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ASAMERA-CANNON MINE CLASS II INSPECTION; MARCH 10-11, 1987

by
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ABSTRACT

A Class II inspection was conducted at the Asamera-Cannon Gold Mine on March 10 and 11, 1987. Inspection monitoring did not find surface or ground water impacts attributable to the mining operation. The Asamera water quality monitoring program was generally acceptable and sampling procedures reasonable. Recommendations related to several aspects of the monitoring program are made.

INTRODUCTION

A Class II inspection was conducted at the Asamera-Cannon Mine on March 10 and 11, 1987. Conducting the inspection was Marc Heffner of the Washington State Department of Ecology Water Quality Investigations Section with the help of Marie Garrett, the Cannon Mine Environmental Specialist, and her assistant Gordon Elliott.

The inspection was conducted to meet the following objectives:

1. Inspect the facility and evaluate the monitoring network.
2. Review monitoring procedures.
3. Conduct a laboratory quality assurance check by splitting samples for analysis by both Asamera and Ecology.

SETTING

The Cannon Mine is an active gold mine located in Chelan County at the southeast corner of Wenatchee. Operation began in mid-1985. The mine is below ground with on-site surface activities including a mill, a tailings pond, and a silica pit. Because of the mine's proximity to Wenatchee, the mining operation is designed to prevent significant surface subsidence. To accomplish this, mined areas are filled with cemented material as mining is completed in an area.

Wastewater generation in the mill comes from the flotation process used to concentrate mined material. The material is dried using a filter press and shipped off site for smelting. The filtrate enters a recycle stream. Waste solids are thickened with the water being reused and the concentrated solids sent to the tailings pond.

The tailings pond lies behind a large earthen dam in Dry Gulch. The natural intermittent drainage is routed around the dam via a steel conduit/sediment basin system that discharges below the dam. Tailings are dispersed along the upstream face of the dam to encourage solids build-up along the dam face and water to pool in the upper end of the pond. A pump station in the pond pumps water back to the mill for reuse.

Activity at the silica pit was minimal during the inspection, but the silica is a potential source of mine fill material. Sand from a small pit near the mill was being used for fill during the inspection.

PROCEDURES

The Asamera monitoring network consists of both surface water and ground water stations (Figure 1).

Ground water sampling consists of static water level only and static water level plus water quality wells. At all wells the static water level is measured first using an electric tape. Wells sampled for water quality are equipped with a dedicated bladder pump. The pump is run to purge two well casing water volumes. A sample is collected for field pH, temperature, and conductivity measurements. An in-line 0.45 um filter is then installed on the pump discharge line and samples are collected. The samples are preserved as required and shipped to a contract laboratory for analysis.

Asamera sampling procedures were followed during the inspection. Samples collected were split for analysis by Asamera and Ecology. Parameters analyzed and sampling times are noted in Table 1. Additional conductivity measurements and collection of unfiltered samples by Ecology are also noted in Table 1.

Surface water samples are analyzed for the same field and laboratory parameters. Instantaneous flow measurements are made at H-weirs installed in the stream beds. Ecology bucket-and-stopwatch instantaneous measurements were made at the same time. The Asamera contract laboratory filters some of the high suspended solids samples prior to analysis as necessary. Samples were split for Asamera and Ecology analysis. Parameters measured and sampling times are included on Table 1.

RESULTS AND DISCUSSION

Sampling and preservation methods used by Asamera appeared appropriate for the parameters being analyzed. Directing the pump discharge farther away from the well casing when purging is suggested to avoid possible well contamination.

Ecology and Asamera analytical results are compared in Table 2. Asamera field temperature and conductivity results did not compare well with Ecology results. Use of an ASTM approved thermometer and check of the Asamera conductivity meter with

