2001 Annual Report

PARTNERS IN PROGRESS
FLAMBEAU MINING COMPANY
RUSK COUNTY, WISCONSIN

January 2002

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Minerals

January 31, 2002

Mr. Lawrence J. Lynch
Mine Reclamation Unit
Bureau of Solid and Hazardous Waste Management
101 South Webster Street, GEF II
Madison, WI 53707

Dear Mr. Lynch:

The Flambeau Mining Company (Flambeau) is submitting one copy of the attached 2001 Annual Report pursuant to Part 1-8 of the Flambeau Mine Permit (Docket No. IH-89-14). An additional eleven copies of the report will be submitted separately. This submittal also addresses other requirements of the Mining Permit and associated approvals.

If you have any comments or questions regarding this submittal, please contact me at (715)532-6690 Ext. 2 or murphyj@kennecott.com.

Sincerely,

Jana E. Murphy

Jana E. Murphy
Environmental & Reclamation Manager

Distribution

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1

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FLAMBEAU MINING COMPANY
2001 ANNUAL REPORT

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1 Purpose and Need

This report serves to document the work that was done at the Flambeau Mine site in 2001 and to satisfy the requirements of the Mining Permit (MP).

Mining Permit, Part 1, Condition 8:

> *In accordance with sec. 144.89, Stats., Flambeau shall submit a report annually to the Department summarizing the activities which took place on the mining site during the year and shall include other additional information specified in this permit and associated plan approvals.*

Mining Permit, Part 2, Condition 4:

> *The annual report required under sec. 144.89, Stats., shall include discussion of all modifications received during the previous year and shall include an inventory of all modifications received subsequent to permit issuance. The annual report shall also discuss deviations from the approved Mining Plan as a result of final engineering refinements of subsequent plan approvals if these deviations do not require modifications, under Part 2, Conditions 2 and 3.*

Mining Permit, Part 2, Condition 6:

> *Flambeau shall keep a log of all incidents, such as spills, pond overflows and embankment failure or leakage, reported to its environmental compliance staff. This log shall, at all reasonable times, be available for inspection by any duly authorized Department employee. A summary of incidents subject to various Department reporting requirements shall be included in the annual report required under sec. 144.89, Stats.*

Mining Permit, Part 2, Condition 7 (Excerpt):

> *The annual report required under sec. 144.89, Stats, shall include a summary of all exploration drilling activities conducted on the mining site during the previous year.*

Mining Permit, Part 4, Condition 9:

> *Monitoring data and results shall be submitted to the Department within 30 days after completion of the required analyses. The annual report required in this permit shall, summarize the year's monitoring activities and any observed trends in the monitoring data.*

Water Withdrawal Approval, Condition 1 (Excerpt):

> *Flambeau Mining Company shall maintain records which document the withdrawal. At a minimum, such information shall include the dates and duration of withdrawal, approximate pumping rate and approximate volume of water withdrawn. Monthly summaries shall be submitted to the department for those months in which a withdrawal occurs. This information shall be available for department review in a separate file at the Flambeau Mining Company office and shall also be summarized in the annual report submitted as a condition of the mining permit.*

The location of the information which fulfills the requirements of the above conditions are referenced in Table 1-1.

TABLE 1-1

Location Information Key

Condition No.	Location of Information
MP, Part 1-8	Section 2 and 3
WWA, Condition 1	Section 2.6.2
MP, Part 2-4	Section 2.8
MP, Part 2-6	Section 2.10
MP, Part 2-7	Section 2.11
MP, Part 4-9	Section 4 and Appendix A through C.

2 2001 Summary

2.1 Introduction

After an exhaustive permitting process including extensive opportunity for public input, the Flambeau Mining Company (Flambeau) on January 14, 1991 received from the Wisconsin Department of Natural Resources (Department) eleven permits to operate an open pit copper mine in Rusk County, Wisconsin. Over the life of the mine (1993 – 1997), 181,000 tons of copper, 3.3 million ounces of silver, and 334,000 ounces of gold were mined.

Backfilling of the open pit began in earnest in early 1997. Waste rock and soils were replaced to their approximate original location in the open pit. Over 30,000 tons of limestone was added to the sulfide-bearing waste rock to neutralize and buffer the groundwater as it resaturated the backfilled materials.

In 1998, the surface reclamation of the mine site began by returning the land surface to its approximate original contour. Stockpiled topsoil was spread across the site where grasslands and woodlands were created. Hydric (wetland) soils had been stockpiled as well and were used to create over ten acres of wetlands. Reclamation activities since 1998 have included seeding, plug planting, tree planting, erosion control, mowing, invasive species control, trail construction, and prescribed burning. During Spring 2001, Flambeau completed the planting plan.

Continued protection of the Flambeau River, located 140 feet from the backfilled pit, has been documented by extensive monitoring. Throughout each phase of the project, samples have been collected from the Flambeau River and include water quality, sediments, fish, and macroinvertebrates. A habitat characterization was performed annually along the east bank of the river to document conditions of the river substrate. Flambeau continues to voluntarily monitor river water quality on a semi-annual to provide further documentation that the Flambeau River remains fully protected.

2.2 Groundwater Quality Assessments

Assessments of the backfill groundwater quality have been routinely performed with the most recent being completed in January 2001. The assessments show that the regional groundwater flow, including backfill water, is flowing toward the Flambeau River as was predicted during permitting. The assessment found that all acidity in the backfill has been neutralized by the limestone. Sulfate concentrations are now controlled by gypsum precipitation. Concentrations of solutes in the backfill are stable and should not significantly increase in the future.

During January 2001, Flambeau installed an additional monitoring well nest, MW-1015A and MW-1015B, approximately 1000 feet northwest of the backfilled pit. The MW-1015 well nest is located closer to the compliance boundary than already previously installed monitoring

wells. Although existing groundwater monitoring well nests located between the backfilled pit and the compliance boundary show Flambeau to be in full compliance with permit standards, the monitoring wells closer to the compliance boundary provide additional information regarding baseline groundwater quality near the compliance boundary and provide further documentation of Flambeau's continued compliance with groundwater permit standards. Beginning in April 2001, monthly baseline monitoring data has been collected from the MW-1015 wells and will continue for twelve months. Following collection of baseline data, the monitoring schedule for well nest MW-1015 will be consistent with the schedule of monitoring prescribed in the approved monitoring plan.

