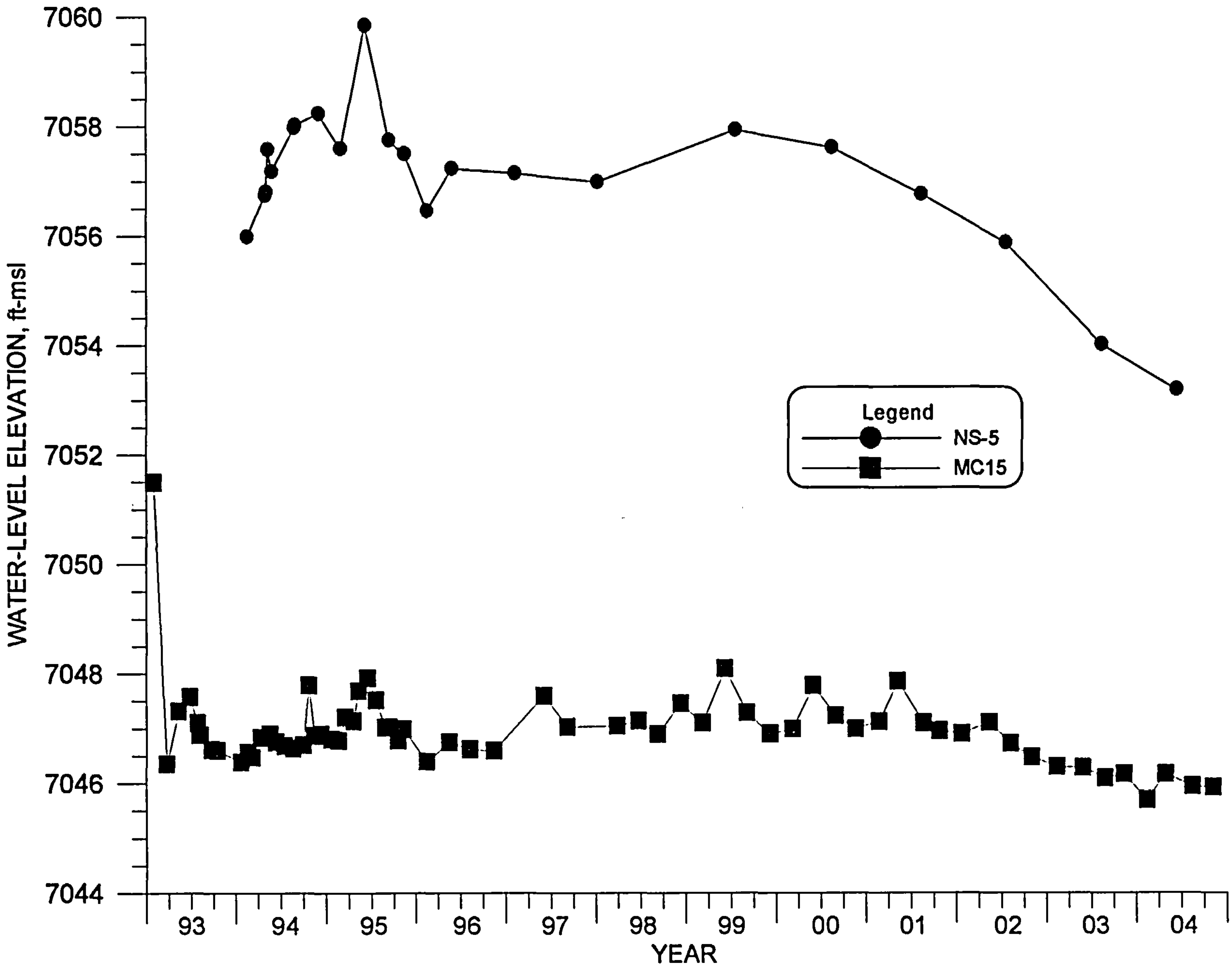


FIGURE 3.3-5. WATER-LEVEL ELEVATION FOR WELLS NS-5 AND MC15.

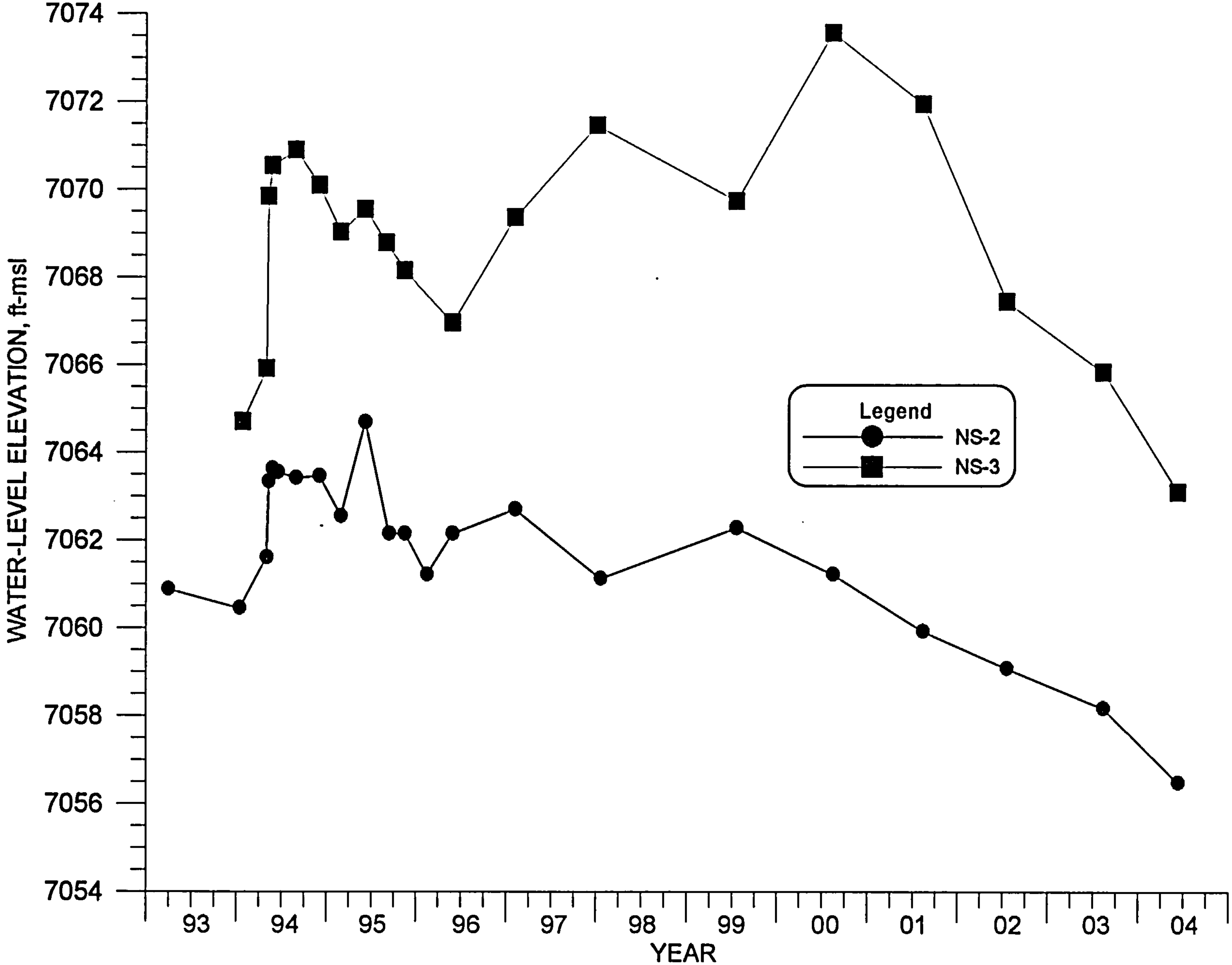


FIGURE 3.3-6. WATER-LEVEL ELEVATION FOR WELLS NS-2 AND NS-3.

4.0 SURFICIAL AQUIFER WATER QUALITY

Tables 4.0-1 and 4.0-2 present year 2004 water quality data for Surficial wells in the tailings area. The year 2004 data is broken into two groups of constituents for the two tables. Values that exceed site standards in Table 1.2-1 are highlighted in Tables 4.0-1 and 4.0-2. Historic water quality data are presented in Appendices A, B, and C. Appendix A presents the tabulated water quality data for the Surficial wells. Appendix B presents water quality data for White River wells, Wind River wells and tailings wells in the tailings area. Appendix C presents the surface water quality data. The ordering of the wells in the appendices and in Table 4.0-1 and Table 4.0-2 is done alphabetically by well name.

Water quality analyses are used to indicate the direct effect of recharge water on water quality of the Surficial aquifer. The historic indicator parameters are TDS, chloride, and conductivity. A fourth water quality parameter, uranium concentration, is incorporated as the hazardous constituent of interest. For the year 2004, maps displaying measured concentrations or activity of sulfate, radium-226 + radium-228, selenium, and thorium-230 are also included in this report. Of these additional constituents, only sulfate is displayed with iso-concentration contours because it is the only additional constituent that exhibits a discernable site-derived seepage plume. Chloride and TDS concentration will be used in this report to identify and convey the water-quality changes. The field conductivity has been used in the past as an important indicator of water quality. However, conductivity changes for some wells are not supported by the more reliable water quality measures of chloride and TDS concentrations. The chloride and TDS concentrations are considered the primary indicators of water quality. Field conductivity is still considered a gross indication of changes in water quality but is only used when supported by other parameters or when other information is not available.

Figure 4.0-1 presents the chloride contours for the Surficial aquifer in the tailings area for 2004. Chloride ions are usually considered conservative (not affected by chemical reactions or adsorption) in this aquifer and, therefore, a good indicator of ground-water movement rates as well as water quality changes.

Chloride concentrations exceed 1000 mg/l at most of the containment system collection wells. Chloride concentrations are about 50 mg/l or less in the area where the White River and Wind River waters have been recharged into the horizontal drains. The water quality in the Surficial aquifer near the containment system has greatly improved, as well as water quality in areas near Spring Creek. All measured concentrations downgradient of the recharge lines are less than 50 mg/l except at well RPI-7A, where the very slightly elevated chloride concentration of 85.5 mg/l is somewhat unusual. This well had not been sampled for several years, but samples from the mid-1990's typically had a chloride concentration of less than 50 mg/l. TDS and chloride concentrations in wells east of the recharge lines are nearly restored, and have shown little change in recent years. This will be discussed in more detail in subsequent sections.

Figures 4.0-2, 4.0-3, 4.0-4, and 4.0-5 present the TDS, field conductivity, uranium and sulfate contours, respectively, for the Surficial aquifer in the tailings area for 2004. In general, these constituents exhibit similar patterns to chloride. These parameters are more likely to be affected by geochemical or other attenuating processes and typically exhibit more variability in background concentrations than chloride. Hence, there is probably less sensitivity to seepage impacts or corrective action efforts for these constituents when compared to chloride, but the indications of seepage impacts are similar.

Figures 4.0-6 through 4.0-8 present the Ra226+Ra228, selenium, and thorium-230 activities or concentrations, respectively, for the Surficial aquifer in the tailings area for 2004. Occurrences of elevated concentrations or activities of these constituents do not reflect discernable seepage patterns. Measured Ra228 activity is generally more erratic than other constituents, and elevated values are often anomalous when compared with the historic record for each of the wells.

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY.

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
5A-1	2/10/2004	138	342	6.90	1008	1346	—	—	—	—	—	—
	4/27/2004	167	363	6.79	1170	1445	0.0030	0.0130	0.362	< 0.200	< 1.000	< 1.20
	8/18/2004	150	346	7.15	1070	1323	—	—	—	—	—	—
	11/5/2004	135	316	7.00	953	1285	0.0030	0.0160	0.260	< 0.200	< 1.000	< 1.20
MC05	6/10/2004	9.80	286	7.75	638	937	—	—	0.0150	—	—	—
MC06	2/10/2004	13.0	238	7.10	608	861	—	—	—	—	—	—
	4/26/2004	11.1	120	7.35	417	554	0.0190	< 0.0030	0.0340	< 0.200	< 1.000	< 1.20
	8/12/2004	17.0	248	7.30	648	843	—	—	—	—	—	—
	11/4/2004	16.0	278	7.40	657	947	0.0130	0.0070	0.0652	0.900	6.50	7.40
MC07	2/10/2004	14.7	84.5	7.60	374	547	—	—	—	—	—	—
	4/26/2004	14.9	50.9	7.50	349	535	0.0020	0.0440	0.0140	< 0.200	< 1.000	< 1.20
	8/12/2004	14.0	51.0	7.90	323	448	—	—	—	—	—	—
	11/4/2004	14.0	48.0	7.80	316	441	0.0030	0.0560	0.0112	< 0.200	< 1.000	< 1.20
MC08	10/25/2004	16.0	101	7.80	470	668	0.0100	0.0320	0.0205	< 0.200	< 1.000	< 1.20
MC09	2/10/2004	242	376	6.70	1526	1867	—	—	—	—	—	—
	4/26/2004	130	476	6.95	1660	1954	< 0.0010	0.148	0.782	2.60	< 1.000	< 3.60
	8/12/2004	291	441	6.75	1940	1976	—	—	—	—	—	—
	11/4/2004	369	450	6.70	1980	2040	0.0020	0.115	0.738	0.600	< 1.000	< 1.60
MC10	6/10/2004	20.7	41.3	8.10	310	505	—	—	0.0370	—	—	—
MC11	2/11/2004	201	27.2	7.10	599	966	—	—	—	—	—	—
	4/27/2004	123	35.2	7.45	657	990	0.0020	0.0030	0.0510	2.80	2.30	5.10
	8/13/2004	207	35.0	8.00	647	1081	—	—	—	—	—	—
	11/4/2004	213	32.0	7.45	607	950	0.0020	0.0020	0.0480	2.40	< 1.000	< 3.40

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
MC13	10/25/2004	19.0	273	7.85	697	937	0.0020	0.0020	0.0314	< 0.200	< 1.000	< 1.20
MC14	2/11/2004	10.5	24.1	7.20	358	529	—	—	—	—	—	—
	4/27/2004	17.7	21.2	7.50	397	560	0.0040	< 0.0010	0.0770	0.900	< 1.000	< 1.90
	8/13/2004	12.0	24.0	8.05	368	504	—	—	—	—	—	—
	11/5/2004	15.0	26.0	7.20	340	528	0.0030	< 0.0010	0.0821	0.300	< 1.000	< 1.30
MC15	2/11/2004	1039	429	6.40	3044	4050	—	—	—	—	—	—
	4/27/2004	1040	467	7.00	3670	4150	0.0050	0.0070	0.312	1.40	2.10	3.50
	8/13/2004	1230	667	7.10	4440	4360	—	—	—	—	—	—
	11/5/2004	1240	613	6.40	3920	4420	0.0040	0.0100	0.358	0.400	1.70	2.10
MCR01	8/31/2004	40.0	461	6.59	920	1050	0.0030	< 0.0010	0.240	1.10	< 1.000	< 2.10
MCR02	8/31/2004	44.0	410	7.00	919	1130	0.0040	< 0.0010	0.0538	1.000	< 1.000	< 2.00
NP01	2/12/2004	25.6	123	7.30	450	659	—	—	—	—	—	—
	4/28/2004	38.6	118	8.00	492	677	0.0050	0.0280	0.100	0.500	< 1.000	< 1.50
	8/18/2004	24.0	141	7.70	495	649	—	—	—	—	—	—
	11/8/2004	19.0	108	7.30	411	578	0.0060	0.0310	0.0784	< 0.200	6.30	< 6.50
NP02	8/24/2004	17.0	131	7.70	448	626	0.0060	0.0230	0.0420	< 0.200	< 1.000	< 1.20
NP03	8/24/2004	13.0	59.0	8.05	320	426	0.0040	0.0500	0.0199	0.400	< 1.000	< 1.40
NP04	8/26/2004	203	552	7.35	1680	1525	0.0020	0.0410	0.677	1.40	< 1.000	< 2.40
NP05	8/26/2004	19.0	55.0	8.50	376	490	0.0260	0.0330	0.0366	0.300	< 1.000	< 1.30

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
NS-2	6/10/2004	59.9	138	7.70	532	850	—	—	0.0580	—	—	—
NS-3	6/10/2004	18.4	172	7.80	505	793	—	—	0.0160	—	—	—
NS-5	6/10/2004	158	23.0	7.60	532	906	—	—	0.0420	—	—	—
P-3	10/20/2004	354	545	6.60	1810	2130	0.0030	0.0280	0.521	< 0.200	< 1.000	< 1.20
P-6	10/20/2004	424	337	6.40	2000	2110	0.0060	0.0920	0.552	0.800	< 1.000	< 1.80
P-8A	10/20/2004	236	468	6.60	1360	1850	0.0070	0.0300	0.491	0.400	< 1.000	< 1.40
P-9	10/20/2004	1020	1110	6.30	4100	4910	0.0030	0.0080	1.65	1.30	< 1.000	< 2.30
P-10	10/22/2004	949	1040	6.20	3850	4210	0.0020	0.0170	0.771	1.30	2.40	3.70
P-11	10/22/2004	1260	1510	6.20	5340	5210	0.0060	0.0290	2.13	1.50	2.00	3.50
P-14	5/24/2004	1360	1250	6.60	5520	6190	—	—	1.29	—	—	—
P-17	5/24/2004	1340	1570	6.30	6330	6620	—	—	1.24	—	—	—
P-19A	5/24/2004	1160	1220	6.15	4800	5250	—	—	1.02	—	—	—
P-20	5/21/2004	2590	1450	6.20	8640	9330	—	—	1.77	—	—	—
RPI-7A	6/28/2004	85.5	326	7.30	830	828	—	< 0.0010	0.0621	1.000	< 1.000	< 2.00
RPI-8A	6/28/2004	13.0	326	7.70	692	906	—	< 0.0010	0.103	0.400	< 1.000	< 1.40