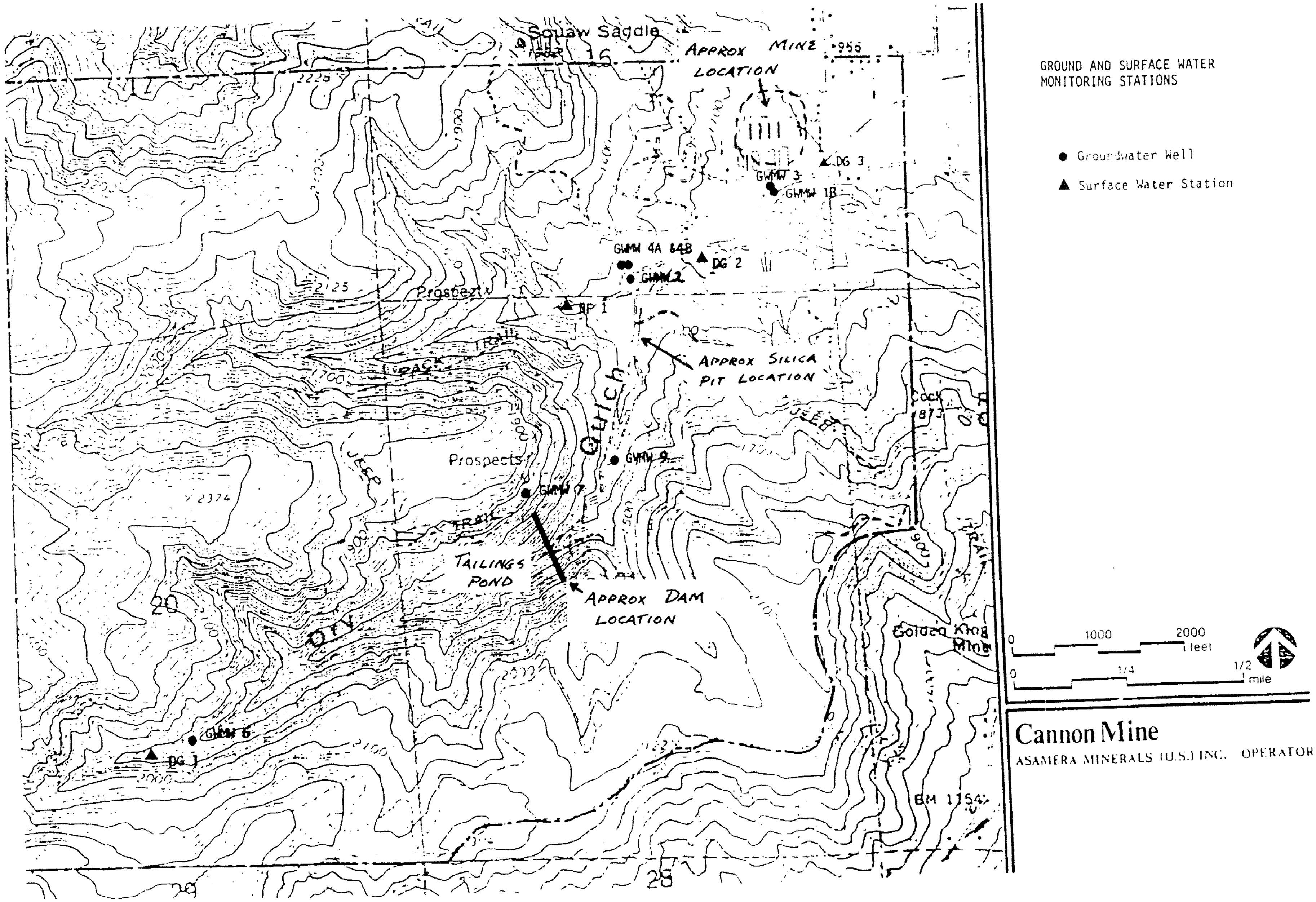

Figure 1. Site map (from Garrett, 1987) - Asamera, March 1987.

Table 1. Sampling Schedule - Asamera, 3/87.

				Field Analyses*					Laboratory Analyses**												
Station	Date	Time	Laboratory	Temperature	Conductivity	pH	Depth to G.W.	Flow Rate	Conductivity	Chloride	Sulfate	T. Cyanide	Cyanate	TSS	TDS	TOC	Iron	Sodium	Zinc	Manganese	Comment
GROUND WATER																					
GWMW 6	3/10	1415	Asamera				X														
		1435	Ecology	X	X																
		1515	Asamera			X															
			Ecology	X	X																
		1610	Ecology	X	X				X	X	X	X		X	X	X	X	X	X	X	Unfiltered
	3/12		Ecology						X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera							X	X	X	X		X	X	X	X	X	X	
GWMW 9	3/10	1015	Asamera				X														
		1025	Ecology	X	X																
		1030	Ecology	X	X																
		1110	Ecology	X	X																
		1130	Ecology	X	X																
		1140	Ecology	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	Duplicate
			Ecology						X	X	X	X	X	X	X	X	X	X	X	X	Duplicate
			Asamera		X	X				X	X	X	X		X	X	X	X	X	X	
GWMW 4B	3/10	0920	Asamera				X														
GWMW 4A	3/10	0915	Asamera				X														
		0945	Ecology	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X				X	X	X	X		X	X	X	X	X	X	
GWMW 2	3/10	0925	Asamera				X														
GWMW 3	3/11	0830	Asamera				X														
		1140	Ecology	X	X				X	X	X	X	X	X	X	X	X	X	X	X	Unfiltered
			Ecology						X	X	X	X	X	X	X	X	X	X	X	X	Filtered
			Asamera	X	X	X				X	X	X	X		X	X	X	X	X	X	
GWMW 1B	3/11	0830	Asamera				X														
		1220	Ecology	X	X				X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X				X	X	X	X		X	X	X	X	X	X	
SURFACE WATER																					
DG 1	3/11	0920	Ecology	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X		X		X	X	X	X		X	X	X	X	X	X	
TP	3/11	1000	Ecology	X	X				X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X				X	X				X	X	X	X	X	X	
Tailings	3/11	1000	Ecology													X	X	X	X	X	
NF 1	3/11	1035	Ecology		X			X	X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X		X		X	X	X	X		X	X	X	X	X	X	
DG 3	3/11	1110	Ecology	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	
			Asamera	X	X	X		X		X	X	X	X		X	X	X	X	X	X	
Seep	3/10	1100	Asamera							X	X				X	X	X	X	X	X	