2.3 Notice of Completion

Data obtained during monitoring of the reclaimed vegetation during 2000 documented that Flambeau met the vegetative performance standards for Notice of Completion (NOC). Flambeau met the vegetative cover, target species diversity, minimum native species, and woody survival performance standards. Prior to submitting the NOC, Flambeau was required to decommission electrical service to the former west wall and remove the perimeter security fence. In May 2001, the above ground electrical line serving the area of the former west wall was removed. Removal of the perimeter fence was completed in June 2001. Collection of biomass samples was required at the time of the NOC. Biomass samples were collected during August 2001 and will be compared to biomass samples that will be collected just prior to Certificate of Completion in approximately four years. On September 4, 2001, Flambeau submitted the NOC to the Department and the Department recognized that Flambeau had met the requirements for NOC and deferred acceptance until Flambeau had documented that the vegetative performance standards had been met in 2001. The 2001 Annual Reclamation Report submitted to the Department in November 2001 provided the documentation that Flambeau has met the vegetative performance standards for two consecutive years.

2.4 Industrial Outlot

A long-term lease agreement exists between Flambeau and the Ladysmith Community Industrial Development Corporation (LCIDC), where the LCIDC leases a 32-acre portion of the former mine site referred as the industrial outlot. The 32-acre area includes the former administration building now occupied by the Ladysmith Department of Natural Resources Service Center; the former Water Treatment Plant (WTP) building now occupied by Xcel Energy and the Department; the railspur for which the LCIDC is actively pursuing a user and has installed major improvements adjacent to the railspur outside of the mine project area; and an approximate eight-acre area north of the railspur in the former Type II stockpile area for which the LCIDC is pursuing a user.

2.5 Community Involvement

Flambeau's involvement with the surrounding communities during 2001 included promotion of community activities, partnering with the communities, economic development, promoting tourism, enhancing communication, restoration projects, and maintaining an open door policy.

The major achievements for 2001 are set forth below:

- A community open house celebrating the grand opening and dedication of the conservation trail system on the Flambeau reclaimed mine site was held during late September. Representatives from the Governor's Office, Rusk County, and Kennecott Minerals spoke at the dedication ceremony that was attended by nearly 400 members of the local communities. Following the ceremony, visitors enjoyed lunch and a walk on the trails. Many visitors had positive comments as presented below:

    - "We've visited this site when mining was talking place, but now this wonderful nature trail and facility is simply amazing and a beautiful addition to the Rusk/Ladysmith area. Great job on the ceremony, wonderful lunch and fantastic planning. Thank you very much!"

    - "Wonderful! Living on the mining company property has given us a front seat for the whole project. Everything was done with loving care. All of the people involved truly loved this whole project. Thanks again!"

    - "What a wonderful place you created! We enjoy taking our daughter for walks and will most certainly enjoy coming here!"

- Flambeau continued its open door policy and conducted numerous tours of the mine site. Presentations for schools, career fairs and assorted groups were provided in the communities.

- Informal guided interpretive tours were conducted on the reclaimed Flambeau Mine site during Spring and late Summer. During the Spring tour, 15 bird species were identified on the site including Yellow Warbler, Yellowthroat, Yellowheaded Blackbird, Coot, Mallard, Bobolink, Eastern Kingbird and Barred Owl. During the later summer tour, birds were not as abundant as compared to the Spring nesting season, however, the tour guide provided an abundance of information on the native plant species found growing on the former Flambeau mine site.

- Flambeau donated a high capacity portable pump previously used on the mine site to the Bruce Community Volunteer Fire Department.

2.6 Water Management

2.6.1 Precipitation Runoff

During the first two years of surface stabilization of the reclaimed mine site, Flambeau had approval to pump runoff from the 1.7-acre biofilter to the south gravel pit to minimize impacts to the Flambeau River. During 1999, the Department agreed that the site had become sufficiently stabilized to discontinue this practice. During 2000 the reclaimed mine site continued to be stabilized and pumping of water before it reached the river was discontinued. During 2001, the reclaimed mine site surface remained stabilized by vegetative growth and there was minimal evidence of erosion. Aerial photographs (color and infrared) taken during August 2001 document that the surface stabilization of the reclaimed mine site is functioning as planned.

Flambeau River water quality samples were collected upstream (SW-1) and downstream (SW-2) from the reclaimed mine site during April and October 2001. Comparing analytical results, there was no significant difference between downstream and upstream samples and this further confirms that the reclaimed site is stable and functioning as designed. A summary of Flambeau river water quality results is found in Section 4.2.

2.6.2 River Water Withdrawal

On May 5, 1998 the Department approved Flambeau's application to withdraw water from the Flambeau River for use on site. During 2001, monthly reports on river water withdrawal were submitted to the Department on August 6 and September 27, 2001. All river water withdrawals were performed in accordance with the Department's May 1998 approval. The irrigation pump system was operated with a portable generator since electrical supply had been removed during May 2001. During 2001 river water was used only to irrigate woodland units.

Wetland 1 is located immediately west of the reclaimed mine site. During permitting, it was recognized that groundwater seeps within Wetland 1 had a high probability of being impacted by groundwater drawdown associated with the development of the open pit. During mining, it was noted that these seeps did cease to produce water. With the backfilling of the open pit being complete in 1997, the groundwater table has recovered significantly and Wetland 1 has been documented to be notably moister with groundwater seeps again flowing.

During 2001, Flambeau continued to monitor the staff gauge within Wetland 1 and maintain the ability to add mitigation water to the wetland. Routine inspections of Wetland 1 found the soils to be saturated and there were large areas within the wetland with standing water. On several occasions Wetland 1 was found to be overflowing into Stream A. As a result of Wetland 1's condition, mitigation water was not added during 2001.

Table 2-1 contains a summary of water withdrawal from the Flambeau River during 2001.

Table 2-1. 2001 River Water Withdrawal

2001	Reclamation Irrigation (Gallons)	Wetland Mitigation (Gallons)	Monthly Totals (Gallons)
April	0	0	0
May	0	0	0
June	0	0	0
July	583,000	0	583,000
August	522,000	0	522,000
September	253,000	0	253,000
Totals	1,358,000	0	1,358,000

2.7 2001 Milestones

The following is a summary of significant milestones throughout the year:

Table 2-2. 2001 Milestones	Month
Second Year Prescribed Burn Complete	May
Planting Plan Complete	May
Perimeter Fence Removal Complete	June
Notice of Completion Submitted to Department	September
Dedication and Grand Opening of Trail System	September
2001 Annual Reclamation Report Documents the Reclaimed Flambeau Mine has Met Vegetative Performance Standards for NOC for Second Year	November
The Northwest Mining Association honored Flambeau with the 2001 Environmental Excellence Award recognizing Flambeau's success in environmental protection and community sustainable development.	December

2.8 Modifications & Deviations

Condition 2-4 in the Mine Permit requires an inventory of deviations and modifications to the Permit received subsequent to permit issuance. Reclamation activities during 2001 were consistent with permits, approved plans, and modifications received subsequent to permit issuance. During 2001 there were no modifications or deviations to the Permit.