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
RPI-9	6/28/2004	19.1	252	7.30	598	746	—	< 0.0060	0.200	0.700	< 1.000	< 1.70
RPI-10	2/11/2004	10.9	292	7.00	682	869	—	—	—	—	—	—
	8/19/2004	11.0	295	7.65	656	828	—	—	—	—	—	—
RPI-16A	10/28/2004	34.0	66.0	7.20	362	527	0.0090	0.0490	0.0203	< 0.200	1.60	< 1.80
RPI-17A	10/28/2004	17.0	72.0	7.50	331	452	0.0030	0.0500	0.0135	< 0.200	1.000	< 1.20
RPI-18A	10/28/2004	16.0	122	7.65	409	577	0.0070	0.0360	0.0696	< 0.200	< 1.000	< 1.20
RPI-19B	2/13/2004	10.4	283	7.85	663	947	—	—	—	—	—	—
	4/28/2004	10.8	301	7.50	799	1063	0.0020	0.0020	0.0730	< 0.200	< 1.000	< 1.20
	8/19/2004	16.0	225	7.80	671	901	—	—	—	—	—	—
	11/8/2004	21.0	173	7.65	568	793	0.0030	0.0020	0.0693	0.600	< 1.000	< 1.60
RPI-20A	4/28/2004	21.9	260	7.30	753	1022	0.0180	0.0010	0.0190	0.400	< 1.000	< 1.40
	8/19/2004	21.0	154	6.95	498	691	—	—	—	—	—	—
	11/8/2004	25.0	185	7.50	515	718	0.0230	0.0010	0.0059	< 0.200	< 1.000	< 1.20
RPI-21B	2/13/2004	9.81	377	7.90	652	889	—	—	—	—	—	—
	4/28/2004	10.1	279	7.45	673	855	0.0040	0.0010	0.0810	0.600	< 1.000	< 1.60
	8/19/2004	10.00	284	7.95	640	841	—	—	—	—	—	—
	11/8/2004	11.0	284	7.65	631	818	0.0040	0.0030	0.0648	0.400	< 1.000	< 1.40
RPI-22	10/29/2004	22.0	289	7.25	721	967	< 0.0010	< 0.0010	0.0151	0.500	2.00	2.50
RPI-24	9/30/2004	886	833	7.20	3340	4220	0.0030	0.0070	1.09	2.20	< 1.000	< 3.20
RPI-32	4/30/2004	42.0	83.8	6.90	690	1032	—	0.0020	0.306	2.40	2.10	4.50

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
SCDIV-1	5/5/2004	33.4	62.1	7.00	394	630	---	0.0040	0.165	1.20	< 1.000	< 2.20
SCDIV-2	1/29/2004	36.4	46.4	7.45	371	551	0.0105	0.0021	0.0673	0.600	< 1.000	< 1.60
	5/5/2004	37.2	45.9	7.20	355	595	---	0.0040	0.0600	0.500	< 1.000	< 1.50
SCDIV-3	2/2/2004	---	---	7.30	---	697	---	---	---	---	---	---
	5/5/2004	29.2	69.9	6.47	409	657	---	< 0.0010	0.152	1.20	< 1.000	< 2.20
SDP-1	5/11/2004	9.60	254	7.50	687	961	---	0.0020	0.0630	0.700	< 1.000	< 1.70
SDP-2	5/12/2004	10.6	265	7.70	662	915	---	0.0010	0.0670	< 0.200	< 1.000	< 1.20
SP03	8/26/2004	111	295	7.55	905	1169	0.0020	0.0250	0.316	0.700	< 1.000	< 1.70
SP04	8/26/2004	21.0	294	7.80	702	206	0.0030	0.0020	0.127	0.600	< 1.000	< 1.60
TW3-1	7/23/2004	2390	1650	6.25	12100	8460	---	0.0280	2.19	3.80	< 1.000	< 4.80
TW4-1B	6/23/2004	712	4160	5.60	7160	7140	---	0.0050	0.278	34.6	< 1.000	***< 35.6***
TW4-3B	6/24/2004	4000	1220	6.10	15100	10850	---	0.0100	1.85	2.60	< 1.000	< 3.60
TW4-9B	6/24/2004	730	1250	6.55	4460	4060	---	0.0050	0.357	12.0	< 1.000	***< 13.0***
TW5-1B	7/19/2004	3440	1390	6.20	13000	9800	---	< 0.0060	0.307	3.90	< 1.000	< 4.90
TW5-2B	6/24/2004	4240	11900	4.30	23900	17050	---	0.0500	1.37	1090	76.7	***1167***
TW5S-2	7/23/2004	1280	294	6.50	4840	4190	---	0.0160	0.393	4.00	< 1.000	< 5.00

C11

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

CI THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
TW5S-5	6/25/2004	3270	1590	6.70	12700	11050	---	0.0090	0.436	21.6	< 1.000	**< 22.6**
TWI-4	7/19/2004	454	742	6.10	2010	2650	---	< 0.0060	1.56	4.50	< 1.000	< 5.50
TWI-8	7/19/2004	48.1	89.0	6.53	443	695	---	< 0.0010	0.0594	2.50	< 1.000	< 3.50
TWI-14	7/23/2004	544	604	6.60	2270	2770	---	0.0010	0.248	3.10	< 1.000	< 4.10
TWI-17	7/23/2004	785	591	6.80	2920	3410	---	0.0020	0.111	3.10	< 1.000	< 4.10
TWI-23	6/23/2004	4380	1820	5.90	15000	13790	---	0.0080	0.485	2.60	< 1.000	< 3.60
WSC-4	4/30/2004	25.4	88.8	6.85	486	684	---	0.0020	0.0650	1.30	< 1.000	< 2.30
WWL-3A	10/25/2004	667	569	7.00	2840	3450	0.0020	0.0610	0.255	10.7	1.40	12.1
WWL-4A	10/26/2004	1160	585	6.60	3060	985	< 0.0020	0.118	0.312	3.10	< 1.000	< 4.10
WWL-10B	10/26/2004	70.0	300	6.90	791	1016	0.0020	0.0580	0.0860	0.800	< 1.000	< 1.80
WWL-12B	10/26/2004	2230	777	6.90	7800	6910	0.0080	0.0360	0.983	5.90	4.80	10.7
WWL-13B	10/26/2004	170	875	7.20	2480	2580	0.0110	***0.248***	***6.07***	3.20	2.20	5.40
WWL-14A	10/25/2004	328	138	6.70	1290	1417	0.0040	0.0370	0.132	1.000	1.000	2.00
WWL-14B	10/25/2004	7870	4220	4.60	20600	14220	0.0200	0.0400	2.66	16.6	3.50	***20.1***
WWL-15A	10/25/2004	885	442	7.25	2250	3520	0.0010	0.0640	0.166	7.00	2.40	9.40

C12

TABLE 4.0-1. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd)

Cl THROUGH Ra226+228

Sample Point Name	Date	Cl (mg/l)	SO4 (mg/l)	pH(f) (std. units)	TDS (mg/l)	Cond(f) (µmhos)	As (mg/l)	Se (mg/l)	Unat (mg/l)	Ra226 (pCi/l)	Ra228 (pCi/l)	Ra226+228 (pCi/l)
WWL-20B	10/26/2004	34.0	369	7.20	1080	1142	0.0060	0.0150	0.0700	1.70	< 1.000	< 2.70

NOTES: - indicates that value exceeds the ground-water protection standard based on approval of ACL.
"<" sign before a value indicates that the value is less than the detection limit.
An "f" subscript on a parameter indicates that values were field measured.
All values are in MG/L unless otherwise noted and the following:
COND = conductivity in micromhos/cm @ 25 DEG. C
pH = pH, in standard units
"#" symbol before a value indicates that the value was a re-check sample.

TABLE 4.0-2. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY.

Th-230 THROUGH Ni

Sample Point Name	Date	Th230 (pCi/l)	Alpha (pCi/l)	Ba (mg/l)	Be (mg/l)	Cd (mg/l)	Cr (mg/l)	NO3 (mg/l)	Fe (mg/l)	Pb (mg/l)	Mo (mg/l)	Ni (mg/l)
5A-1	4/27/2004	0.500	< 1.000	0.0440	< 0.0010	< 0.0010	0.0030	—	—	< 0.0010	0.0020	0.0190
	11/5/2004	< 0.200	1.20	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC06	4/26/2004	< 0.200	3.50	0.0410	< 0.0010	< 0.0010	< 0.0010	—	—	0.0010	0.0050	0.0050
	11/4/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC07	4/26/2004	< 0.200	< 1.000	0.0380	< 0.0010	< 0.0010	0.0020	—	—	< 0.0010	0.0060	< 0.0030
	11/4/2004	< 0.200	1.50	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC08	10/25/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC09	4/26/2004	< 0.200	3.80	0.0610	< 0.0010	< 0.0010	0.0040	—	—	< 0.0010	< 0.0010	0.0060
	11/4/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC11	4/27/2004	0.600	4.00	0.0940	< 0.0010	< 0.0010	0.0020	—	—	< 0.0010	< 0.0010	0.0040
	11/4/2004	< 0.200	3.00	0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC13	10/25/2004	< 0.200	2.00	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC14	4/27/2004	< 0.200	1.000	0.0580	< 0.0010	< 0.0010	< 0.0010	—	—	< 0.0010	0.0020	0.0020
	11/5/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MC15	4/27/2004	0.500	3.20	0.0790	< 0.0010	0.0010	0.0040	—	—	0.0020	< 0.0010	0.0480
	11/5/2004	< 0.200	1.10	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MCR01	8/31/2004	< 0.200	2.20	0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
MCR02	8/31/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
NP01	4/28/2004	0.700	< 1.000	0.0480	< 0.0010	< 0.0010	0.0020	—	—	< 0.0010	0.0060	0.0040

TABLE 4.0-2. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd.)

Th-230 THROUGH Ni

Sample Point Name	Date	Th230 (pCi/l)	Alpha (pCi/l)	Ba (mg/l)	Be (mg/l)	Cd (mg/l)	Cr (mg/l)	NO3 (mg/l)	Fe (mg/l)	Pb (mg/l)	Mo (mg/l)	Ni (mg/l)
NP01	11/8/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
NP02	8/24/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
NP03	8/24/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
NP04	8/26/2004	< 0.200	2.00	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
NP05	8/26/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-3	10/20/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-6	10/20/2004	< 0.200	1.20	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-8A	10/20/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-9	10/20/2004	< 0.200	2.00	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-10	10/22/2004	< 0.200	1.50	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
P-11	10/22/2004	< 0.200	2.00	< 0.100	< 0.0100	***0.0200***	< 0.0500	---	---	< 0.0500	< 0.100	***0.0700***
RPI-7A	6/28/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
RPI-8A	6/28/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
RPI-9	6/28/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
RPI-16A	10/28/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500

C14

TABLE 4.0-2. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd.)

Th-230 THROUGH Ni

Sample Point Name	Date	Th230 (pCi/l)	Alpha (pCi/l)	Ba (mg/l)	Be (mg/l)	Cd (mg/l)	Cr (mg/l)	NO3 (mg/l)	Fe (mg/l)	Pb (mg/l)	Mo (mg/l)	Ni (mg/l)
RPI-17A	10/28/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-18A	10/28/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-19B	4/28/2004	< 0.200	< 1.000	0.0380	< 0.0010	< 0.0010	< 0.0010	—	—	< 0.0010	0.0030	0.0080
	11/8/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-20A	4/28/2004	< 0.200	< 1.000	0.0370	< 0.0010	< 0.0010	< 0.0010	—	—	< 0.0010	0.0010	0.0070
	11/8/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-21B	4/28/2004	< 0.200	< 1.000	0.0340	< 0.0010	< 0.0010	< 0.0010	—	—	< 0.0010	0.0070	0.0060
	11/8/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-22	10/29/2004	< 0.200	1.10	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-24	9/30/2004	< 0.200	1.70	< 0.100	< 0.0100	< 0.0100	< 0.0500	—	—	< 0.0500	< 0.100	< 0.0500
RPI-32	4/30/2004	< 0.200	—	—	—	—	—	—	—	—	—	—
SCDIV-1	5/5/2004	< 0.200	—	—	—	—	—	—	—	—	—	—
SCDIV-2	1/29/2004	< 0.200	1.70	0.0347	< 0.0010	< 0.0010	< 0.0010	—	—	< 0.0010	0.0103	0.0011
	5/5/2004	< 0.200	—	—	—	—	—	—	—	—	—	—
SCDIV-3	5/5/2004	< 0.200	—	—	—	—	—	—	—	—	—	—
SDP-1	5/11/2004	< 0.200	—	—	—	—	—	—	—	—	—	—
SDP-2	5/12/2004	< 0.200	—	—	—	—	—	—	—	—	—	—

TABLE 4.0-2. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd.)

Th-230 THROUGH Ni

Sample Point Name	Date	Th230 (pCi/l)	Alpha (pCi/l)	Ba (mg/l)	Be (mg/l)	Cd (mg/l)	Cr (mg/l)	NO3 (mg/l)	Fe (mg/l)	Pb (mg/l)	Mo (mg/l)	Ni (mg/l)
SP03	8/26/2004	< 0.200	1.50	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
SP04	8/26/2004	< 0.200	< 1.000	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
TW3-1	7/23/2004	1.80	---	---	---	---	---	---	---	---	---	---
TW4-1B	6/23/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TW4-3B	6/24/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TW4-9B	6/24/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TW5-1B	7/19/2004	0.700	---	---	---	---	---	---	---	---	---	---
TW5-2B	6/24/2004	***45.1***	---	---	---	---	---	---	---	---	---	---
TW5S-2	7/23/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TW5S-5	6/25/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TWI-4	7/19/2004	0.900	---	---	---	---	---	---	---	---	---	---
TWI-8	7/19/2004	***5.90***	---	---	---	---	---	---	---	---	---	---
TWI-14	7/23/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TWI-17	7/23/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
TWI-23	6/23/2004	< 0.200	---	---	---	---	---	---	---	---	---	---

C15

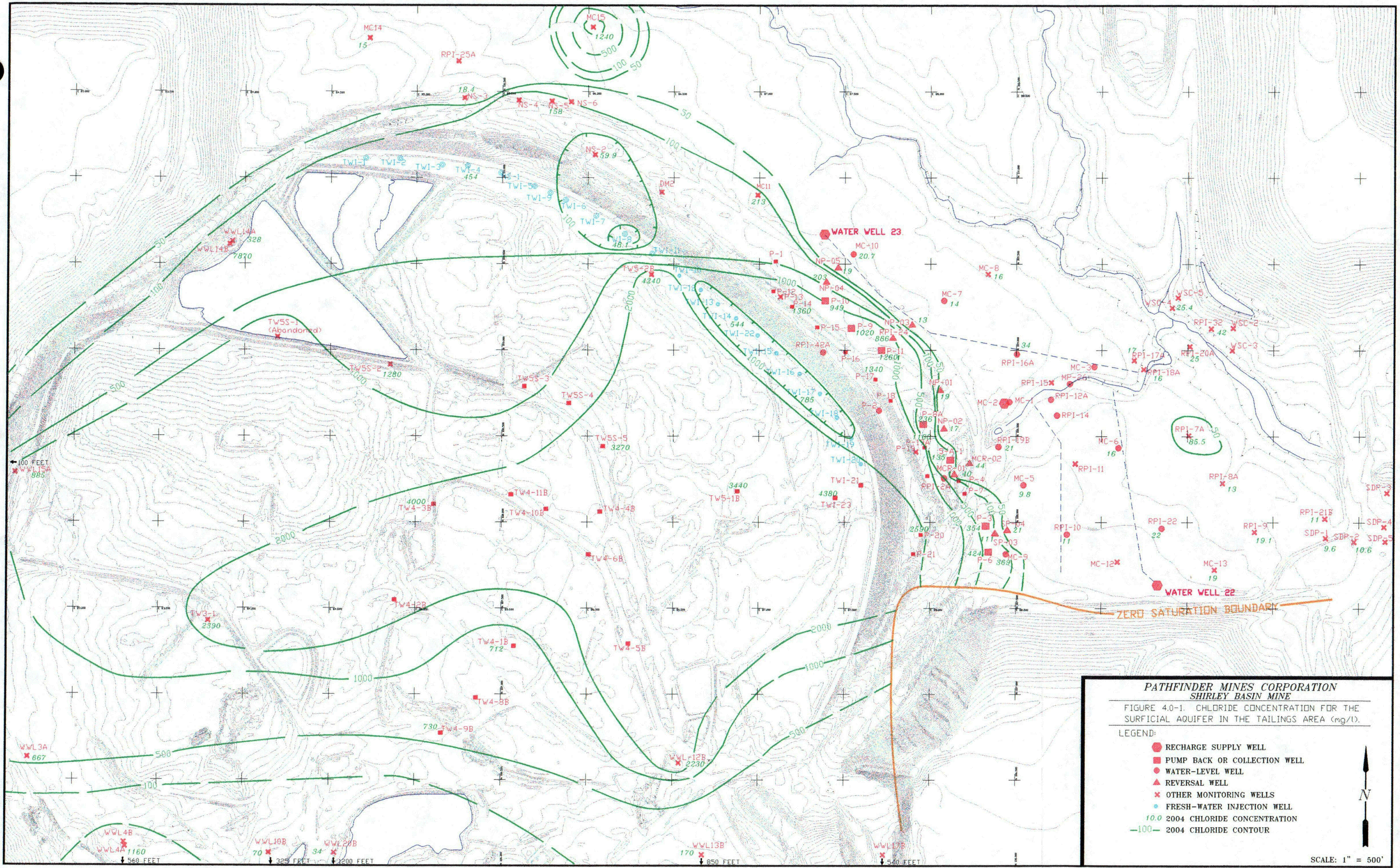
TABLE 4.0-2. YEAR 2004 SHIRLEY BASIN MINE SURFICIAL AQUIFER WATER QUALITY. (cont'd.)