*analyzed prior to field filtration
**ground water samples field filtered prior to analysis unless otherwise noted

Table 2. Laboratory comparison - Asamera, 3/87.

Station	Date	Laboratory	Field Analyses+ Temp. (C)	Field Analyses+ Temp. (F)	Field Analyses+ Conductivity (umhos/cm)	Field Analyses+ pH (S.U.)	Laboratory Analyses++ Conductivity (umhos/cm)	Chloride (mg/L as Cl-)	Sulfate (mg/L)	T. Cyanide (mg/L)	Cyanate (mg/L)	TSS (mg/L)	TDS (mg/L)	TOC (mg/L)	Iron (ug/L)	Sodium (mg/L)	Zinc (u/gl)	Manganese (ug/L)	Comment
GROUND WATER																			
GWMW 6	3/12	Ecology					880	16	117	<0.005	1.4j	10	685h	82z	900	181	24	113	
		Asamera						20	161	<0.003	<0.1		697	9.5	330	180	80	40	
GWMW 9	3/10	Ecology	11.1	52.0	1060	7.1	1130	70	31	<0.005	0.18	1	670	11	800	152	8	80	Duplicate
		Ecology					1120	68	33	<0.005	0.06	<1	650	14	1170	150	6	85	Duplicate
		Asamera			580	7.1		66	31	<0.003	<0.1		666	1.2	610	140	<10	40	
GWMW 4A	3/10	Ecology	11.3	52.3	1300	6.7	1350	54	200	0.008	0.19	<1	850	18	190	65	3	4	
		Asamera	10.6	51	735	6.6		51	192	<0.003	<0.1		866	1.2	10	56	<10	<10	
GWMW 3	3/11	Ecology	12.5	54.5	1900		1860	380	100	<0.005	0.08	<1	980	9.0	450	308	5	345	
		Asamera	12.2	54	1360	6.9		436	74	0.005	<0.1		1093	0.9	30	340	<10	260	
GWMW 1B	3/11	Ecology	12.4	54.3	2900		2860	940	12	<0.005	1.4	<1	1300	6.1	390	554	7	47	
		Asamera	10.6	51	1625	6.6		740	10	<0.003	<0.1		1410	<0.6	20	550	<10	40	
SURFACE WATER																			
DG 1	3/11	Ecology	5.7	42.3	250		242	2.0	18	<0.005	0.06	690	340	18	37900	28	106	248	
		Asamera	7.8	46	<400	6.4		4	19	<0.003	<0.1		312	11.0	900	23	<10	<10	
TP	3/11	Ecology	10.8	51.4	2200		2360	230	720	0.058	<0.01	57	1500	13	1700	352	9	81	
		Asamera	9.4	49	1400	9.1		211	662				1539	3.6	60	380	<10	<10	
NF 1	3/11	Ecology			700		709	5.4	35	0.005	0.05	4	330	13	580	25	5	12	
		Asamera	10.6	51	410	7.8		9	29	<0.003	<0.1		393	1.2	<10	17	<10	<10	
DG 3	3/11	Ecology	8.4	47.1	390		366	9.0	49	0.005	0.16	1200	360	21	62800	31	743	365	
		Asamera	10.6	51	<400	7.2		12	65	<0.003	<0.1		254	13.0	170	25	10	<10	

z = Sample low due to interfering substance
h = Over holding time. Analysis run.
j = Estimated value
\+ = No filtration prior to analysis
++ = Ground water samples field-filtered prior to laboratory analysis unless otherwise noted

a standard solution are recommended. Asamera pH measurements appeared accurate. Most laboratory results compared favorably. Some differences in total organic carbon (TOC), iron, and manganese results occurred. Submission of a blind known and/or spike to the contract lab along with samples is a suggested quality assurance practice.