2.9 Construction Reports

During June 2001, construction documentation for well nest MW1015 was submitted to the Department.

2.10 Incident Log

Mine Permit Condition 2-6 requires a log of all incidents such as spills, pond overflow, embankment failure or leakage. This log is maintained on-site and is available for inspection. Spills are reported in accordance with Wis. Adm. Code ch. NR 706, CERCLA Reportable Quantities and SARA Section 302 Extremely Hazardous Substances Reportable Quantities.

During 2001 there were no reportable or recordable incidents that occurred on the reclaimed Flambeau Mine site.

2.11 Drill Holes

Mine Permit Condition 2-7 requires a summary of all exploration drilling activities conducted on the mine site during the previous year. No exploration drilling activities were conducted on the reclaimed mine site during 2001.

3 Reclamation Activities

As required by the Mine Permit Section 3, reports on progress of reclamation activities are prepared throughout the year. An annual report is required by Condition 3-26(d). The 2001 Annual Reclamation Report dated November 15, 2001 was submitted to the Department and is incorporated by reference. Other reclamation updates submitted on January 31 and November 8, 2001 are incorporated by reference. Reclamation activities reported in the November 2001 Annual Reclamation Report included a summary of onsite vegetation activities such as the completion of the planting plan and reports on monitoring of vegetation, birds and butterflies.

Reclamation monitoring of the site was performed by Applied Ecological Services, Brodhead, WI during Spring and late Summer. Vegetation monitoring was performed in 300 sample quadrats along 30 transects. Bird and butterfly monitoring was performed to document use of the site by wildlife. Following are highlights of the 2001 monitoring program results:

- 96 percent plant cover across reclaimed site excluding wetlands and industrial outlot;
- 20 planted species were found in the grassland community, 35 in the woodlands, and 64 in the wetlands;
- woody species survival within the defined woodlands is at 100 percent;
- 40 bird species identified as breeding on site or immediate peripheral property; and
- 7 butterfly species recorded as using site.

The most significant finding of the monitoring data shows that Flambeau continues to meet the vegetative performance standards for Notice of Completion (NOC) for the second consecutive year.

Flambeau submitted its NOC to the Department in a document dated September 4, 2001. Flambeau's NOC submittal summarized the requirements for NOC which include performance standards for the surface reclamation of the reclaimed mine site, removal of the perimeter fence, and removal of the electric line serving the irrigation pump (west wall). The 2000 Annual Reclamation Report (November 2000) included monitoring data providing documentation that the performance standards had been met. The September 4, 2001 provided a summary of the performance criteria and results of monitoring during 2000 showing that the standards were met in 2000. In addition, the NOC submittal provided formal notification to the Department that the electric line and perimeter fence had been removed. The electric line had been removed during May 2001 and the removal of the perimeter fence was completed during June 2001.

Table 3-4 summarizes the performance standards and the results of monitoring, 2000-2001.

Table 3-1. Performance Standards and Reclaimed Flambeau Site Status (2000-2001).

Performance Standard	Total Cover (%) 70		Planted Native Species (#) 15/15/12[2]		Diversity[1] (%) 80		Tree Species Survival (%) 80	
Community	2000	2001	2000	2001	2000	2001	2000	2001
Grassland	96	95	15/6[3]	16/4	88	94	NA[4]	NA
Woodland	98	98	25/10	24/11	100	96	100	100
Wetland	100	100	32/35	32/32	82	82	NA	NA
Industrial Outlot	96	93	NA	NA	NA	NA	NA	NA

[1]As compared to Target Planted Species.
[2]Min. 15 planted native species each in grassland and woodland; and min. 12 planted native species in wetland.
[3]# Target Planted Species Found/# Enhancement Planted Species Found
[4]NA = Not Applicable

Management of the reclaimed mine site included herbicide treatment of invasive species, mowing firebreaks and grass trails, and the second year of the 10-year prescribed burn period.

In summary, the results of 2001 surface reclamation monitoring show that the reclaimed mine has met the vegetative standard requirements for NOC for the second year. The site continues to track with the desired trajectory for plant community development, diversity, cover, plant frequency, productivity, and wildlife use.

4 Site Monitoring

Environmental monitoring at the reclaimed Flambeau Mine during 2001 included assessing the quality of groundwater, backfill pore water, wetland water, wetland water levels, and Flambeau River water and crayfish. All environmental monitoring continues to show that Flambeau remains in compliance with all permit standards and the Flambeau River remains fully protected.

4.1 Groundwater Quality Sampling and Analysis

Quarterly groundwater monitoring was performed in accordance with descriptions provided in the Updated Monitoring Plan (July 1991), the Revised Mining Permit Quality Assurance/Quality Control Document (August 1991) and the Local Agreement. Results of the monitoring were submitted to the Department Mine Reclamation Unit March 23, June 29, September 28 and December 20, 2001. Those reports are incorporated by reference.

4.1.1 Backfilled Pit Water Quality Assessment

As part of the permitting effort for the Flambeau project, assessments were completed to determine if the reclaimed site would comply with the permitted groundwater quality standards at the compliance boundary and protect surface water quality in the Flambeau River. The original assessment relied on predicted post-mining hydrologic conditions to conclude that the Flambeau River would act as a hydrologic boundary for the pore water migrating from the pit backfill and that backfill pore water would not migrate to the downgradient compliance boundary. In addition, the original analysis showed that the flux of backfill pore water into the river would be so small relative to the flow in the river that surface water quality would not experience a measurable change.

In a document dated August 27, 1999, Flambeau provided to the Department an evaluation of water quality data with respect to compliance with groundwater quality permit standards and the protection of water quality in the Flambeau River. The August 1999 evaluation confirmed that Flambeau remains in full compliance with groundwater quality permit conditions, that in the future, groundwater quality will not be affected at the permitted compliance boundary, and that water quality in the Flambeau River will be protected.