Th-230 THROUGH Ni

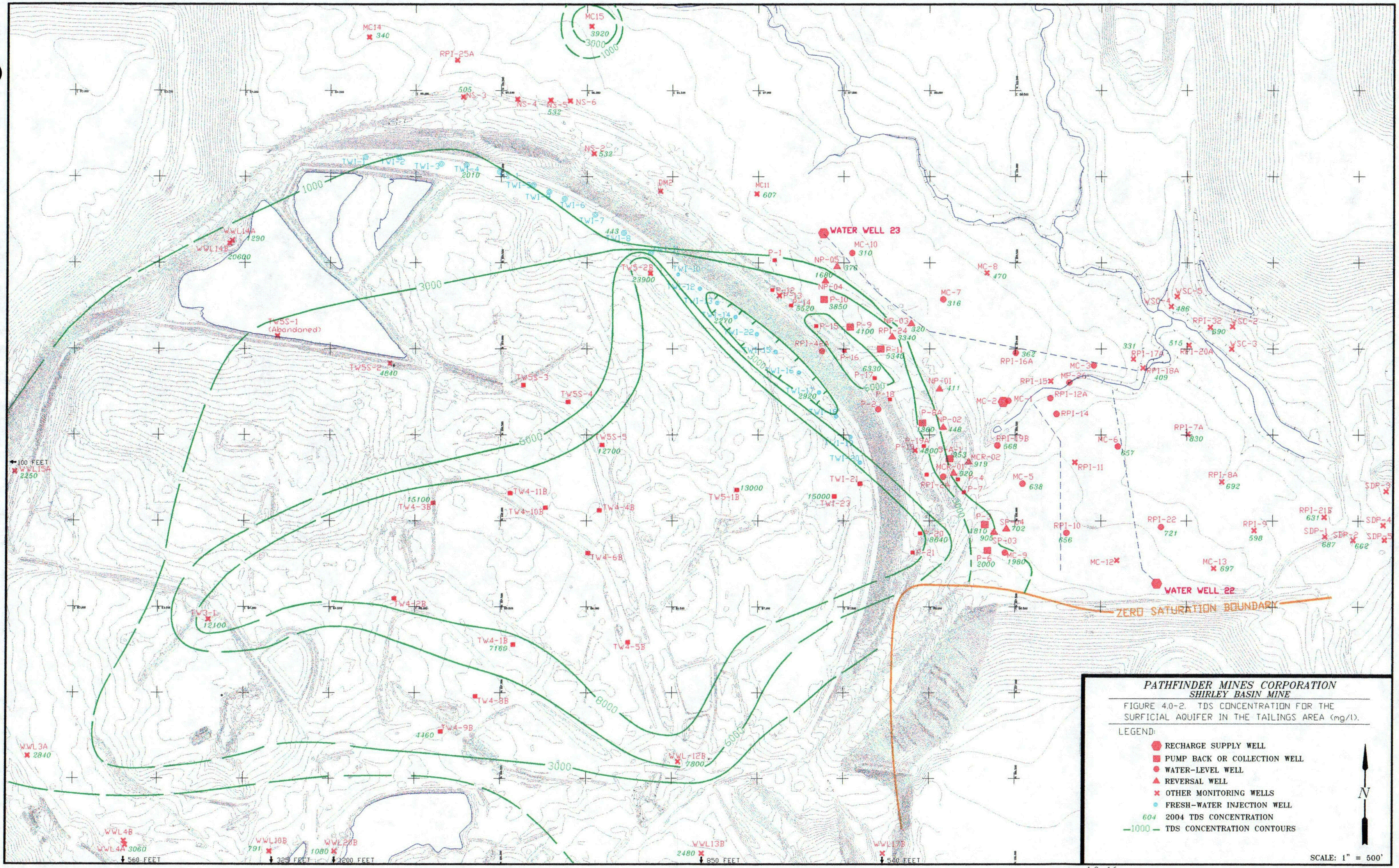
Sample Point Name	Date	Th230 (pCi/l)	Alpha (pCi/l)	Ba (mg/l)	Be (mg/l)	Cd (mg/l)	Cr (mg/l)	NO3 (mg/l)	Fe (mg/l)	Pb (mg/l)	Mo (mg/l)	Ni (mg/l)
WSC-4	4/30/2004	< 0.200	---	---	---	---	---	---	---	---	---	---
WWL-3A	10/25/2004	< 0.200	11.8	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-4A	10/26/2004	< 0.200	5.40	< 0.100	< 0.0100	0.0100	< 0.0500	---	---	< 0.0500	< 0.100	***0.370***
WWL-10B	10/26/2004	< 0.200	1.60	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-12B	10/26/2004	< 0.200	5.80	0.200	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-13B	10/26/2004	< 0.200	5.80	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-14A	10/25/2004	< 0.200	2.50	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-14B	10/25/2004	< 0.200	***28.4***	< 0.100	0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	***3.40***
WWL-15A	10/25/2004	< 0.200	9.50	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500
WWL-20B	10/26/2004	< 0.200	2.00	< 0.100	< 0.0100	< 0.0100	< 0.0500	---	---	< 0.0500	< 0.100	< 0.0500

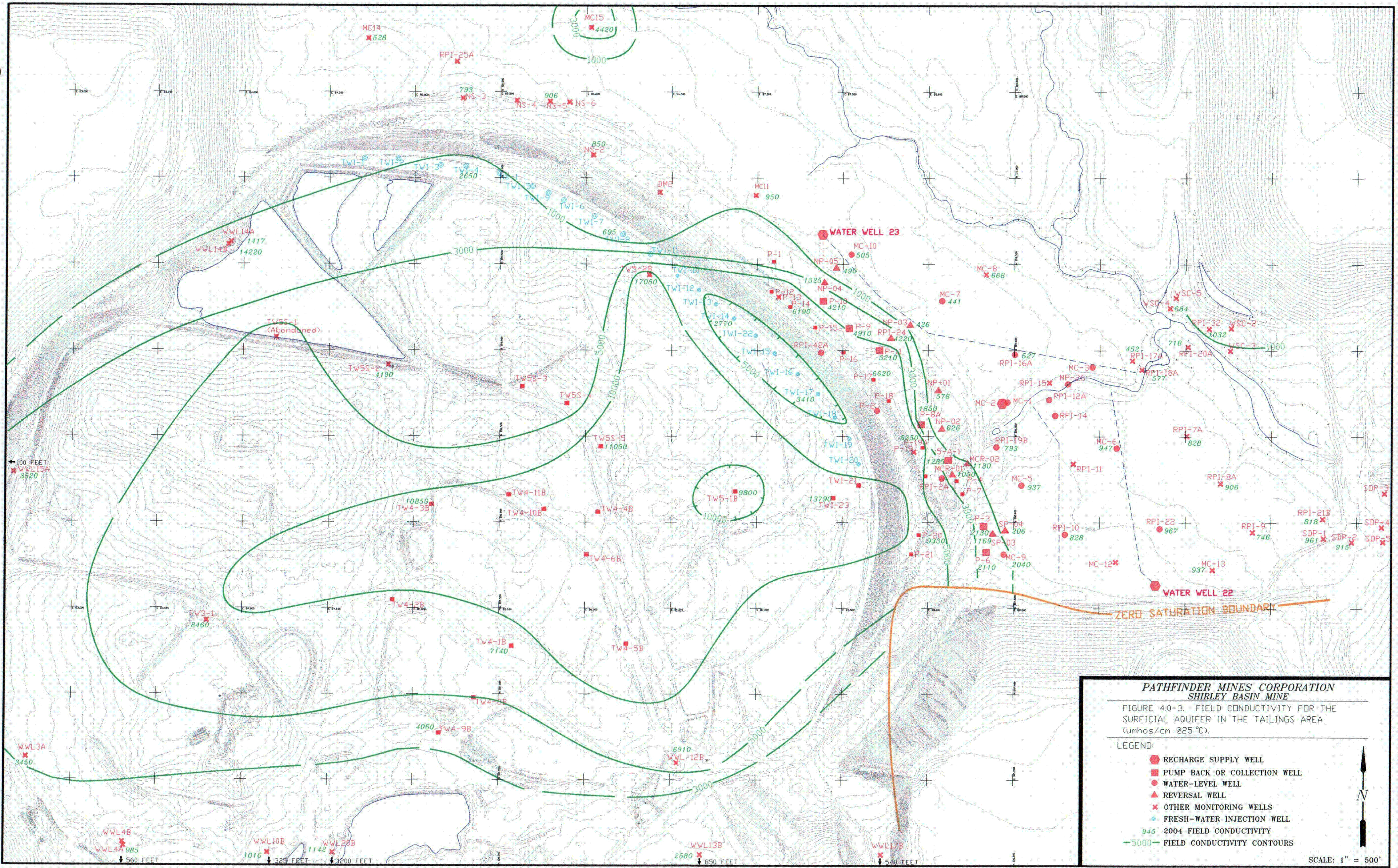
NOTES: [shaded] - indicates that value exceeds the ground-water protection standard based on approval of ACL.
"<" sign before a value indicates that the value is less than the detection limit.
An "f" subscript on a parameter indicates that values were field measured.
All values are in MG/L unless otherwise noted and the following:
COND = conductivity in micromhos/cm @ 25 DEG. C
pH = pH, in standard units
"#" symbol before a value indicates that the value was a re-check sample.

C16


PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 4.0-1. CHLORIDE CONCENTRATION FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (mg/l).
LEGEND:
RECHARGE SUPPLY WELL
PUMP BACK OR COLLECTION WELL
WATER-LEVEL WELL
REVERSAL WELL
OTHER MONITORING WELLS
FRESH-WATER INJECTION WELL
10.0 2004 CHLORIDE CONCENTRATION
—100— 2004 CHLORIDE CONTOUR
N
SCALE: 1" = 500'
WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY

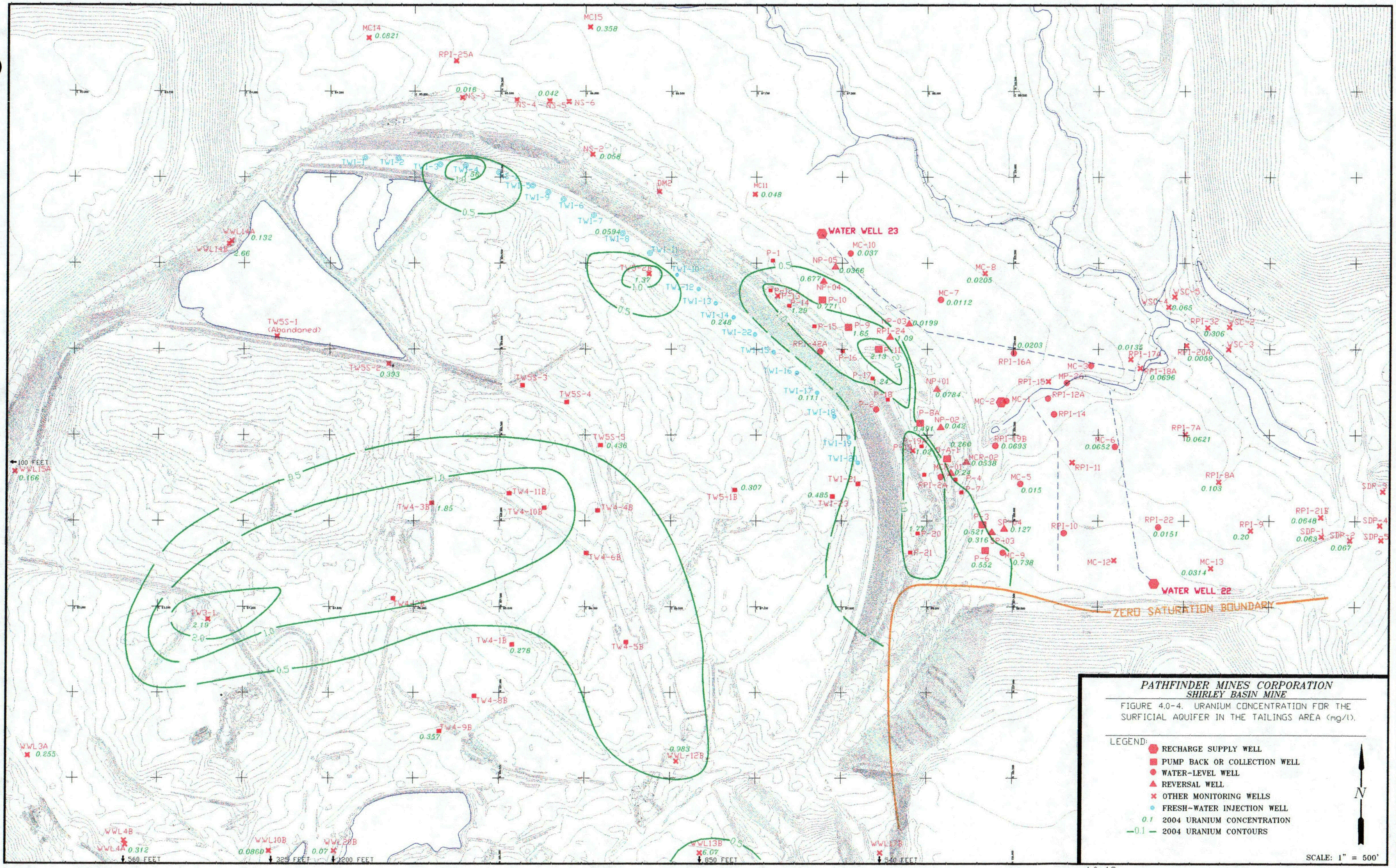
C17


WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY
PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 4.0-2. TDS CONCENTRATION FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (mg/l).
LEGEND:
RECHARGE SUPPLY WELL
PUMP BACK OR COLLECTION WELL
WATER-LEVEL WELL
REVERSAL WELL
OTHER MONITORING WELLS
FRESH-WATER INJECTION WELL
604 2004 TDS CONCENTRATION
1000 TDS CONCENTRATION CONTOURS
N
SCALE: 1" = 500'



PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE

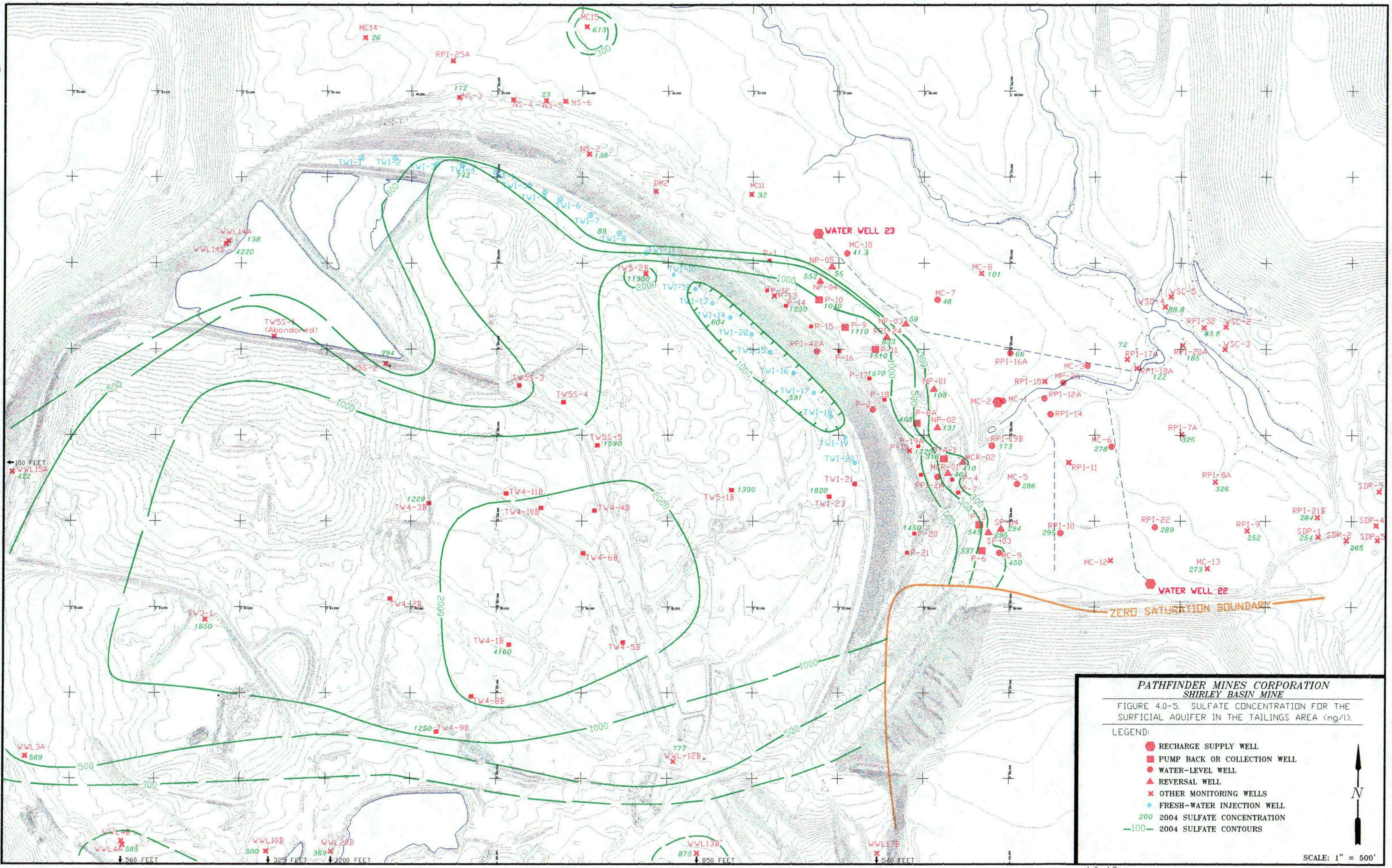
FIGURE 4.0-3. FIELD CONDUCTIVITY FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (umhos/cm @25 °C).