A tailings pond (TP) water sample was collected as part of the inspection. The data were compared to the upgradient stream (DG1) and well (GWMW6) samples to determine which parameters might indicate mining impacts (Figure 2). Chloride, sodium, sulfate, conductivity, and total dissolved solids (TDS) were selected for further comparisons. Routine collection and analysis of a tailings pond water sample is suggested to help identify indicator parameters. Also, inclusion of a sample representative of water in the mine could provide similar information. Parameters tested may be reduced if TP and mine parameters are consistent over time.

Use of the baseline data collected by Asamera prior to opening of the mine was briefly considered. The data appeared widely scattered, making determination of changes over time impractical in this report.

Surface Water

Surface water flows in the Dry Gulch Basin are intermittent. Previous investigation showed that monitoring stations DG1, NF1, and DG3 were dry from June through December in 1986 (Garrett, 1987). Dry Gulch Creek did not flow above ground in all portions of the Asamera reach during the inspection.

Inspection flow data are summarized in Table 3. Heavy silting is a problem with the H-flumes necessitating cleaning before measuring. The flume measurements compared well with the Ecology bucket-and-stopwatch measurements. Flow was less at DG3 than at DG1 during the inspection.

Table 3. Surface water flow rates - Asamera, 3/87.

Station	Asamera Measurement* (cfs)	Ecology Measurement** (cfs)
DG 1	0.09	0.08
DG 3	0.04	0.04
NF 1	0.02	0.02