In a document dated October 17, 2000, Flambeau submitted to the Department another assessment of the backfilled pit water quality that was prepared by SRK Consulting and Foth & Van Dyke. The memorandum evaluated data obtained since the pit was backfilled to assess the performance of the reclaimed mine site with respect to compliance with groundwater quality permit standards and the protection of water quality in the Flambeau River. The 2000 assessment was appended to the 2000 Annual Report.

This 2000 assessment reported that neutralization of the acidity in the backfill pore water was complete, concentrations of solutes in the backfill pore water are stable, the pit backfill was

not affecting water quality in the Flambeau River, and the flux of pore water from the backfill will be negligible with respect to its potential impact on water quality in the Flambeau River.

In a memorandum dated January 15, 2002, SRK Consulting presented an assessment reviewing results from the 2001 monitoring of pore water quality. The 2001 monitoring results confirm the findings presented in the year 2000 monitoring results assessment. The current results can be summarized as follows:

- The results for April 2001 verify that the alkalinity and dissolved CO2 measures are closely correlated;
- Sulfate present in the backfill has been converted to gypsum and the sulfate concentrations are now controlled by gypsum precipitation;
- Equilibrium conditions with calcite indicate that acid neutralization is complete;
- Consistent results in samples collected from 1998 through 2001 demonstrate that the concentrations of major ions in the backfill pore water are stable;
- Redox potentials have decreased significantly in some of the wells, but are steady or increasing slightly in others;
- Modeling results suggest that iron oxyhydroxides are converting to more stable phases such as goethite or hematite, and therefore that soluble iron concentrations are unlikely to increase in future; and
- Manganese concentrations are variable and elevated in one well (MW-1013B), increasing marginally in another (MW-1013C), but are nearly constant or slightly decreasing in the remaining wells. Further monitoring is required to determine if solubility controls will limit further changes.

Based on the 2001 assessment and conclusions, SRK recommends that:

- With the exception of the two items listed below, monitoring of groundwater within and around the backfilled pit should continue to be performed in accordance with the program contained in the project's approved monitoring plan. An annual review of the data should be included in the project's annual report to determine if conditions affecting the conclusions reached in the 2001 assessment remain consistent. As additional data are collected and the continuation of stable conditions is documented, consideration can be given to reducing the frequency of monitoring within the backfilled pit;
- CO2 sampling be discontinued since alkalinity data can be used to assess changes in CO2 concentrations in the backfill pore water; and
- Eh measurements should continue to be taken each quarterly sampling event until stable conditions are observed.

The January 15, 2002 memorandum, Flambeau Project – Monitoring Results, is found in Appendix A.

4.1.2 Trend Analysis

The non-parametric Mann-Kendall test for trend was used to statistically determine whether any trends exist in groundwater or Flambeau River water. Since the data sets are becoming large, and there is a significant amount of data available following mining production, October of 1997 was selected as the start date for the trend tests. October of 1997 is the beginning of the post-mining period. The non-parametric Mann-Kendall test indicates whether any general increasing or decreasing trends have occurred during this time frame. Note that since only general trends are tested, the Mann-Kendall test will not identify short-term reversals in the data, and must be used in conjunction with the trend graphs. The Type I error for each test was set to 0.01. Monitoring data for each groundwater and surface water monitoring site are graphed and tabulated in Appendix B. More detailed information on trend analysis and other trends is also contained in Appendix B.

Only those water quality parameters which showed a statistically significant trend upward or downward are discussed in this section. The results of the Mann-Kendall tests are as follows:

The results of the trend tests are best used in conjunction with the trend graphs found in Attachment B to properly evaluate trend conditions. It should be noted that a statistically increasing or decreasing trend does not necessarily indicate a substantial increase or decrease in parameter concentrations.

The main conclusions that may be reached from the trend graphs and statistical trend tests are as follows:

- MW-1000P-R: Several parameters exhibited an increase in concentrations at the beginning of the post-mining period. These are conductivity, alkalinity, hardness, iron, manganese, sulfate and TDS. Of these parameters, only alkalinity continues to be statistically increasing.
- MW-1002: During the post-mining period, alkalinity and hardness have statistically increasing trends. However, concentration levels are very similar to those observed during the pre-mining period (prior to January of 1993). The currently increasing trend of these two parameters reflects an increase to pre-mining levels after a decrease during the production period. A decreasing trend of copper was also indicated by the statistical test for MW-1002.
- MW-1002G: A statistically increasing trend of alkalinity was observed during the post-mining period, however actual concentrations are increasing by only a very small amount, and are within ranges observed prior to this time period.
- MW-1004P: A statistically increasing trend of iron was observed for the post-mining period, however current concentrations are well below those observed during the pre-mining period. A decreasing trend of TDS is observed in this well.
- MW-1004S: Statistically decreasing trends of conductivity and alkalinity were observed, along with an increasing trend of sulfate. The current conductivity and alkalinity concentrations are similar to those of the pre-mining period. Sulfate concentrations are

increasing above historical levels by about 10-15 mg/L, but well below the permit standard of 250 mg/l.

- MW-1005: Statistically decreasing trends of conductivity, alkalinity, hardness, iron and manganese were observed for the post-mining period. Levels of all of these parameters have generally decreased below pre-mining and production levels.
- MW-1005P: A statistically decreasing trend of sulfate is occurring. Sulfate has not been detected in this well over the last nine sampling events.
- MW-1005S: A statistically increasing trend of manganese occurred for MW-1005S during the post-mining period, but actual change in concentration was very slight. A statistically decreasing trend of sulfate is also occurring during this time period.
- MW-1010P: A statistically decreasing trend of conductivity and increasing trend of iron are occurring during the post-mining period for this well. Iron increased significantly during October of 2000, but since then it has actually returned to levels seen historically, hence the trend noted by the statistical test is most likely reversed.