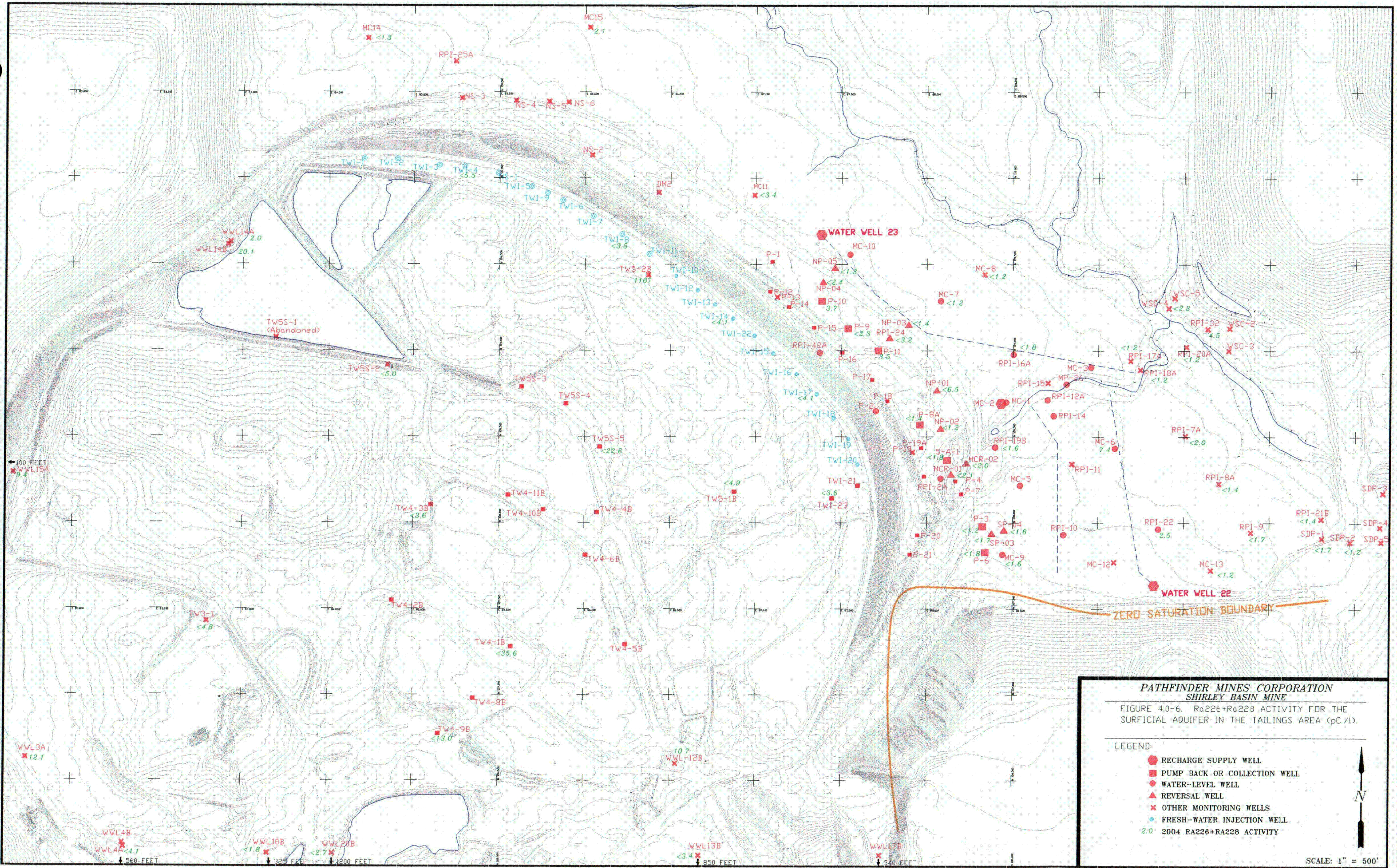
PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE

FIGURE 4.0-4. URANIUM CONCENTRATION FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (mg/l).

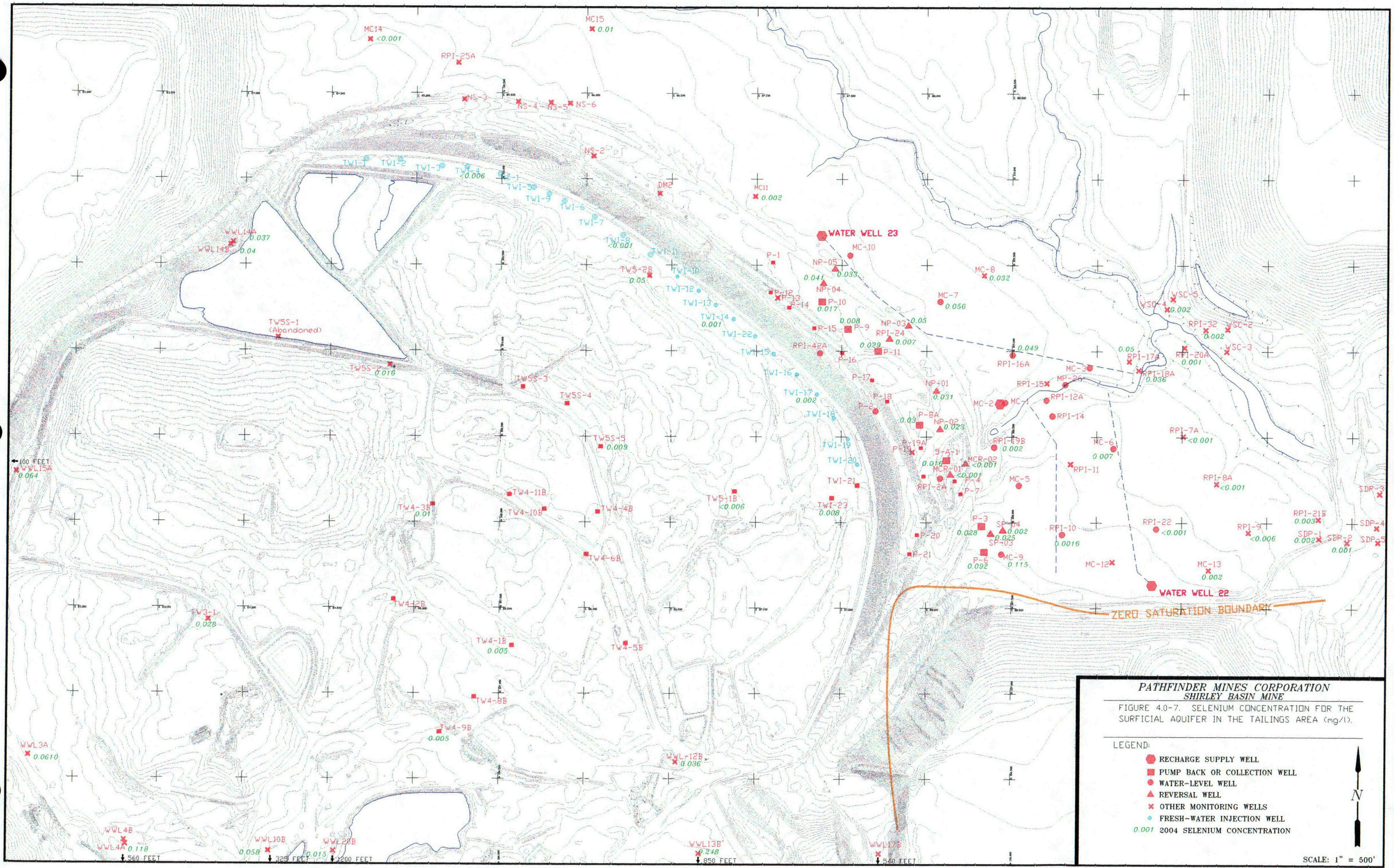
C20


PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 4.0-5. SULFATE CONCENTRATION FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (mg/l).
LEGEND:
RECHARGE SUPPLY WELL
PUMP BACK OR COLLECTION WELL
WATER-LEVEL WELL
REVERSAL WELL
OTHER MONITORING WELLS
FRESH-WATER INJECTION WELL
200 2004 SULFATE CONCENTRATION
—100— 2004 SULFATE CONTOURS
N
SCALE: 1" = 500'
WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY

C21

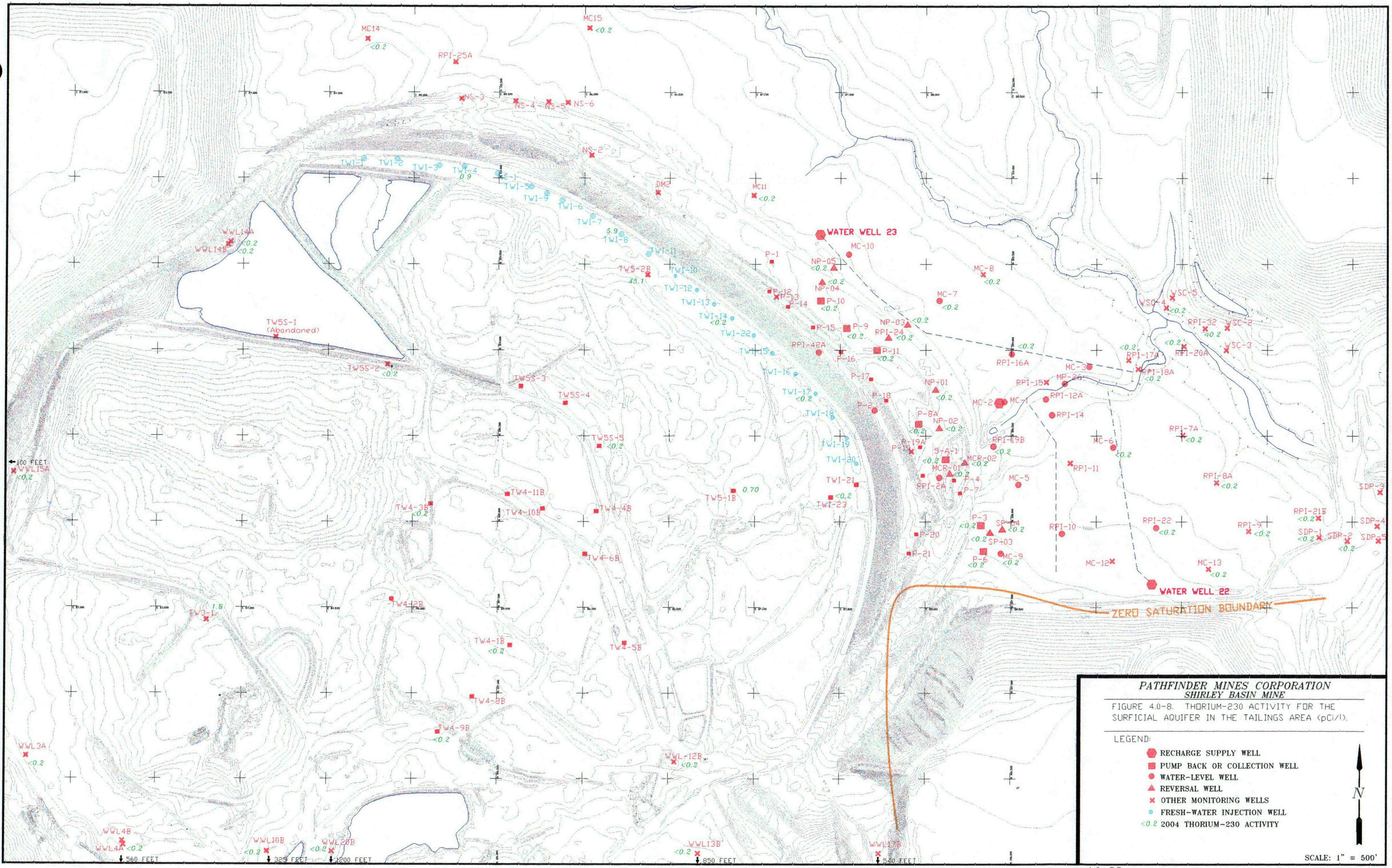

PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 4.0-6. Ra226+Ra228 ACTIVITY FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (pC/l).
LEGEND:
RECHARGE SUPPLY WELL
PUMP BACK OR COLLECTION WELL
WATER-LEVEL WELL
REVERSAL WELL
OTHER MONITORING WELLS
FRESH-WATER INJECTION WELL
2.0 2004 RA226+RA228 ACTIVITY
N
SCALE: 1" = 500'
WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY
TW5S-1 (Abandoned)

C22



PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE
FIGURE 4.0-7. SELENIUM CONCENTRATION FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (mg/l).
LEGEND:
RECHARGE SUPPLY WELL
PUMP BACK OR COLLECTION WELL
WATER-LEVEL WELL
REVERSAL WELL
OTHER MONITORING WELLS
FRESH-WATER INJECTION WELL
0.001 2004 SELENIUM CONCENTRATION
SCALE: 1" = 500'
N
WATER WELL 23
WATER WELL 22
ZERO SATURATION BOUNDARY
TW5S-1 (Abandoned)

C23



PATHFINDER MINES CORPORATION
SHIRLEY BASIN MINE

FIGURE 4.0-8. THORIUM-230 ACTIVITY FOR THE SURFICIAL AQUIFER IN THE TAILINGS AREA (pCi/l).

C24

4.1 NORTH MINE CREEK RECHARGE AREA

Most of the north Mine Creek recharge area downgradient of the recharge line shows vastly improved groundwater quality. Based on chloride concentration and TDS, these wells show water quality similar to recharge water from wells WW23, and WW20 (Table 4.1-1). The north plume aquifer downgradient of the recharge line is essentially free of contaminants. Efforts will continue to center on maintenance of strong reversal gradients and continuous operation of the recharge system until ACL approval. General water quality data taken upgradient of the recharge system shows little change in 2004. Water quality in wells NP04 and NP05 improved dramatically following reestablishment of gradient reversal.

Concentrations of TDS and chloride downgradient of the north recharge line have stabilized at levels roughly equal to those of the recharge water. Well MC-11 is located northwest of the northern end of the recharge line, and both TDS and choride concentrations in the Surficial aquifer in this area have increased slightly over the last five years (see Figures 4.1-1 and 4.1-2) and there was a fairly abrupt increase in 1998 followed by a dramatic increase in mid-1999. TDS concentrations for samples in late 1999 dropped dramatically to levels consistent with those before the spikes and remained relatively consistent through 2004. Prior to 1998, these changes were within natural variations for this aquifer. Chloride concentrations in well MC-11 had been somewhat erratic, and this was attributed to seasonal natural recharge prior to 1998. Recent choride concentrations have shown a rising trend. It is postulated that the injection well operation has pushed a small "pulse" of impacted ground water through the MC-11 area. TDS and choride concentrations at well NP05 have declined since 1997 due to reestablishment of reversal (see Figures 4.1-1 and 4.1-2). The water quality in well NP05 exhibits essentially complete restoration that was maintained in 2004.

Chloride and TDS concentration data correspond with the conductivity data for the north recharge area. Chloride concentrations for wells MC-7 and MC-8 are at background levels (see Figure 4.1-3). TDS concentration values appear to be representative of the mixed recharge water (see Figures 4.0-2 and 4.1-4).

TABLE 4.1-1. MONITOR WELL DATA COMPARED TO RECHARGE WATER DATA.

RECHARGE WATER	2004 DATA TDS	2004 DATA CHLORIDE
WW22	317 (11-16-2004)	15.0 (11-16-2004)
WW23	301 (11-16-2004)	16.0 (11-16-2004)
MC-2	259 (11-5-2004)	21.0 (11-5-2004)

MONITOR WELLS	2004 DATA TDS	2004 DATA CHLORIDE
MC-7	316 (11-4-2004)	14.0 (11-4-2004)
MC-8	470 (10-25-2004)	16.0 (10-25-2004)

NOTE: All concentrations in mg/l.

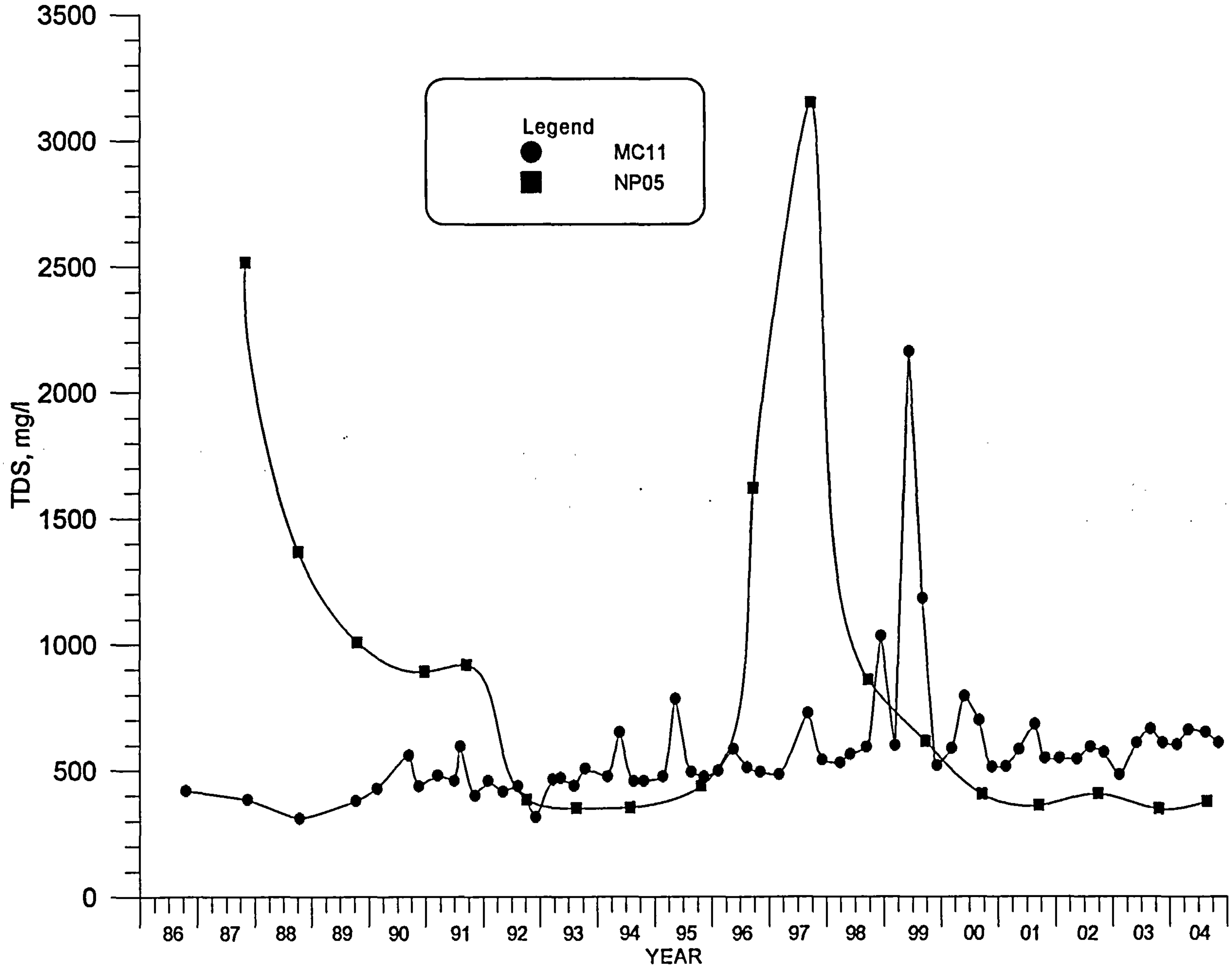


FIGURE 4.1-1. TDS CONCENTRATIONS FOR WELLS MC11 AND NP05.