* = Asamera instantaneous measurement made using installed H-flumes

** = Ecology instantaneous measurement made using bucket-and-stopwatch method

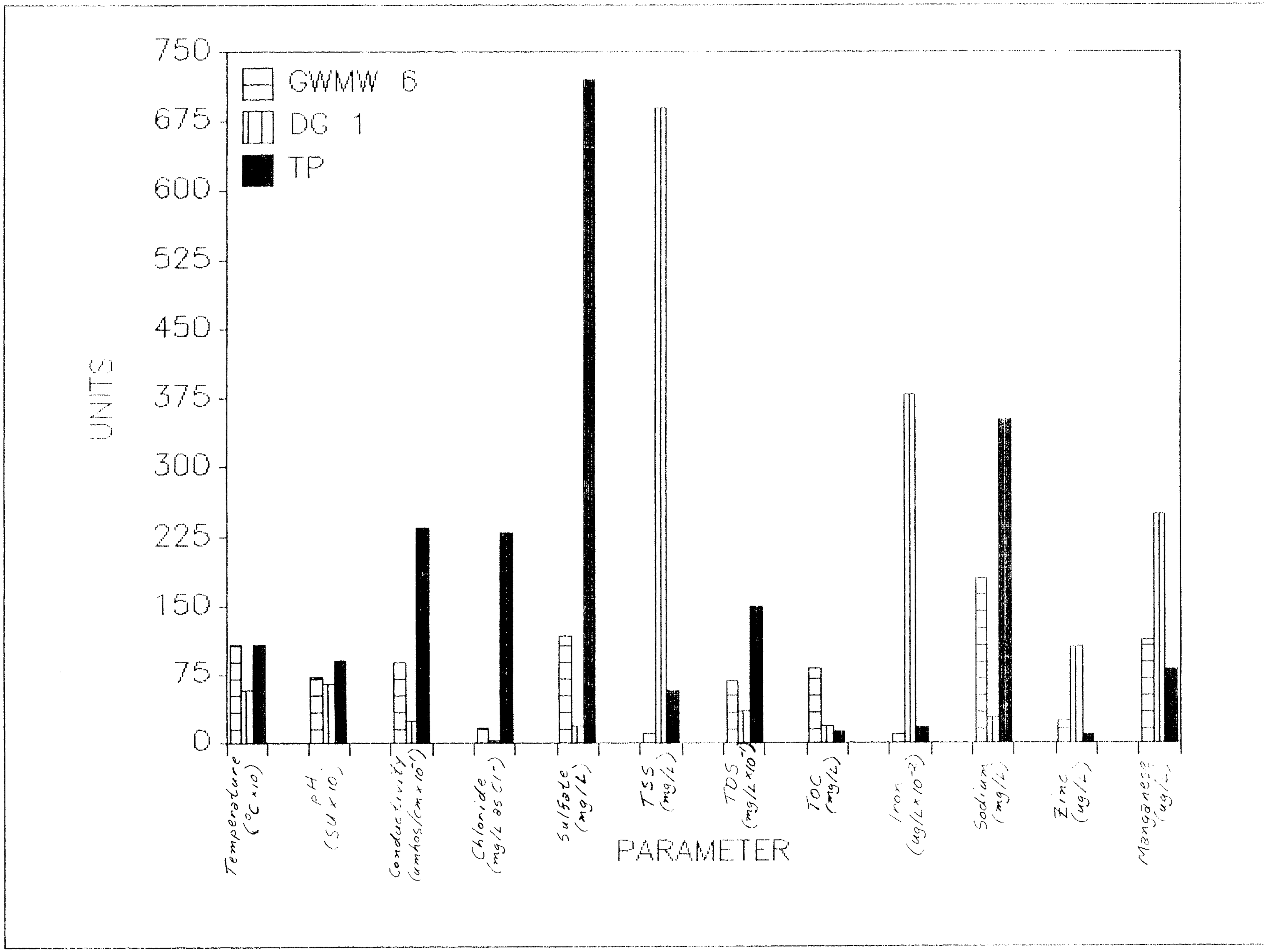

Figure 2. Comparison of upgradient stations to tailings pond - Asamera, March 1987.

Surface water quality data are presented in Table 4. The DG1 sample indicated that the creek is heavily laden with solids upstream of the Asamera reach. Figure 3 compares in-stream concentrations to parameters that were high in the tailings pond. The seep sample data, which was collected from a small pond directly below the dam, suggested that the seep was being influenced by the tailings pond. The seep pond had no outlet and did not appear to be any cause for concern. The discontinuous nature of the stream and poor upstream quality make determination of mine-related impacts difficult. Figure 3 suggests that water used in the mill was not contaminating the surface streams.

Asamera surface activities and on-site dirt roads suggest that total suspended solids (TSS) concentrations should be routinely monitored at the surface water monitoring stations as an indicator of excessive surface disturbance. High TSS concentrations at the upstream station may make data interpretation difficult.

Routine maintenance of the channelized upper portion of Dry Gulch Creek is necessary. The flow is routed through a series of conduits and settling basins. During the inspection the sediment levels in the basins were high. Regular cleaning is recommended to prevent overland flow due to basin walls being breached.

Ground Water

Ground water data are summarized in Table 5. Figure 4 compares selected monitoring well parameters to the tailings pond data. As with the surface water, no clear impacts on the ground water due to mining activities were noted. GWMW3 and GWMW1B had higher chloride and sodium concentrations and higher conductivities than the background well (GWMW6). These same parameters were high in the tailings pond. The sulfate concentrations in GWMW3 and 1B were lower than background while the tailings pond had a high concentration. Thus, association of the changes with mining activities is not possible.

GWMW3 and 1B are in the vicinity of the mine. Routine collection of a representative sample from the mine is recommended for comparison with well data. A monitoring well located downgradient of the mine is also suggested.

Ground water elevation data are presented in Table 6. Also included in the table is the distance from the ground water surface to the well screen. The upgradient wells (GWMW6 and GWMW9) are screened roughly 100 feet into the ground water. Screening wells closer to the ground water surface, particularly GWMW9, may prove more useful in detecting any changes due to mining activities.

Several of the wells had a characteristic hydrogen sulfide odor when being pumped. Analysis of both sulfate and sulfide is suggested to more reasonably monitor sulfur in the system.

Table 4 - Ecology Surface Water Analytical Results - Asamera, 3/87.

Station	Date	Time	Field Analyses: Temp. (C)	Field Analyses: Temp. (F)	Field Analyses: Conductivity (umhos/cm)	Field Analyses: pH+ (S.U.)	Field Analyses: Flow Rate (cfs)	Laboratory Analyses: Conductivity (umhos/cm)	Chloride (mg/L) as Cl-	Sulfate (mg/L)	Total Cyanide (mg/L)	Cyanate (mg/L)	TSS (mg/L)	TDS (mg/L)	TOC (mg/L)	Iron (ug/L)	Sodium (mg/L)	Zinc (ug/L)	Manganese (ug/L)
DG 1	3/11	0920	5.7	42.3	250	6.4	0.08	242	2.0	18	<0.005	0.06	690	340	18	37900	28	106	248
TP	3/11	1000	10.8	51.4	2200	9.1		2360	230	720	0.058	<0.01	57	1500	13	1700	352	9	81
Seep	3/10	1100							96+	334+				1102+	2.1+	<10+	100+	<10+	10+
Tailings	3/11	1000													1.1*	1620**	625**	28**	408**
NF 1	3/11	1035	++	++	700	7.8	0.02	709	5.4	35	0.005	0.05	4	330	13	580	25	5	12
DG 3	3/11	1110	8.4	47.1	390	7.2	0.04	366	9.0	49	0.005	0.16	1200	360	21	62800	31	743	365