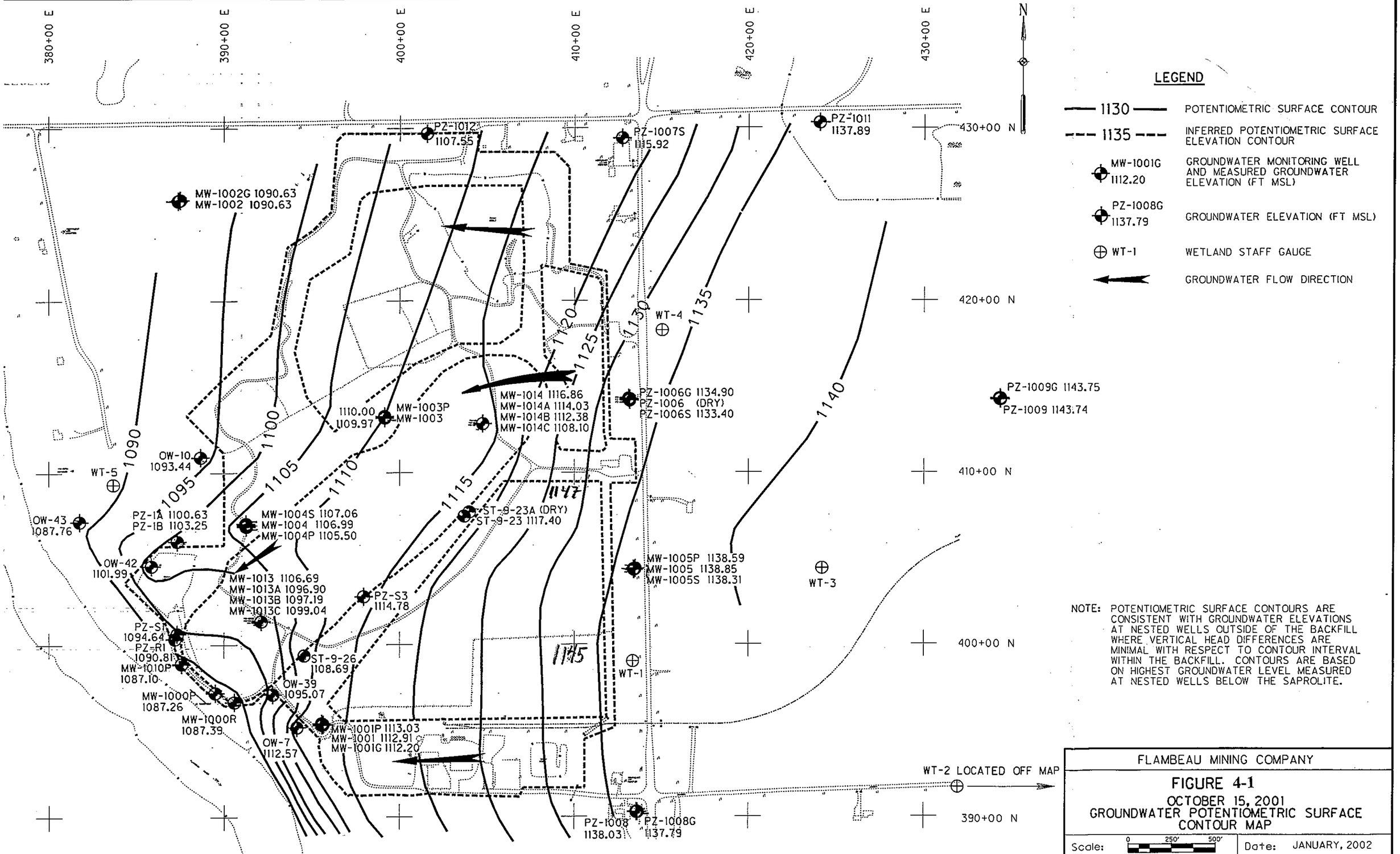
Several trends were noted for the in-pit wells and for the new wells MW-1015A and MW-1015B. These are as follows:

- MW-1013B: An increasing trend of manganese is occurring in this well, however, the latest result revealed a decrease in concentration.
- MW-1013C: Iron and manganese have statistically increasing trends. Similar to MW-1013B, the latest result was a decrease in concentration.
- MW-1014B: Cadmium and manganese have statistically decreasing trends.
- MW-1014C: Statistically decreasing trends were noted for hardness, iron, manganese, zinc and conductivity.
- MW-1015A: A statistically decreasing trend of barium and increasing trend of manganese was observed, but actual changes in concentration are slight.
- MW-1015B: A decreasing trend of manganese was observed.

No significant trends were noted for the surface water results.

Overall, the groundwater elevation data continued to show that the groundwater system is recovering.

Figure 4-1 shows the groundwater potentiometric surface for October 2001 and presents the locations of monitoring wells. Figure 4-2 shows a cross section of the backfilled pit with in-pit monitoring wells, October 2001 groundwater potentiometric surface in relation to backfill materials, and the projected post-mining steady state groundwater elevation. Graphs and further discussion on groundwater elevations are included in Appendix B.



NOTE: POTENTIOMETRIC SURFACE CONTOURS ARE CONSISTENT WITH GROUNDWATER ELEVATIONS AT NESTED WELLS OUTSIDE OF THE BACKFILL WHERE VERTICAL HEAD DIFFERENCES ARE MINIMAL WITH RESPECT TO CONTOUR INTERVAL WITHIN THE BACKFILL. CONTOURS ARE BASED ON HIGHEST GROUNDWATER LEVEL MEASURED AT NESTED WELLS BELOW THE SAPROLITE.

FLAMBEAU MINING COMPANY

FIGURE 4-1

OCTOBER 15, 2001
GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP

Scale: 0 250' 500'	Date: JANUARY, 2002	
Prepared By: Foth & Van Dyke	By: JOW	01F001

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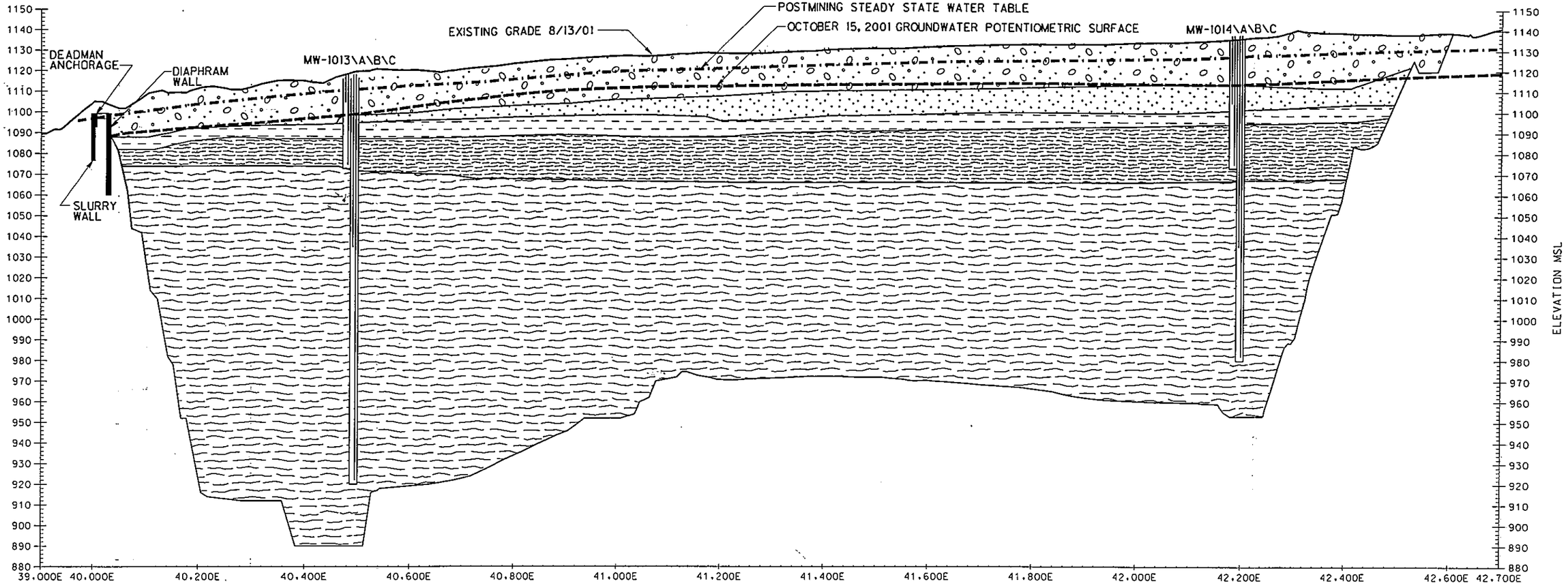