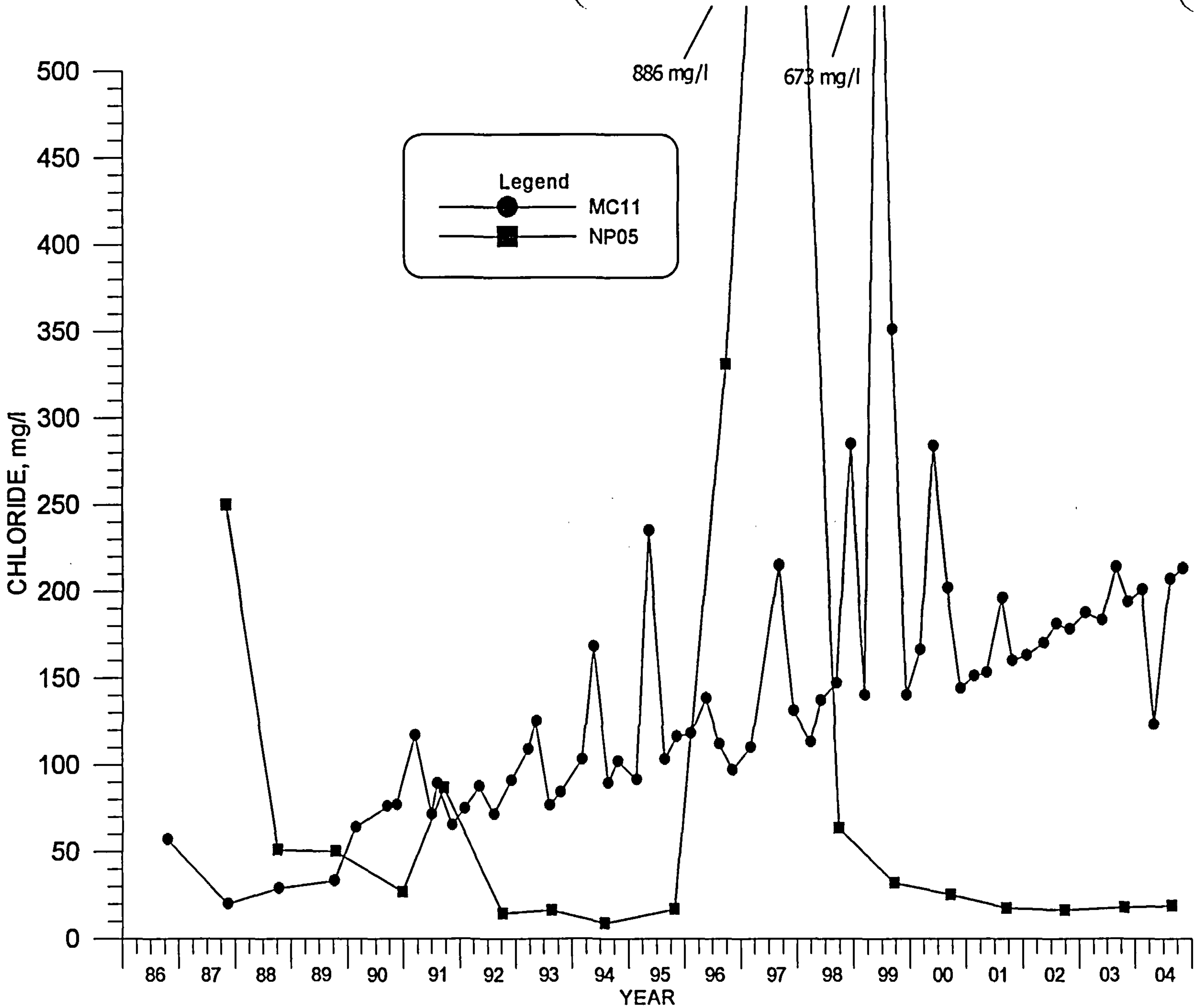


FIGURE 4.1-2. CHLORIDE CONCENTRATIONS FOR WELLS MC11 AND NP05.

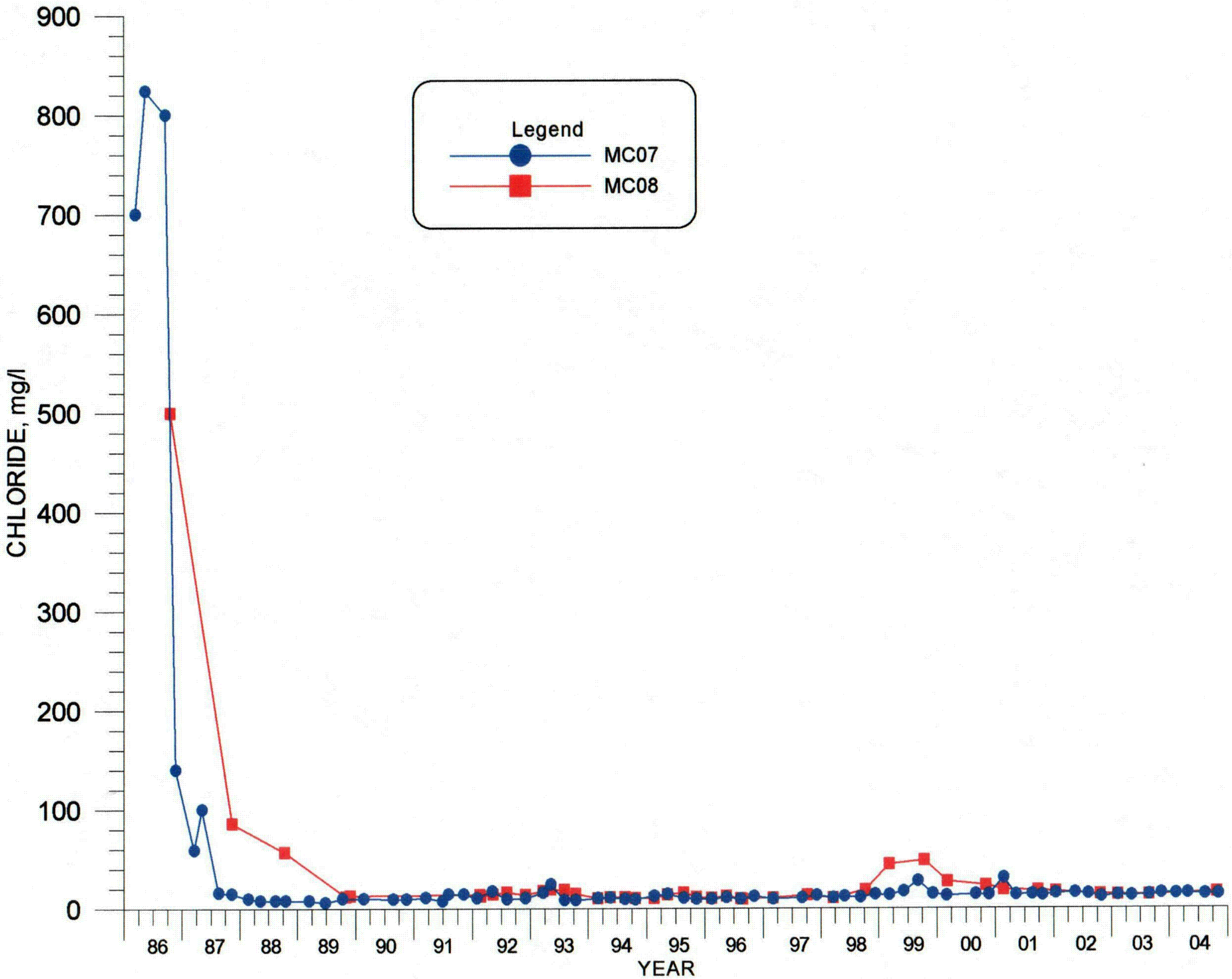


FIGURE 4.1-3. CHLORIDE CONCENTRATIONS FOR WELLS MC07 AND MC08.

C25

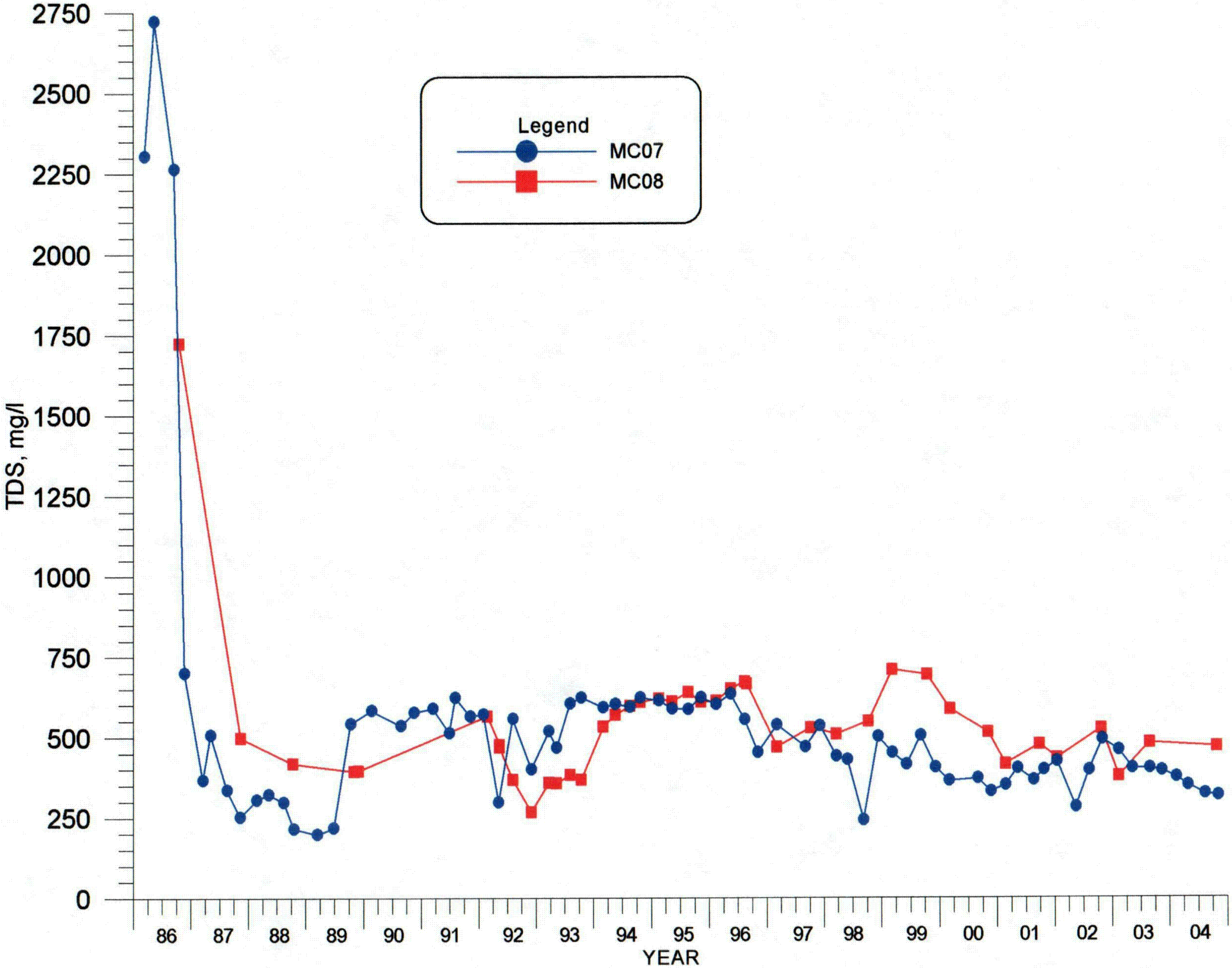


FIGURE 4.1-4. TDS CONCENTRATIONS FOR WELLS MC07 AND MC08.

C26

4.2 SOUTH MINE CREEK RECHARGE AREA

The water quality in wells east of the recharge lines for the south Mine Creek recharge area has been restored to nearly background conditions. Figure 4.2-1 shows that the TDS values in wells RPI-9 and RPI-21B have been reduced to essentially the recharge water concentration. The August 1996 analysis for well RPI-21B is thought to be anomalous, and the significant drop in TDS in 2002 is somewhat atypical.

Monitor well data from RPI-22, RPI-21B and MC-13 show restoration occurred prior to 1990 (see Figure 4.2-2). Wells RPI-7A, RPI-8A and RPI-9 had previously been used as indicator wells for the success of restoration of this area, but sampling in these wells was discontinued after data indicated restoration was essentially complete in 1992. Samples taken in 2004 confirm the water-quality restoration for these three wells.

Figure 4.0-1 illustrates that the recharge/collection system has nearly restored the Surficial aquifer water quality to within a few hundred feet of the collection system. Water quality on the east side of the recharge lines shows only very minor residual elevation of constituent concentrations above recharge or background conditions. There was some minor deterioration of water quality in well MC-9 that reflects the weakening of gradient reversal with the reduction in injection rates for the south recharge lines. Water quality west of the recharge lines has gradually improved until 2003 and 2004 when progress was limited. There have been some elevated TDS or chloride values at wells RPI-11 and RPI-14 in the past that reflect the lower permeability in the area and the position of the recharge lines that creates a nearly stagnant area between the recharge lines. These wells were not sampled in 2004. There is a general gradient towards the tailings and water quality of wells RPI-19B and MC-5 indicates that the slightly elevated concentrations in wells RPI-11 and RPI-14 are not a result of continued seepage from the tailings.

The rate of restoration of the Surficial aquifer to the west of the south recharge line increased dramatically in 1996, but the rate of restoration slowed during 1997 and the changes in concentrations have been very gradual until the weakening of the gradient reversal in 2004. Water quality in well RPI-10 improved quickly with the new recharge and is essentially restored to background conditions. Gradient reversal between wells RPI-11 and MC-5 was strengthened significantly in 1996 but has likely diminished in 2004. The slow restoration progress in these wells prior to 1996 was considered to be indicative of lower transmissivity in this area and the difficulty in achieving a strong gradient reversal. The addition of a recharge line in the south area has been very successful in restoring water quality in this area. Figure 4.2-3 presents the TDS concentrations in wells MC-9, SP03 and SP04.

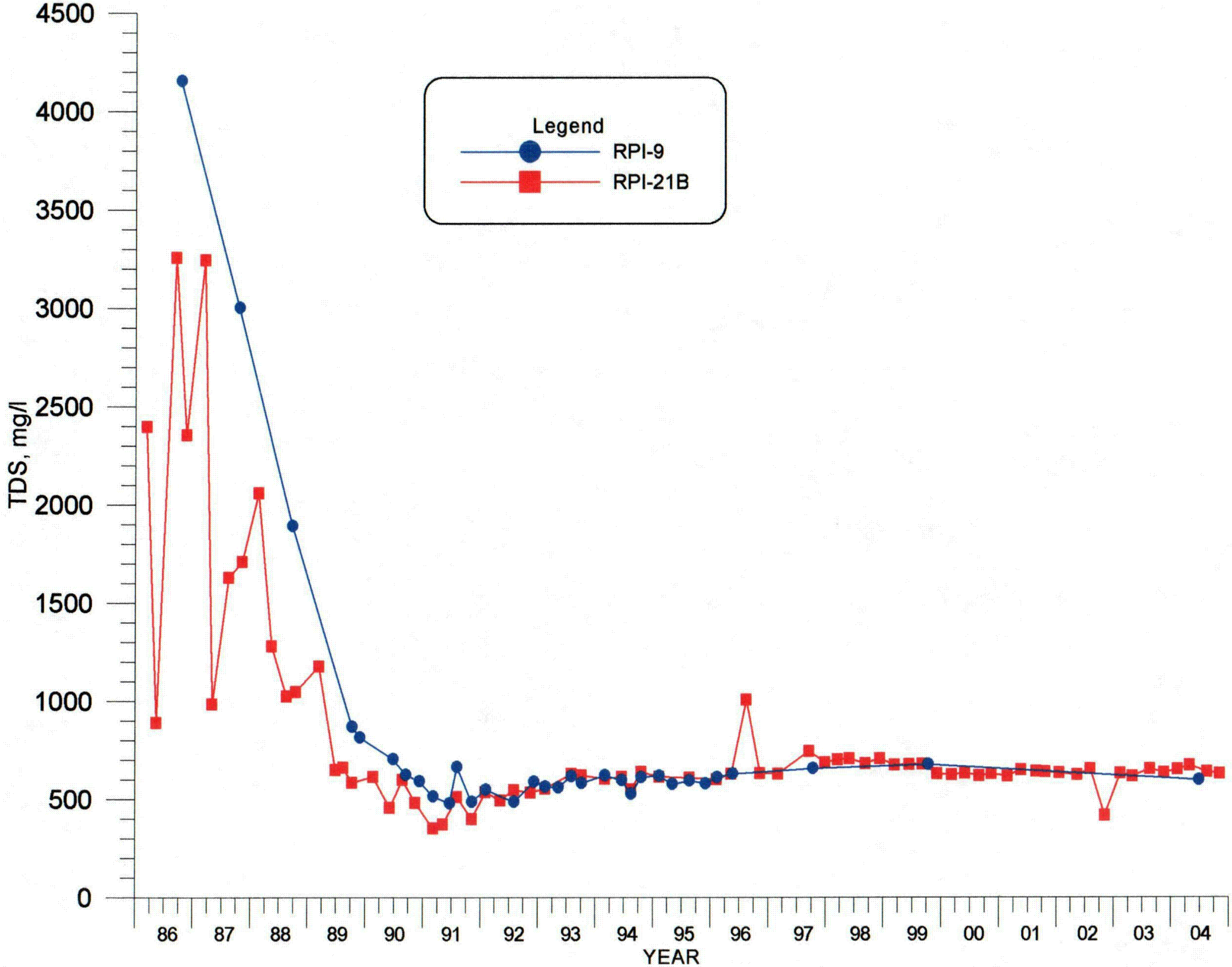


FIGURE 4.2-1. TDS CONCENTRATIONS FOR WELLS RPI-9 AND RPI-21B.