+ = Asamera measurement
* = Percent dry basis - 32.1 percent moisture
** = mg/Kg dry weight
++ = Thermometer broke

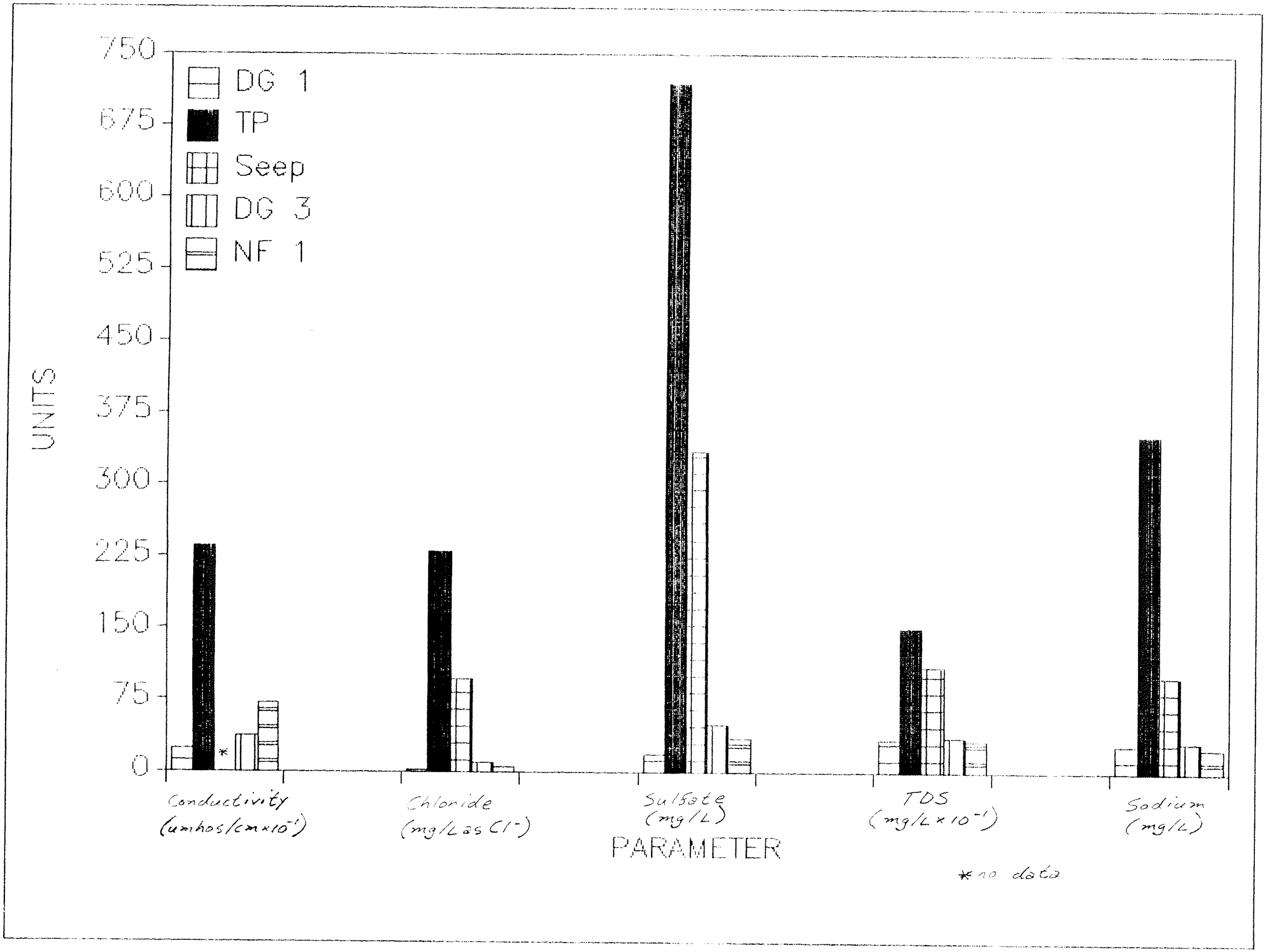

Figure 3. Comparison of surface water stations to tailings pond - Asamera, March 1987.