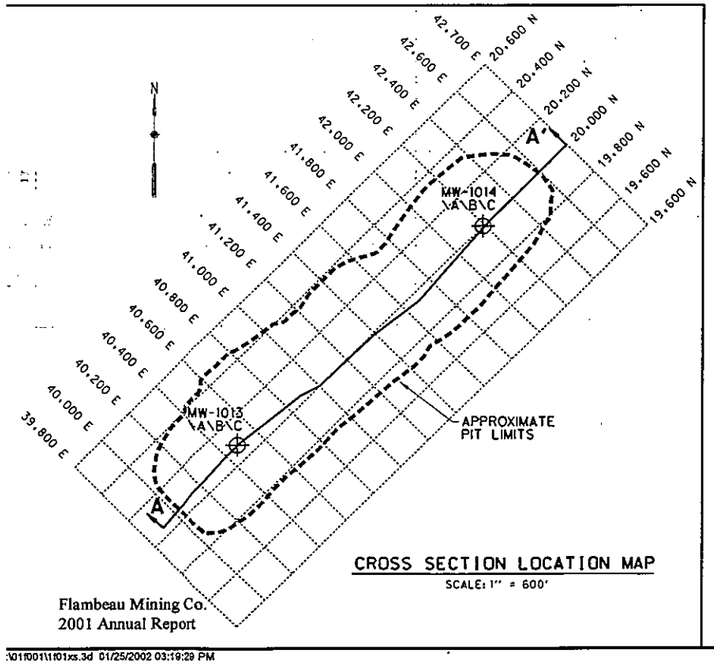

CROSS SECTION LOCATION MAP
SCALE: 1" = 600'

Flambeau Mining Co.
2001 Annual Report

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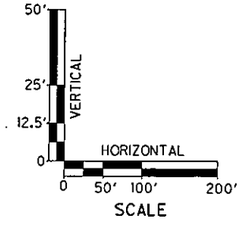
MINE PIT COORDINATES
SECTION A - A'

LEGEND

- TILL
- SANDSTONE
- SAPROLITE
- TYPE I MATERIAL
- TYPE II MATERIAL



FLAMBEAU MINING COMPANY

FIGURE 4-2
MINE PIT CROSS SECTION A - A'
WITH IN-PIT GROUNDWATER
MONITORING WELLS

Scale: SEE BAR SCALE	Date: JANUARY, 2002	
Prepared By: Foth & Van Dyke	By: JOW	01F001

4.2 Surface Water

The 2001 surface water monitoring program included sampling and analyses of the following elements: crayfish, water quality, and wetland surface flows. The Revised Mining Permit Quality Assurance/Quality Control Document (August 1991) specifies that an annual surface water monitoring report will be prepared and submitted to the Department in March of each year. This portion of the 2001 Annual Report meets this requirement.

In accordance with the Updated Monitoring Plan, after discharges from the wastewater treatment facilities have ceased, which they did in 1998, sediments, crayfish and fish were collected once each year for two years. With the collection of sediments, crayfish and fish in 1999 and 2000, Flambeau has met this requirement. The Updated Monitoring Plan prescribes that during the third year after cessation of wastewater discharges and for each year thereafter, until notice of completion of reclamation is issued by Flambeau, crayfish will be sampled and analyzed. Given Flambeau's submittal of Notice of Completion during September 2001, 2001 was the last year that crayfish were sampled. In accordance with the Updated Monitoring Plan, fish will be sampled during the year that the certificate of completion is issued.

The Updated Monitoring Plan requires that during the two years following the cessation of wastewater discharge, three surface water samplings will be made. Two of these samplings are to occur at the time of spring runoff during each of these years. One additional sample is to be taken during a stormwater runoff event so that the downstream sample taken in the Flambeau River includes runoff from the reclaimed mine site. Flambeau collected surface water samples on March 23, 1999, April 8, 1999, November 1, 1999, June 1, 2000 and November 16, 2000. Flambeau has met the requirement for collecting surface water samples in accordance with the approved monitoring plan. On its own initiative, Flambeau's intends to continue sampling the Flambeau River at SW-1 and SW-2 twice each year for copper, conductivity, iron, manganese, pH, sulfate and zinc to document the continued protection of the Flambeau River.

Figure 4-3 shows the sampling locations for sediment, macroinvertebrates, fish and surface water quality of the Flambeau River.

4.2.1 Macroinvertebrates (Crayfish)

Crayfish were collected in the Flambeau River at three sampling locations for metal analyses. The sampling and analyses are conducted in accordance with the Updated Monitoring Plan and the Revised Mining Permit Quality Assurance/Quality Control Document (August 1991). Blue Iris Environmental, Inc. collected crayfish samples on July 24, 2001.