C27

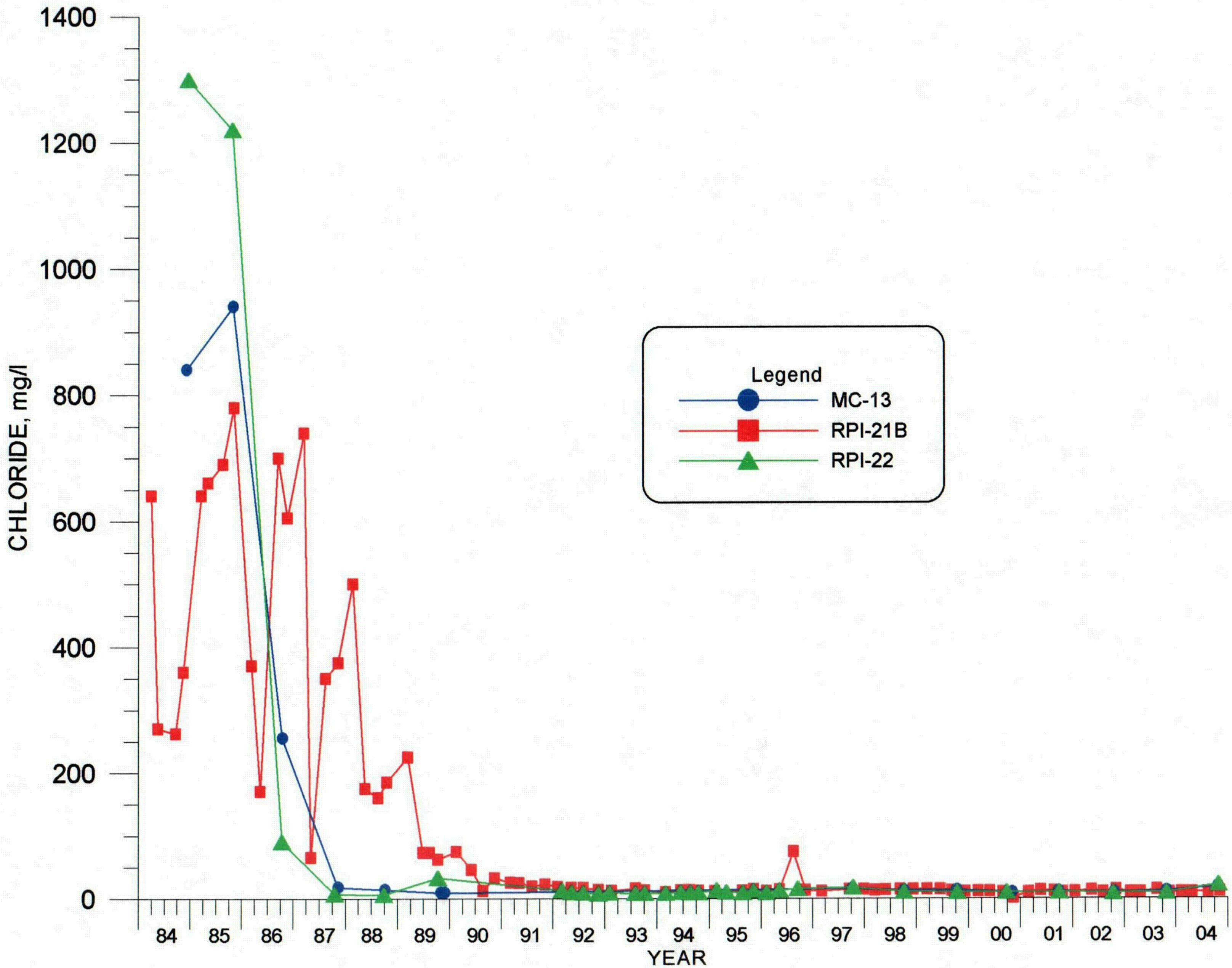


FIGURE 4.2-2. CHLORIDE CONCENTRATIONS FOR WELLS MC-13, RPI-21B AND RPI-22.

C28

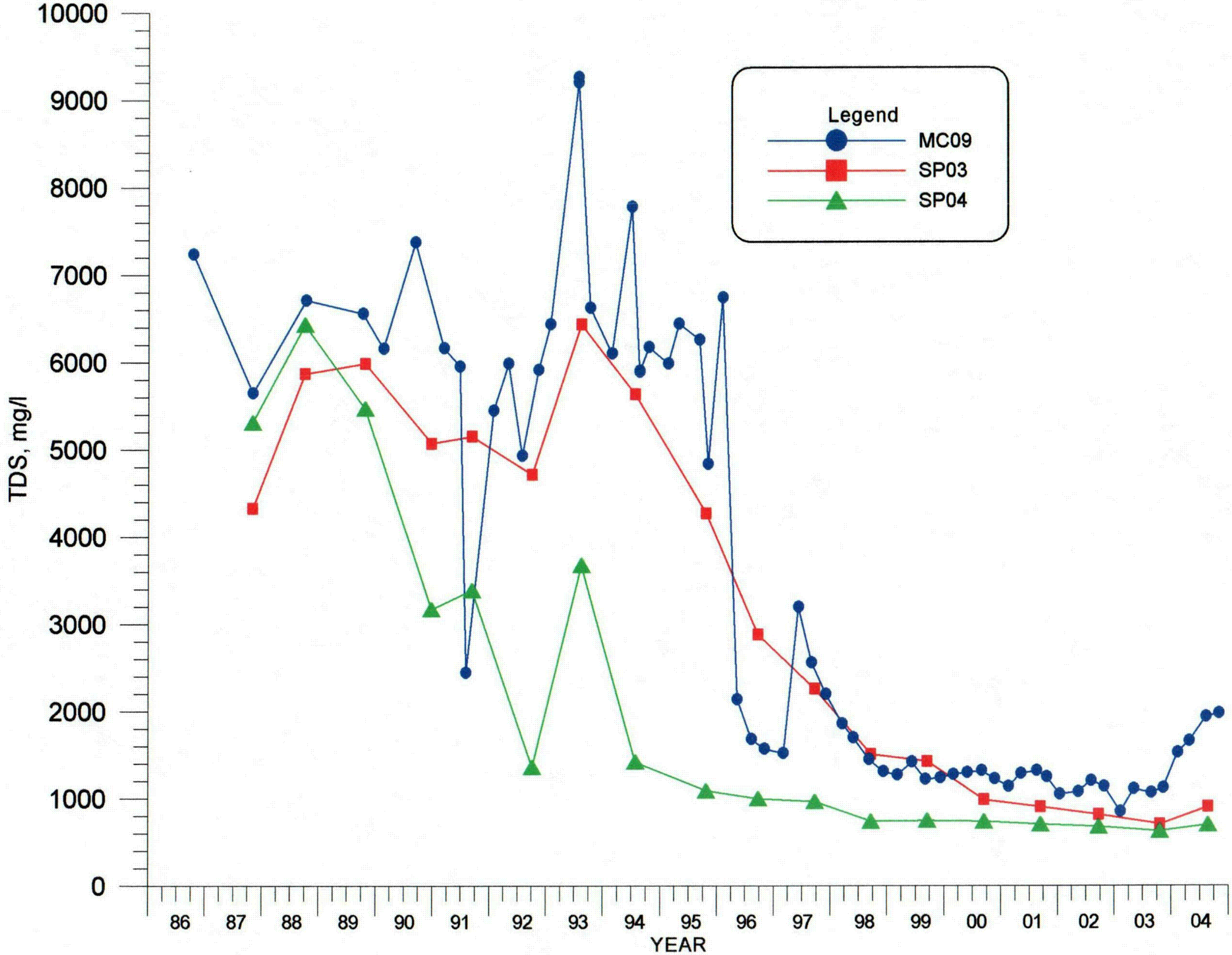


FIGURE 4.2-3. TDS CONCENTRATIONS FOR WELLS MC09, SP03 AND SP04.

C29

4.3 MINE CREEK CHANNEL AREA

Contaminant concentrations in monitor wells RPI-19B, MCR02, and MCR01, are considered indicative of the effectiveness of collection/recharge efforts in the Mine Creek area. Figure 4.3-1 presents the chloride concentrations for wells RPI-19B and MCR02. The ground-water quality in this area is essentially restored and there are only very modest changes in constituent concentrations.

Contaminant concentrations in the Surficial aquifer of the lower Mine Creek area have been significantly affected by the recharge lines. Figure 4.3-2 illustrates that TDS concentrations in wells RPI-17A and RPI-18A have been relatively stable for over ten years, while TDS concentration at well RPI-20A has shown a modest but consistent decline over the same period and is now at similar TDS levels.

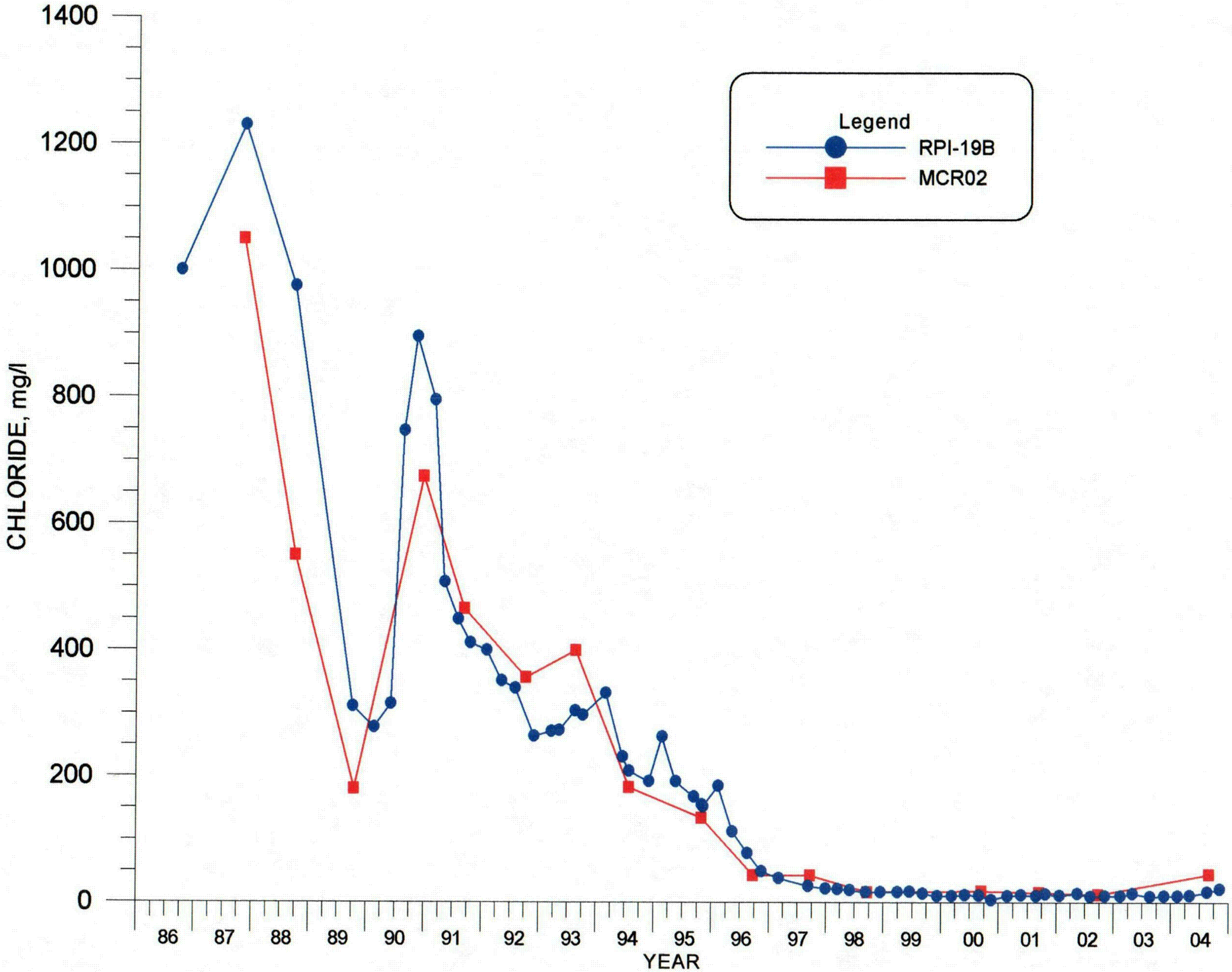


FIGURE 4.3-1. CHLORIDE CONCENTRATIONS FOR WELLS RPI-19B AND MCR02.

C30

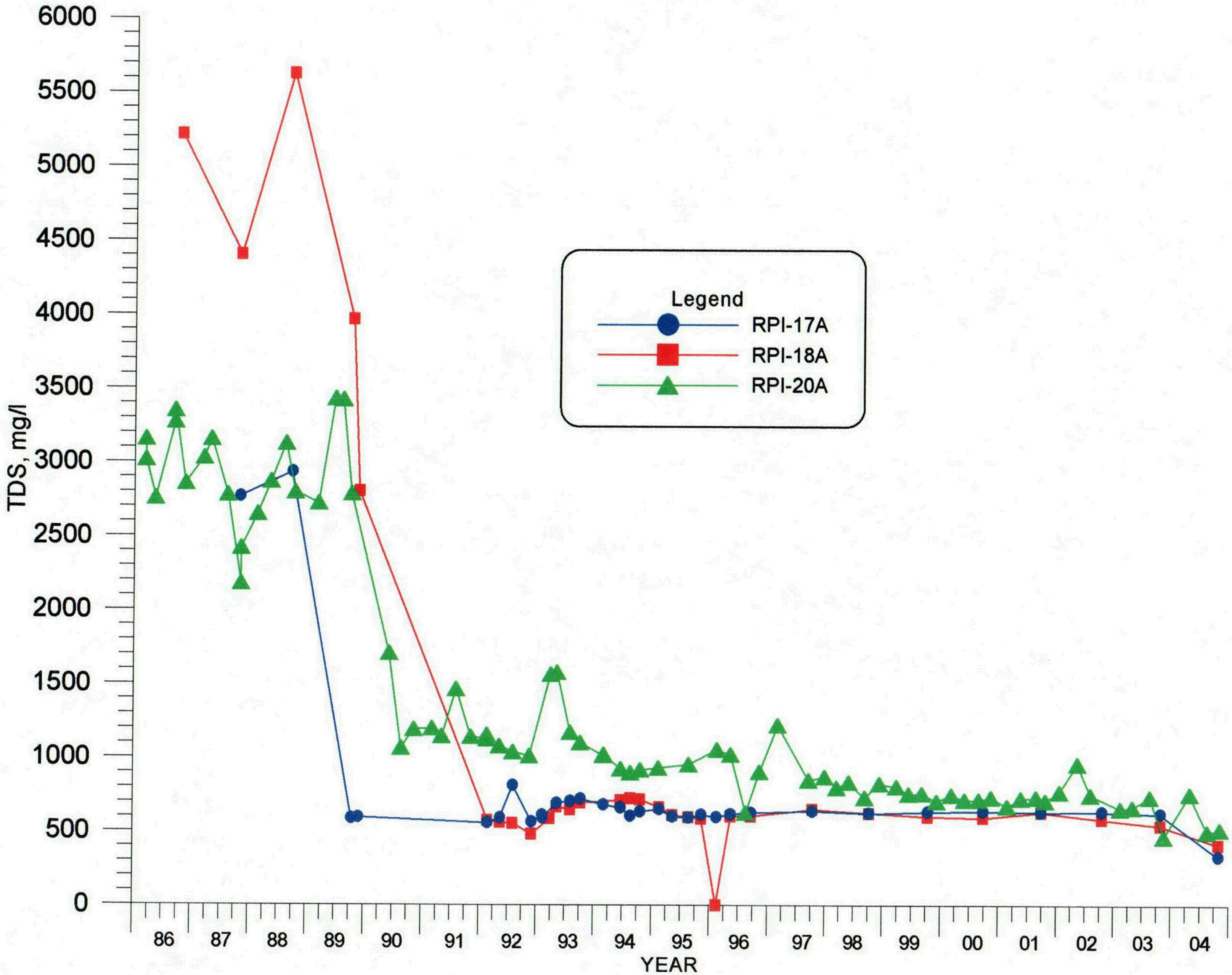


FIGURE 4.3-2. TDS CONCENTRATIONS FOR WELLS RPI-17A, RPI-18A AND RPI-20A.

C31

4.4 NORTH INJECTION WELL AREA

An injection and monitoring well system for the northern perimeter of the No. 5 dam was installed in 1994. Water quality samples were taken from wells to monitor the performance of this system. The data in Tables A-1 and A-2 of Appendix A and Figures 4.4-1 and 4.4-2 indicate some changes in the water quality in well NS-2 and that are thought to reflect the influence of injection water. Recent water quality changes in well MC-15 indicate a seasonal cycling. A four-year overall declining trend in TDS concentration for well MC-15 through 2001 (see Figure 4.4-2) appears to have been marginally reversed.

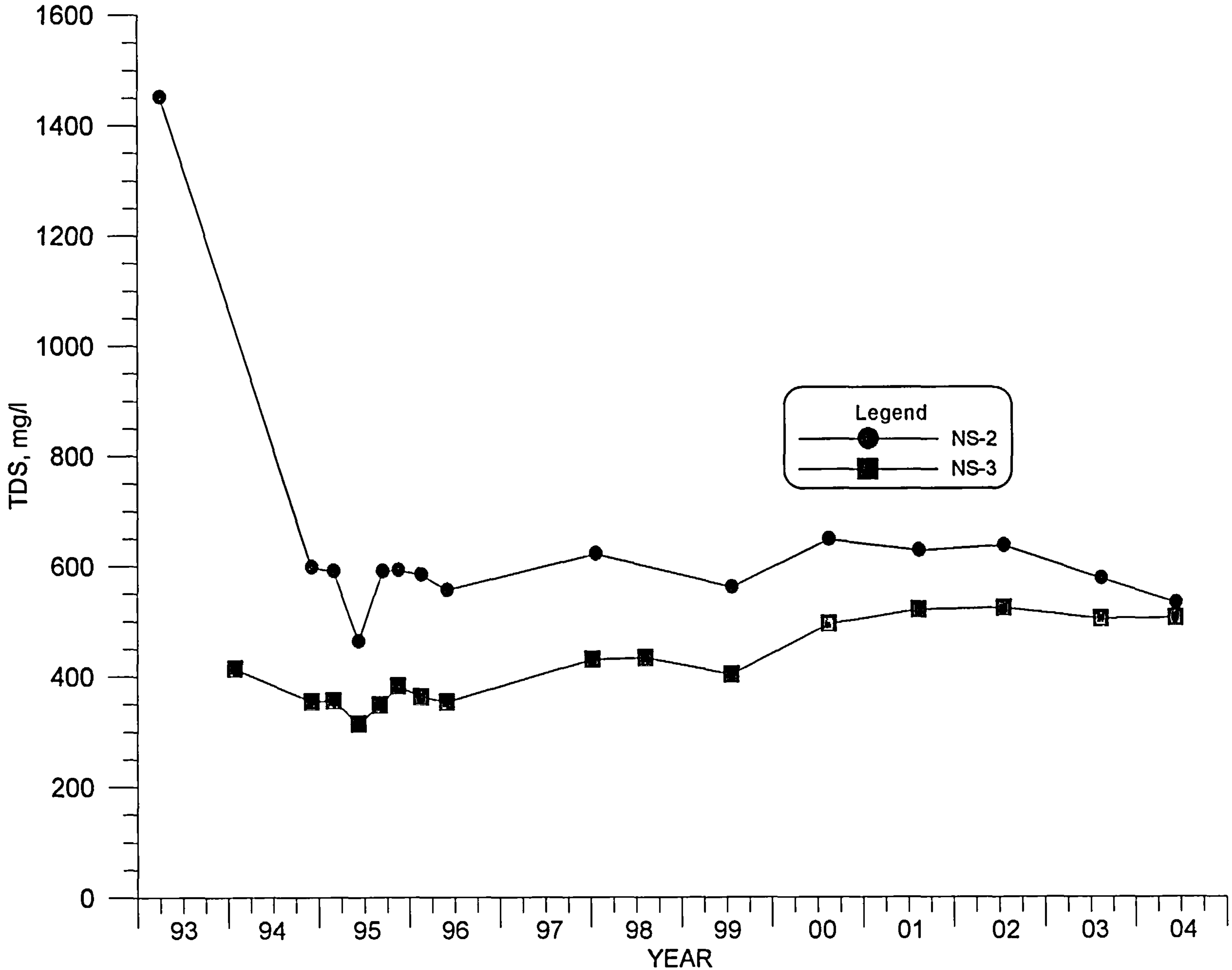


FIGURE 4.4-1. TDS CONCENTRATIONS FOR WELLS NS-2 AND NS-3.