Table 5. Ecology Ground Water Analytical Results - Asamera, 3/87.

			Field Analyses+++					Laboratory Analyses***												
			Temp.																	
Station	Date	Time	(C)	(F)	Conductivity (umhos/cm)	pH** (S.U.)	Screen Elevation** (ave.-ft)	Conductivity (umhos/cm)	Chloride (mg/L) as Cl-)	Sulfate (mg/L)	Total Cyanide (mg/L)	Cyanate (mg/L)	TSS (mg/L)	TDS (mg/L)	TOC (mg/L)	Iron (ug/L)	Sodium (mg/L)	Zinc (ug/L)	Manganese (ug/L)	Comment
GWMW 6	3/10	1435	11.3	52.3	440		1728													
		1515	11.1	52.0	650	7.2														
		1610	10.8	51.4	900			868	12	110	<0.005		150	620	17	5480	186	57	126	Unfiltered
	3/12	*						880	16	117	<0.005	1.4j	10	685h	82z	900	181	24	113	
GWMW 9	3/10	1025	11.3	52.3	1200		1238													
		1030	11.3	52.3	1200															
		1110	11.3	52.3	1040															
		1130	11.3	52.3	1100															
		1140	11.1	52.0	1060	7.1		1130	70	31	<0.005	0.18	1	670	11	800	152	8	80	Duplicate
								1120	68	33	<0.005	0.06	<1	650	14	1170	150	6	85	Duplicate
GWMW 4A	3/10	0945	11.3	52.3	1300	6.6	1035	1350	54	200	0.008	0.19	<1	850	18	190	65	3	4	
GWMW 3	3/11	1140	12.5	54.5	1900	6.9	839	2090	530	70	<0.005	<0.01	<1	1100	5.6	440	377	5	303	Unfiltered
								1860	380	100	<0.005	0.08	<1	980	9.0	450	308	5	345	Filtered
GWMW 1B	3/11	1220	12.4	54.3	2900	6.6	809	2860	940	12	<0.005	1.4	<1	1300	6.1	390	554	7	47	

* = Due to sampling problems on March 10, sample collected on March 12 by Asamera
z = Sample low due to interfering substance
h = Over holding time. Analysis run.
j = Estimated value
** = Asamera measurements
*** = Ground water samples field-filtered prior to analysis unless otherwise noted
+++ = No filtration prior to analysis