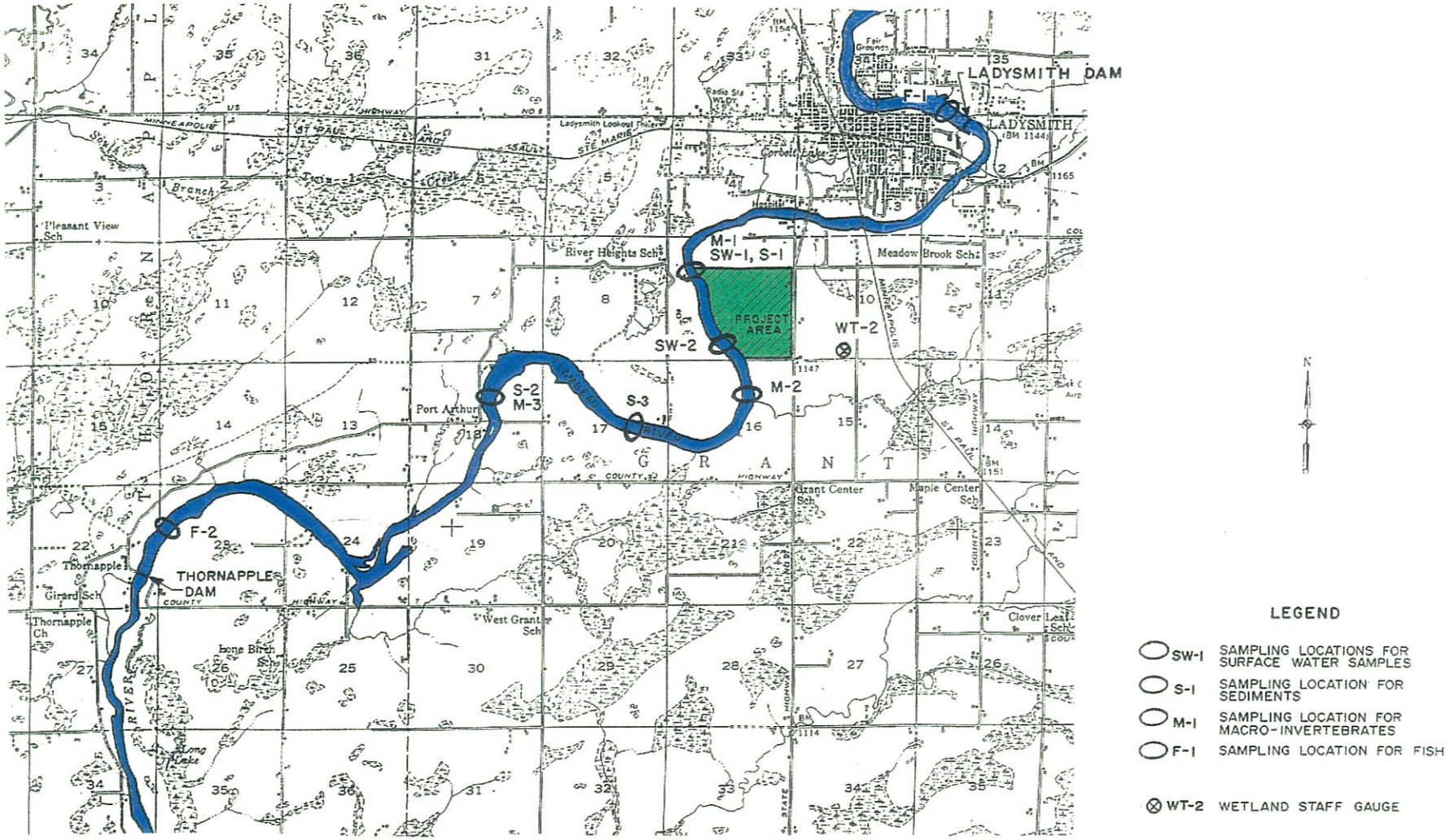


Figure 4-3. Surface Water Monitoring Site Locations
Flambeau Mining Company

Whole bodies were used for analysis and the results represent a composite for all crayfish collected per site. The analytical data continues to indicate that there is no relative difference in parameter concentrations when comparing upstream to downstream locations. Data for the three sites are similar when compared to each other and, with the exception of cadmium, data are also comparable to previous years' results. Results for cadmium for both upstream and downstream samples are higher than previous years' data, however, all sites show a similar, if not identical increase. Therefore, such increases cannot be attributed to any post-mining activity or condition.

Results for collection and analyses of crayfish are included in Appendix C. Crayfish sampling locations are shown in Figure 4-3.

4.2.2 Surface Water Quality

During 2001, samples were collected in accordance with procedures described in the Updated Monitoring Plan (July 1991) and the Revised Mine Permit Quality Assurance/Quality Control Document (August 1991).

The sample identified as SW-1 is upstream of the reclaimed mine site; SW-2 is downstream of the reclaimed mine site. Figure 4-3 shows the locations of the surface water sampling. Results of sampling were submitted to the Department on May 10, 2001 and December 20, 2001. Those submittals are incorporated by reference.

A summary of the 2001 surface water quality results is included in Table 4-1. The results from 2001 are generally consistent with data collected from the same locations in 1992-2000 and 1991 during baseline data collections. No significant difference in parameter concentrations is evident when comparing downstream water quality to upstream water quality; and there are no trends in surface water quality results. Trend graphs of surface water quality results and statistical trend analysis are contained in Appendix B.

4.2.3 Wetland Surface Flows

Water levels in wetlands 1, 5C, 6C, 7 and 10A were measured three times during 2001, spring, summer and fall. Staff gauges designated WT 1 (Wetland 5C), WT 2 (Wetland 7), WT 3 (Wetland 6C), WT 4 (Wetland 10A) and WT 5 (Wetland 1) are measured. Figure 4-1 and Figure 4-3 show the staff gauge locations.

Table 4-1. 2001 SURFACE WATER QUALITY DATA

	SW-1 (Upstream)		SW-2 (Downstream)	
	Apr-01	Oct-01	Apr-01	Oct-01
Copper (ug/l)	<1.3	<1.3	<1.3	<1.3
Conductivity (lab)	56	140	52	140
Conductivity (field)	45	140	44	110
Iron (mg/l)	0.65	0.36	0.66	0.39
Manganese (ug/l)	68	83	66	95
pH (lab)	7.6	7.5	7.4	7.6
pH (field)	6.6	7.1	6.8	7.1
Sulfate (mg/l)	<5	8.8	<5	8.9
Zinc (ug/l)	<12	<12	<12	<12

Measurements were provided to the Department on June 29, September 28 and December 20, 2001; the reports are incorporated by reference. Tables 4-2 through 4-6 summarize the wetland elevations for the five wetlands. Wetlands 5C, 6C, 7 and 10A showed readings similar to previous years. Wetland 1 continues to exhibit wet conditions with flowing groundwater seeps and standing water evident.