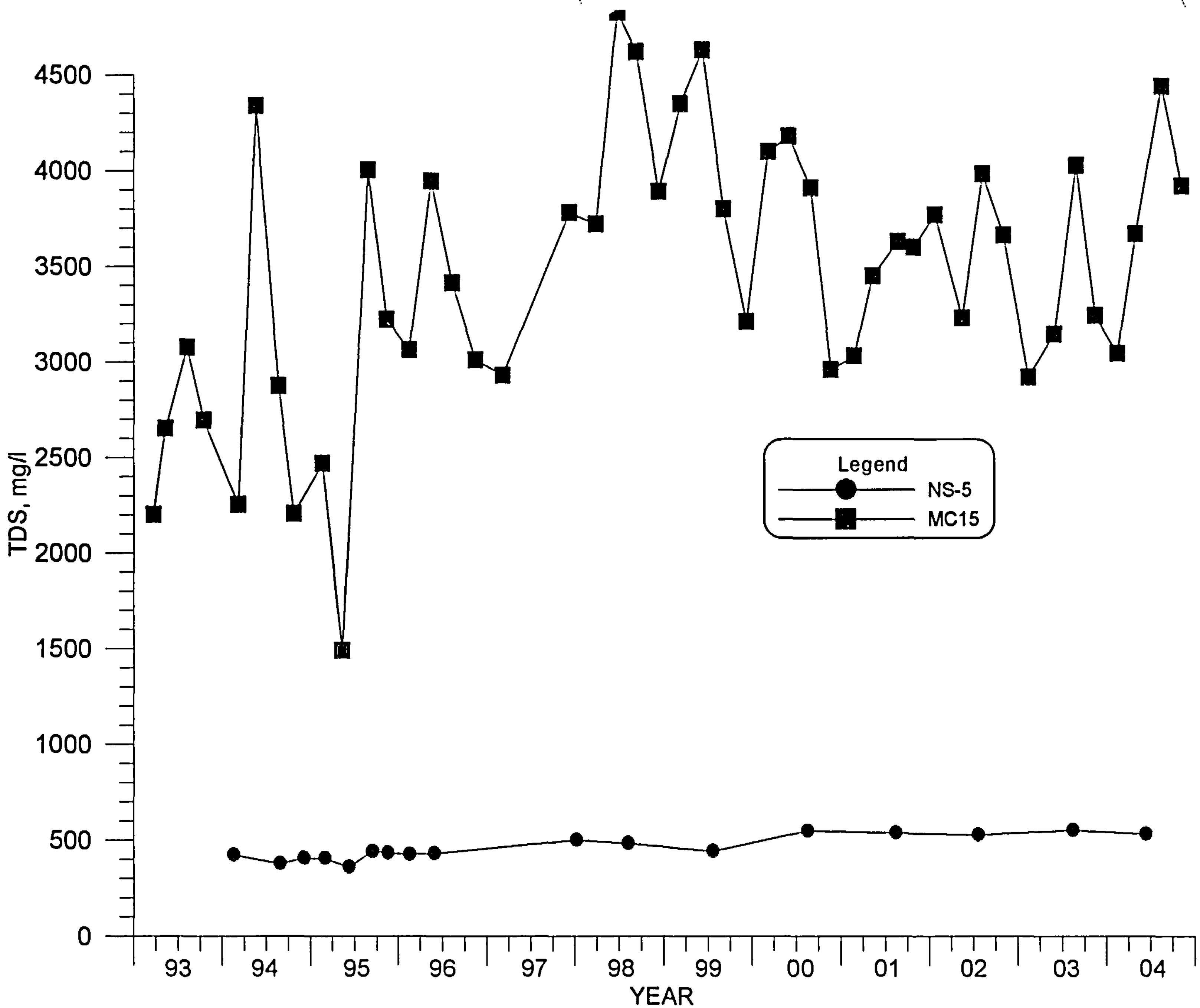


FIGURE 4.4-2. TDS CONCENTRATIONS FOR WELLS NS-5 AND MC15.

4.5 GENERAL TAILINGS AREA

The water quality in the Surficial aquifer to the west and south of the tailings impoundments varies widely. Water quality data for this area is presented in Tables A-1 and A-2 of Appendix A. Within the immediate area of the tailings, all Surficial aquifer wells show seepage effects. These effects range from relatively mild contamination reflected by past sampling at injection well TWI-3 and more recent sampling of well TWI-4 on the northern perimeter of the tailings impoundment, to severe contamination at well TW4-3B. With the exception of the 2004 sample from well TW5-2B, the water quality in the Surficial wells within the immediate tailings area was reasonably consistent with past sampling. Well TW5-2B was among several tailings area Surficial aquifer wells that were abandoned in 2004 and the water quality in this well had been very erratic in recent years. Previous reports have documented and discussed the water quality within the Surficial aquifer beneath the tailings, including the occurrence of erratic or anomalous results.

Some of the Surficial aquifer wells on the western and southern periphery of the tailings have shown mild to moderate seepage impacts, while the remainder have water quality that reflects the local recharge or natural water quality of the Surficial aquifer. Well WWL-14B appears to have been severely impacted by recharge from the adjacent evaporation pond, and is not considered representative of the Surficial aquifer because of a dramatic discrepancy in water-level elevation. The declining water level in this well closely parallels that of the evaporation pond, and this perched zone is likely to dissipate. Wells WWL-3A, WWL-12B, WWL-14A and WWL-15A appear to have been impacted by seepage from the tailings with no significant change in historic trends noted for the 2004 data. The water quality at well WWL-13B is believed to be affected by past activity in the mill area, and the mill area activity may have also contributed to the deteriorated water quality at well WWL-12B (see Figures 4.5-1 and 4.5-2).

The water quality in wells WWL-4A, WWL-10B and WWL-20B is believed to be reflective of natural resident or recharge water quality. Water quality in well WWL-4A continues to be erratic, and Figure 4.5-3 illustrates the natural fluctuation in TDS concentrations in well WWL-20B. Past reports have included extensive discussions of the presence and concentrations of various constituents that are considered indicative of seepage impacts.

In the Mine Creek area, TDS concentration contours closely resemble the chloride concentration and field conductivity (see Figure 4.0-3) contours. There are minor changes in individual wells with modest improvement in water quality in the collection area east of the tailings. Uranium concentrations in the Surficial aquifer (Figure 4.0-4) continue to exhibit a limited mobility that results from neutralization of the tailings seepage as it enters the Surficial aquifer.

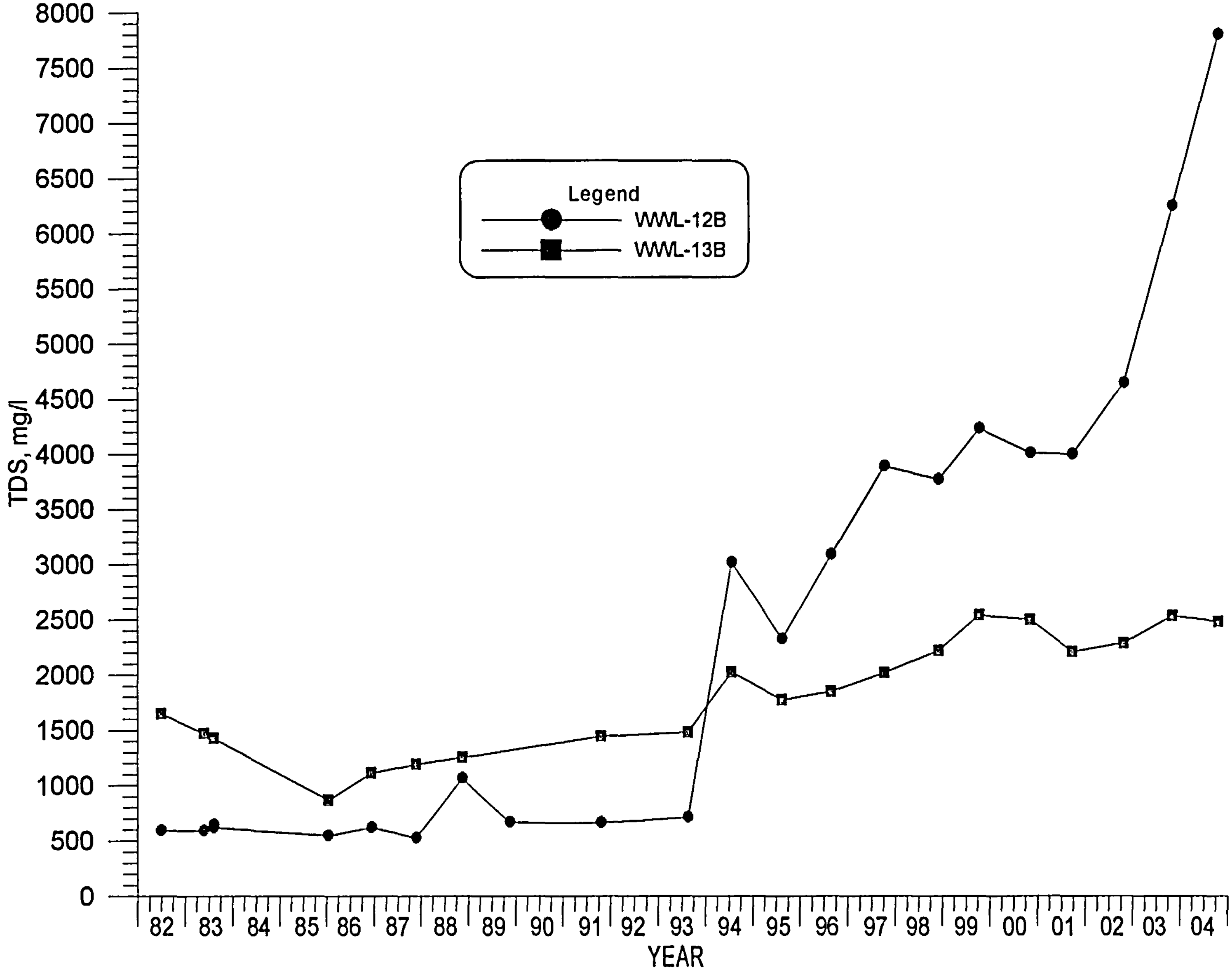


FIGURE 4.5-1. TDS CONCENTRATIONS FOR WELLS WWL-12B AND WWL-13B.

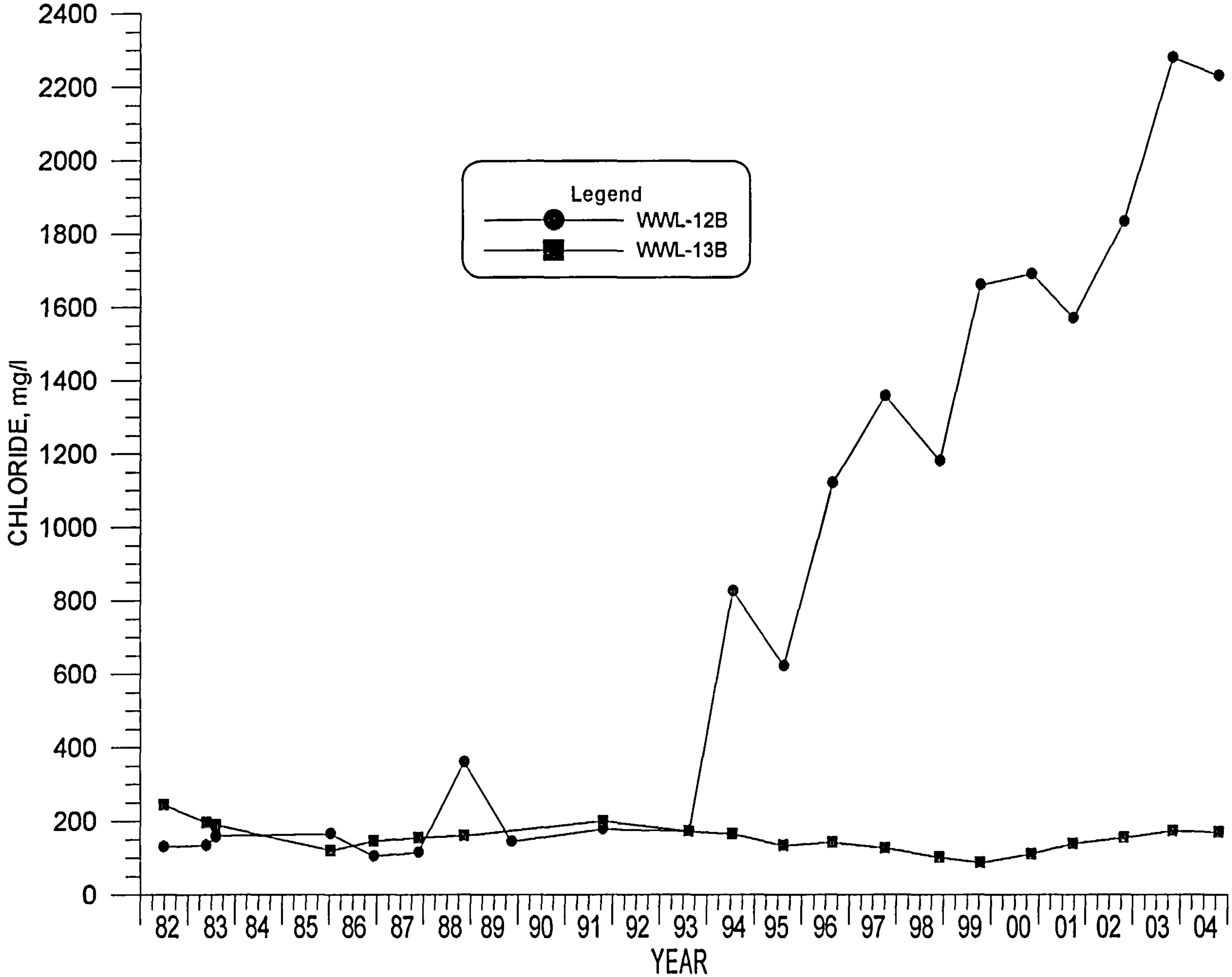


FIGURE 4.5-2. CHLORIDE CONCENTRATIONS FOR WELLS WWL-12B AND WWL-13B.

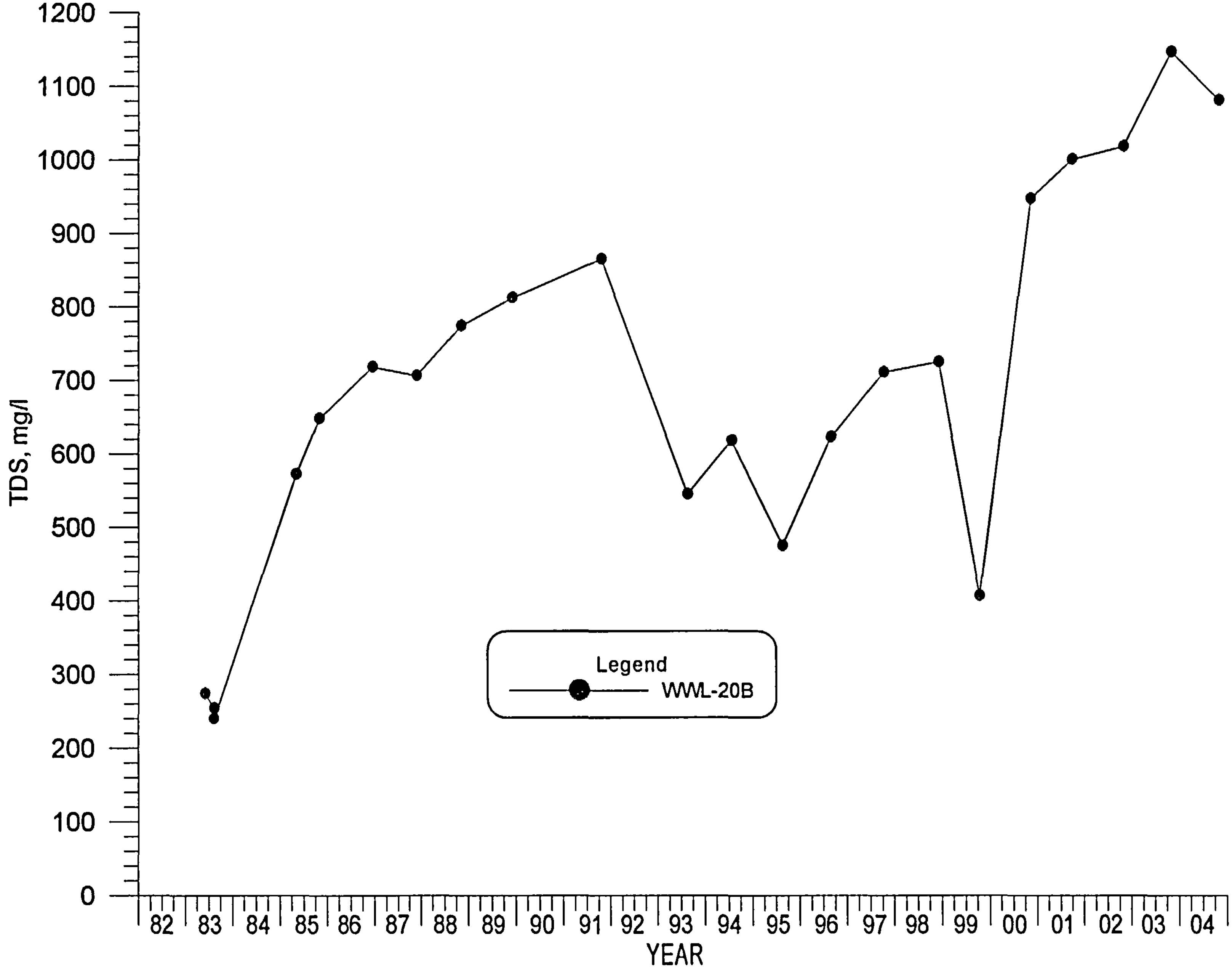


FIGURE 4.5-3. TDS CONCENTRATIONS FOR WELL WWL-20B.