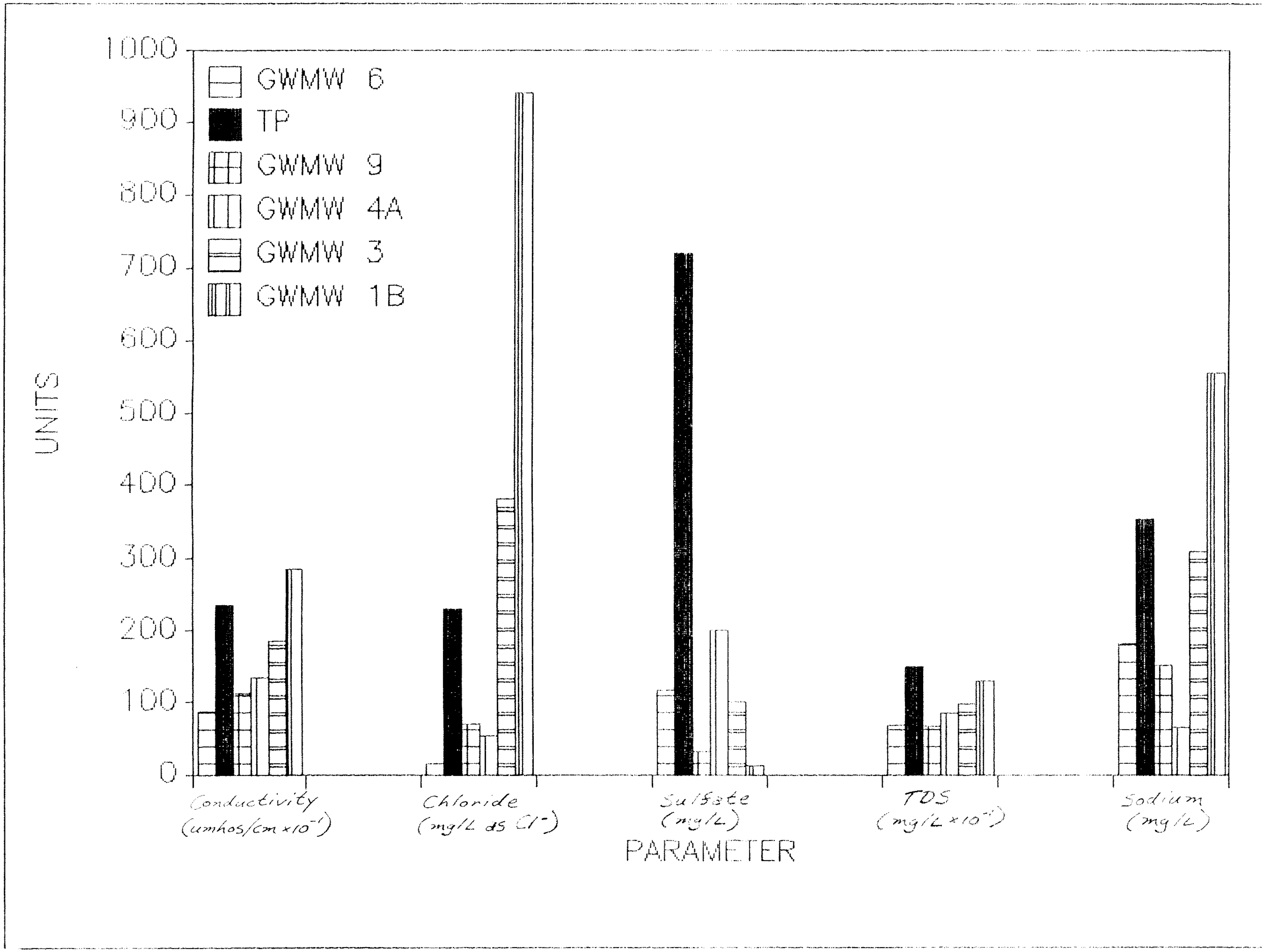

Figure 4. Comparison of ground water stations to tailings pond - Asamera, March 1987.

Table 6. Groundwater elevation measurements* - Asamera, 3/87.

Well	Well Cap Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)	Depth to Well Screen (avg-ft)	Well Screen Elevation (avg-ft)	Distance - Groundwater Surface to Screen (avg-ft)
GWMW 6	1822.5	14.0	1808.5	95	1728	80
TP	1580+		1525++			
GWMW 9	1357.9	15.1	1342.8	120	1238	105
GWMW 4B**	1113.3	51.1	1062.2	99	1014	48
GWMW 4A	1114.1	53.3	1060.8	79	1035	26
GWMW 2**	1112.8	52.5	1060.3	160	953	107
GWMW 1B	1033.1	179.0	854.1	224	809	45
GWMW 3	1033.7	182.5	851.2	195	839	12

* = Measurements made by Asamera
\+ = Water surface elevation
++ = Bottom of pool elevation
** = Static height measurement only; no water quality sampling

RECOMMENDATIONS AND CONCLUSIONS

Inspection monitoring did not find surface or ground water impacts attributable to mining activities. The Asamera monitoring program was generally acceptable and sampling procedures reasonable.

Recommendations concerning several aspects of the monitoring program are summarized below:

Analytical

1. Field temperature and conductivity measurements should be improved. Use of a conductivity standard and an ASTM approved thermometer are recommended.
2. A known or spiked quality assurance sample should routinely be submitted to the contract laboratory along with the regular samples.

Station Changes

1. Three additional monitoring stations were recommended for inclusion in the routine network: tailings pond water, mine water, and a well downgradient of the mine.
2. Moving screens to allow collection of samples in GWMW6 and GWMW9 closer to the ground water surface should be considered.

Parameter Changes

1. Two additional parameters were suggested: TSS for the surface water stations and sulfide for the ground water stations.
2. Dropping parameters for which concentrations in the tailings pond water and the mine water are routinely below upgradient concentrations should be considered.

General

1. Pump discharge when purging the monitoring wells should be directed away from the well to avoid contamination.
2. Regular clean-out of the Dry Gulch Creek conduit/settling basin routing system above the tailing pond dam is recommended.

REFERENCES

Garrett, M., 1987. Asamera Minerals (U.S.) Inc., Cannon Mine, Wenatchee, Washington, Environmental Monitoring Program, Fourth Quarter, 1986.