5.0 SURFACE-WATER MONITORING

Surface-water monitoring of Spring Creek in the past has been used to show the minimal impact of seepage on surface-water quality in Spring Creek (Spring Creek intercepts the flow from the Surficial aquifer). With the restoration of the Surficial aquifer, particularly in the Mine Creek area, the tailings-impacted seepage contribution to Spring Creek has been all but eliminated. One indication of seepage impact on Spring Creek is measured at Mine Creek site SW8. This is where the surface water from Mine Creek is sampled before entering Spring Creek. Typical late season base flow in Spring Creek is in excess of 300 gpm, and thus the Mine Creek contribution of a few gpm is only a fraction of the composite flow. Table 5.0-1 shows several years of monitoring results at SW8. Water quality at SW8 has stabilized over recent years with only seasonal changes, a modest improvement in 2004, and only very slightly elevated concentrations of constituents.

The SW2 site is in Spring Creek just downstream of Mine Creek while the SW3 site is downstream of all of the Surficial discharge (see Figure 5.0-1). Like site SW8, the general water quality at these two sites has shown only seasonal fluctuations in recent years, with very little or no impacts of tailings seepage (see Table 5.0-1). The Po210 activity at SW3 for 2002 appears to be anomalous, and no other constituents exhibit significant changes.

The SW1A site is located upstream of any site impacts and is considered representative of background surface water quality conditions. The 1992 water quality data for SW1A (see Table 5.0-1) show drastic improvement as a result of cessation of mine dewatering discharge. Prior to 1992, mine dewatering discharge (under an NPDES permit) upstream of site SW1A influenced water quality at this monitoring point. The results of the 5/13/04 sample (see Table C-1) are somewhat unusual and the water quality is generally not consistent with that of preceding and subsequent samples.

During July of 2004, water quality samples were collected from Spring Creek, Fox Creek, Mine Creek and Little Medicine Bow River in conjunction with an aquatic survey. The samples were collected at the SW locations with some minor adjustments and two additional sites along the Spring Creek drainage. The results of this sampling program were consistent with the past and current sampling at the SW sites.

TABLE 5.0-1. SURFACE-WATER MONITORING

	SW8 1988 10/06/88	SW8 1989 10/24/89	SW8 1991 11/12/91	SW8 1992 10/18/92	SW8 1993 10/02/93	SW8 1994 10/12/94	SW8 1995 10/20/95	SW8 1996 10/22/96	SW8 1997 12/16/97	SW8 1998 06/03/98	SW8 1999 12/04/99	SW8 2000 11/15/00	SW8 2001 10/30/01	SW8 2002 11/05/02	SW8 2003 11/18/03	SW8 2004 11/09/04
TSS	2.6	8.0	-	17	-	4.7	10.0	<1.0	12	1.2	<1.0	--	--	--	--	--
TDS	3084	1114	1070	1062	1002	1131	992	919	756	828	648	694	697	729	756	484
Cl	600	137	144	96.8	81.1	54	69	42.7	28	46.8	23.6	8.7	18.7	16.5	22.8	21
SO_4	316	376	415	371	352	377	357	356	291	339	262	269	270	288	282	175
U-Nat	1.39	0.03	0.04	0.03	0.025	0.01	0.01	0.0262	0.055	0.0319	0.026	0.0218	0.0221	0.0247	0.0319	0.0539
Ra^{226}	2.0±0.5	3.0±0.6	5.6±0.5	3.8	1.0	1.0	2.5	4.4±0.4	3.7±0.3	1.9	1.3	2.0	2.2	2.1	2.4	1.4
Th^{230}	0.3±0.2	0.2±0.2	0.8±<0.2	<0.2	-	<0.2	2.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pb^{210}	1.6±0.9	1.2±1.6	-	2	-	2.4	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<2.73	<2.7	<2.7	<1.0
Po^{210}	0.5±0.2	0.2±0.2	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.7	<2.7	<2.7	<1.0
pH	7.9	7.4	7.7	8.0	8.0	8.3	7.9	7.2	6.91	7.7	7.3	7.0	7.4	7.5	7.4	7.7
Cond.	2590	1135	1368	1496	1449	1755	1596	1632	1044	1287	3229	997	1008	1046	1058	663

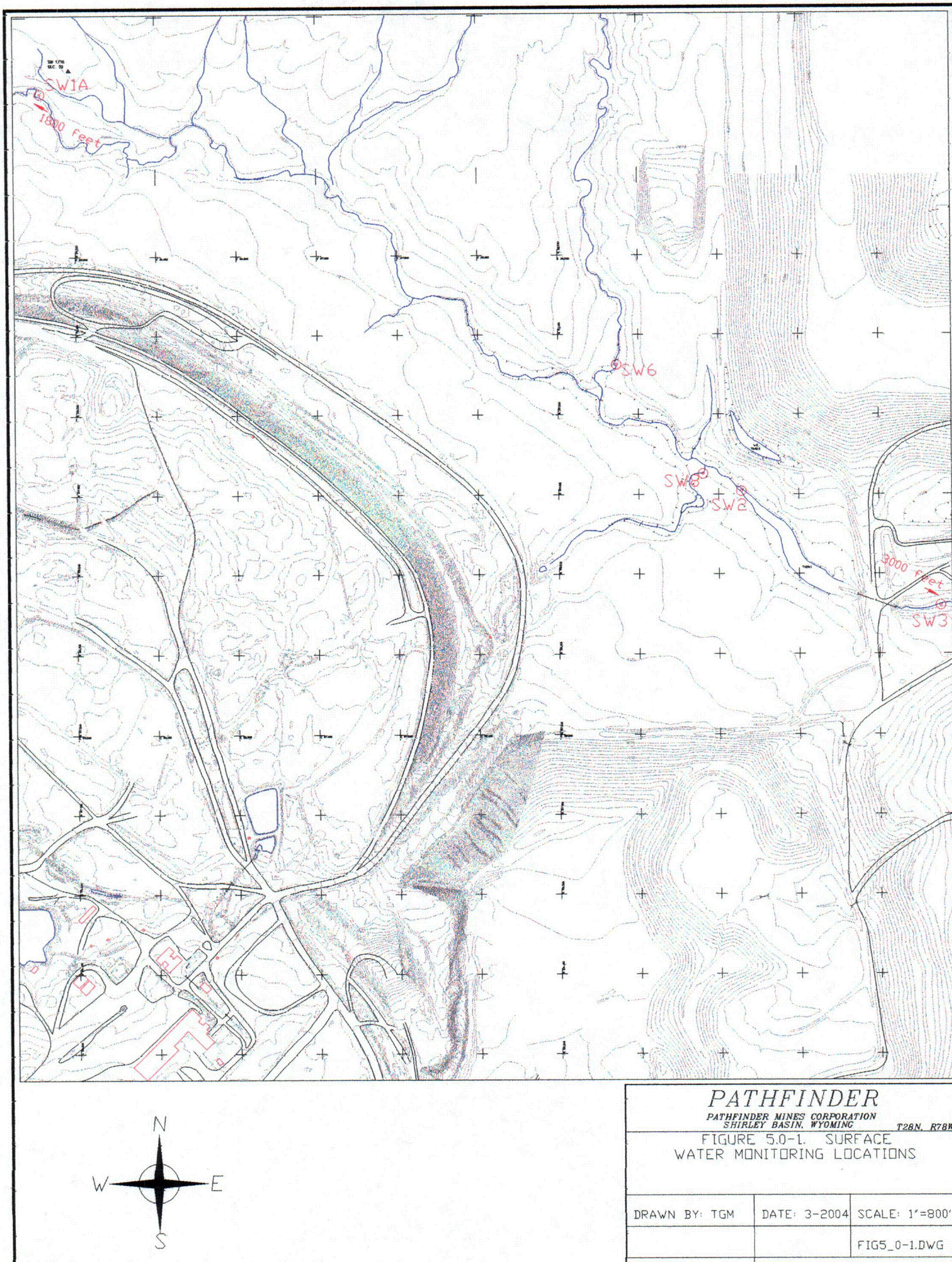
	SW1A 1991 11/12/91	SW1A 1992 10/17/92	SW1A 1993 11/09/93	SW1A 1994 10/12/94	SW1A 1995 10/20/95	SW1A 1996 10/22/96	SW1A 1997 12/15/97	SW1A 1998 06/03/98	SW1A 1999 12/07/99	SW1A 2000 11/21/00	SW1A 2001 10/29/01	SW1A 2002 10/05/02	SW1A 2003 11/18/03	SW1A 2004 11/09/04
TSS	-	0	2.5	2.0	17.6	1.4	6.9	6.8	11.0	--	--	--	--	--
TDS	975	192	312	220	257	230	227	251	213	525	436	214	254	204
Cl	57.9	1.9	2.2	<1.0	<1.0	1.1	2.1	2.6	3.8	32.4	40.1	2.8	1.8	6.0
SO_4	599	27.1	16.3	13.9	15.8	14.9	18.5	13.9	22.2	91.0	76.1	13.2	13.7	17.0
U-Nat	0.45	0.015	0.019	0.02	0.02	0.0146	0.0191	0.0190	0.0246	0.0625	0.0642	0.0184	0.0194	0.0164
Ra^{226}	0.7±0.3	<0.2	0.5	<0.2	0.20	<0.2	<0.2	0.8	<0.2	<0.2	0.9	<0.2	0.4	<0.2
Th^{230}	<0.2	<0.2	<1.0	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pb^{210}	-	<1.0	3.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.73	<2.7	<2.7	<1.0
Po^{210}	-	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<2.7	<2.7	<2.7	<1.0
pH	7.7	8.2	7.9	8.0	7.7	7.2	6.5	6.67	7.65	6.25	7.25	7.5	7.8	7.2
Cond.	1207	317	375	449	393	389	261	346	246	796	646	279	293	287

TABLE 5.0-1. SURFACE-WATER MONITORING (cont.)

	SW2 1991 11/12/91	SW2 1992 11/21/92	SW2 1993 11/09/93	SW2 1994 10/12/94	SW2 1995 10/20/95	SW2 1996 10/22/96	SW2 1997 12/15/97	SW2 1998 06/03/98	SW2 1999 12/03/99	SW2 2000 11/15/00	SW2 2001 10/30/01	SW2 2002 11/05/02	SW2 2003 11/18/03	SW2 2004 11/09/04
TSS	-	19	16.0	6.0	14.8	15.0	4.3	9.9	3.0	--	--	--	--	--
TDS	947	257	326	303	333	292	289	286	324	293	297	301	325	241
Cl	61.5	17.7	14.4	13.8	16.6	15.9	9.2	11.9	18.8	<1	11.8	12.4	18.6	15.0
SO4	548	44.9	40.5	40	44	37.4	42.8	44.9	58.8	43.4	35.9	46	28.8	26.0
U-Nat	0.43	0.03	0.028	0.02	0.02	0.0202	0.0255	0.0242	0.0420	0.0264	0.0224	0.0267	0.0253	0.0214
Ra226	0.4±0.2	0.6	0.7	<0.2	1.4	0.6±0.2	<0.2	<0.2	<0.2	0.5	0.900	1.3	0.5	0.5
Th230	<2.0	<1.0	<1.0	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<.02	<0.2	<0.2	<0.2
Pb210	-	<1.0	4.3	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.73	<2.7	<2.7	<1.0
Po210	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.4	<1.0	<1.0	<2.7	<2.7	<2.7	<1.0
pH	7.8	7.9	8.1	8.3	8.2	7.6	7.05	7.45	7.20	6.30	7.4	7.5	7.7	7.05
Cond.	1242	483	600	528	529	345	392	475	552	435	413	433	416	346

	SW3 1991 11/12/91	SW3 1992 10/19/92	SW3 1993 11/09/93	SW3 1994 10/12/94	SW3 1995 10/20/95	SW3 1996 10/22/96	SW3 1997 12/16/97	SW3 1998 06/03/98	SW3 1999 12/03/99	SW3 2000 11/21/00	SW3 2001 10/30/01	SW3 2002 11/06/02	SW3 2003 11/25/03	SW3 2004 11/09/04
TSS	-	33	15.0	39	19.2	57	3.7	7.0	10.0	--	--	--	--	--
TDS	902	296	387	303	387	388	312	313	314	314	290	301	402	285
Cl	53.3	24.2	18.7	17.7	20	21.0	11.7	13.2	16.9	15.7	12.3	9.2	24.3	16.0
SO4	519	58.3	57.6	56.0	70	80.7	47.1	56.9	63.3	48.9	42.9	51.1	71.8	47.0
U-Nat	0.43	0.021	0.031	0.03	0.03	0.0232	0.0298	0.0261	0.045	0.0294	0.0244	0.0272	0.0342	0.0291
Ra226	0.9±0.3	0.7	0.3	0.9	0.30	0.6±0.2	0.6	0.8	<0.2	<0.2	1	0.3	1.6	1
Th230	<0.2	<0.2	<1.0	2.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pb210	-	<0.1	<1.0	<1.0	4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.73	<2.7	<2.7	<1.0
Po210	-	<0.1	<1.0	2.3	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<2.7	32	<2.7	<1.0
pH	8.1	8.3	8.2	8.6	8.1	8.0	6.87	8.06	7.5	6.7	7.5	7.5	7.2	7.3
Cond.	1172	497	600	528	609	669	435	765	565	501	430	415	545	409

Note: Concentrations in mg/l except Ra226, Th230, Pb210 and Po210 in pCi/l, pH in standard units and Cond. in umhos/cm @ 25 deg. C.



PATHFINDER
PATHFINDER MINES CORPORATION
SHIRLEY BASIN, WYOMING
T28N, R78W

FIGURE 5.0-1. SURFACE WATER MONITORING LOCATIONS

DRAWN BY: TGM	DATE: 3-2004	SCALE: 1"=800'
		FIG5_0-1.DWG
REVIS. NO:	HYDRO-ENGINEERING L.L.C.	

C32

6.0 WHITE RIVER AQUIFER MONITORING

Water quality for White River aquifer wells is presented in Tables B-1 and B-2 of Appendix B. White River wells WW22 and WW23 are located downgradient of the tailings. Data obtained during 2004 from these wells are typical of historical data. Well WW22 was used as a recharge supply well up until early in 1999 and has recently been reactivated as a recharge supply well. Well MC-2 is also used as a recharge supply well. Chloride concentrations are less than 25 mg/l, and sulfate concentrations are in the expected range of values. TDS concentrations are fairly steady. The uranium concentration in well WW22 is slightly greater than that in well WW23, but there are no indications of seepage impacts based on chloride and TDS concentrations. Uranium concentrations have historically been highly variable in the White River aquifer in this area indicating the likely presence of natural mineralized zones.

The water quality in wells WWL-10A and WWL-20A (see Figure 2.1-1 for location) has been generally consistent over the period of record. There have been no trends or constituent concentrations that indicate impacts from tailings seepage. The minor fluctuations in constituent concentrations that have occurred may be the result of local gradient changes induced by the pumping of wells WW-22, WW-23 and MC-2 to supply recharge water. These local gradient changes may have also contributed to the elevated concentrations of major ions that have been observed in White River well WH-9 over the last several years. There were no significant changes in water quality in this well during 2004, and the source of the constituents is believed to be to the west of the well, or in the immediate vicinity of the well. White River aquifer wells WWL-16A and WWL-18A are located several thousand feet to the south and southwest of the tailings and are beyond the area of plausible impacts by tailings seepage.

7.0 ADDITIONS TO SURFICIAL AQUIFER COLLECTION AND INJECTION.

No additions were made to the Surficial Aquifer collection or injection system in 2004. The operation of the tailings area Surficial collection wells and injection wells was discontinued in late 2003 due to the commencement of tailings reclamation. The tailings reclamation work continued throughout 2004.

8.0 TAILINGS DEWATERING AND EVAPORATION

The pumping of tailings dewatering wells was discontinued at the end of 2003 to allow tailings reclamation to proceed. There were approximately 36 wells that were pumped for some period during 2003, and a collection sump in the No.4 Pond was also pumped. With the declining water levels in the more permeable tailings and the harsh pumping environment for tailings dewatering wells, the dewatering rates had diminished to levels where further progress in dewatering was limited. Only selected tailings wells have been preserved during the tailings reclamation construction.

Water levels in the tailings have been lowered by the past dewatering efforts. Water-levels were not monitored in the tailings in 2004. Prior to the start of construction for tailings reclamation, typical water level declines were in the range of one-half to two feet per year.

8.1 ENHANCED EVAPORATION

There was no operation of the enhanced evaporation system during 2004. At the beginning of 2004, the estimated volume of ponded water in the tailings area was 11 million gallons. There was no significant quantity of water added to the evaporation ponds during 2004 with the exception of direct precipitation on the ponds. At the end of 2004, roughly 5 to 6 acres of the evaporation pond area were covered by water. The estimated volume of water in the evaporation ponds at the end of 2004 was less than 2 million gallons.

9.0 RECOMMENDATIONS

The collection/injection system in the Mine Creek area east of the tailings is still in operation. This represents the portion of the corrective action program that has been effective in the containment of seepage impacted ground water. The rates of Surficial aquifer collection and injection within the tailings area represented a relatively small fraction of the total collection and injection rates from the corrective program, and the discontinuation of this part of program does not appreciably change the containment. The current Surficial aquifer collection/injection program should be continued pending approval of the ACL application. If the fresh-water distribution system will allow it, a portion of the fresh-water recharge to the north recharge line and any increased production from the recharge supply wells should be diverted to the south recharge lines to strengthen the gradient reversal in this area. Diverting most or all of the south recharge supply to the line farthest to the west will also produce the most benefit in terms of strengthening the gradient reversal for the available recharge supply.