In May 2001, Flambeau submitted a Wetland Area Hydrographic Assessment prepared by Foth & Van Dyke evaluating the wetland water elevations and recommending cessation of monitoring of wetland surface water elevations, with the exception of Wetland 1, in accordance with the Updated Monitoring Plan. Based upon the Wetland Area Hydrographic Assessment, Flambeau requested the Department's approval of cessation of monitoring wetland surface water elevations for Wetlands 5C, 6C, 7 and 10A. During 2001, wetland water elevations continued in accordance with the Updated Monitoring Plan pending Department approval of Flambeau's request.

Wetland 1 will continue to be monitored at the staff gauge and the ability to add mitigation water will be retained until it is determined that the groundwater elevation in the area of Wetland 1 has stabilized.

TABLE 4-2

WETLAND STAFF GAUGE READING SUMMARY

Staff Gauge Location/
Water Level (MSL)

WETLAND 5C

(WT-1)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
FEB	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
MAR	--	1140.62	NRT	NRT	NRT	NRT	NRT	1140.26	NRT	NRT	NR
APR	--	1140.47	1140.60	1140.73	1140.34	1140.24	1140.28	NSW	1140.07	1140.06	NR
MAY	1140.84	1140.21	1140.47	1140.22	1140.11	NSW	NSW	1141.00	NSW	1140.04	1140.29
JUN	1140.78	NSW	1140.34	1140.06	NSW	1140.14	NSW	NSW	NSW	1140.04	NR
JUL	1140.05	NSW	NSW	NSW	NSW	NSW	1140.10	NSW	NSW	NSW	NR
AUG	NSW	NSW	1140.48	NSW	1140.65	NSW	1140.40	NSW	1140.23	NSW	NSW
SEP	1140.21	1140.09	1140.51	1140.34	NSW	NSW	NSW	NSW	NSW	NSW	NR
OCT	NSW	1140.68	1140.46	1140.28	1140.18	1140.29	1140.14	NSW	NSW	NSW	1140.02
NOV	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NSW	NSW	NSW	NR
DEC	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR

NRT = No Reading Taken Due to Frozen Conditions
NSW = No Standing Water
NR= Not Required

TABLE 4-3

WETLAND STAFF GAUGE READING SUMMARY

Staff Gauge Location/
Water Level (MSL)

WETLAND 7

(WT-2)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
FEB	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
MAR	--	1153.85	NRT	NRT	NRT	NRT	NRT	1153.59	NRT	NRT	NR
APR	--	1153.74	1153.82	1153.89	1153.59	1153.64	1153.62	1153.31	1153.34	1153.58	NR
MAY	1154.00	1153.62	1153.57	1153.49	1153.50	1153.45	1153.39	1153.27	1153.39	1153.57	1153.74
JUN	1153.58	1153.37	1153.64	1153.37	1152.99	1153.50	1153.10	1153.02	1153.59	1153.50	NR
JUL	1153.51	1153.16	1153.46	1153.13	NSW	1153.27	1153.42	NSW	1153.27	1153.47	NR
AUG	1153.15	1153.15	1153.56	NSW	1153.03	NSW	1153.52	NSW	1153.64	1153.40	1153.50
SEP	1153.52	1153.06	1153.57	1153.48	1153.24	1152.90	1153.34	NSW	1153.51	1153.50	NR
OCT	1153.44	1153.16	1153.51	1153.49	1153.58	1153.50	1153.48	NSW	1153.31	1153.25	1153.38
NOV	NRT	NRT	NRT	NRT	NRT	NRT	NRT	1152.96	1153.24	1153.25	NR
DEC	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR

NRT = No Reading Taken Due to Frozen Conditions
NSW = No Standing Water
NR= Not Required

TABLE 4-4

WETLAND STAFF GAUGE READING SUMMARY

Staff Gauge Location/
Water Level (MSL)

WETLAND 6C

(WT-3)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
FEB	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
MAR	--	1146.90	NRT	NRT	NRT	NRT	NRT	1146.58	NRT	NRT	NR
APR	--	1146.72	NRT	1146.89	1146.67	1146.51	1146.51	NSW	1146.59	1146.50	NR
MAY	1147.05	NSW	1146.78	NSW	1146.52	NSW	NSW	NSW	NSW	NSW	NSW
JUN	NSW	NSW	1146.66	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NR
JUL	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NR
AUG	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW
SEP	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NR
OCT	NSW	NSW	NSW	NSW	1146.49	NSW	NSW	NSW	NSW	NSW	NSW
NOV	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NSW	NSW	NSW	NR
DEC	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR

NRT = No Reading Taken Due to Frozen Conditions
NSW = No Standing Water
NR= Not Required

TABLE 4-5

WETLAND STAFF GAUGE READING SUMMARY

Staff Gauge Location/
Water Level (MSL)

WETLAND 10A

(WT-4)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
FEB	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
MAR	--	1146.76	NRT	NRT	NRT	NRT	NRT	1146.63	NRT	NRT	NR
APR	--	1146.58	1146.74	1146.86	1146.64	1146.58	1146.43	1146.30	1146.57	1146.53	NR
MAY	1146.81	1146.46	1146.57	1146.48	1146.55	1146.38	1146.23	1146.39	1146.31	1146.51	1145.65
JUN	NSW	1146.16	1146.55	1146.39	1146.13	1146.49	1145.97	1146.16	1146.11	1146.41	NR
JUL	1146.11	1145.91	1146.41	1146.18	1145.83	1146.24	1146.38	NSW	1146.02	1146.36	NR
AUG	NSW	1146.00	1146.55	1145.80	1146.52	NSW	1146.49	1145.56	1146.59	1146.26	1146.42
SEP	1146.26	1146.12	1146.57	1146.45	1146.14	1145.85	1146.23	1145.87	1146.48	1146.33	NR
OCT	1146.10	1146.34	1146.53	1146.43	1146.53	1146.51	1146.37	1145.65	1146.12	1146.03	1146.26
NOV	NRT	NRT	NRT	NRT	NRT	NRT	NRT	1145.87	1145.97	1146.07	NR
DEC	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR

NRT = No Reading Taken Due to Frozen Conditions
NSW = No Standing Water
NR= Not Required

TABLE 4-6

WETLAND STAFF GAUGE READING SUMMARY

Staff Gauge Location/
Water Level (MSL)

WETLAND 1

(WT-5)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
FEB	--	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR
MAR	--	1102.32	NRT	NRT	NRT	NRT	NRT	1101.92	NRT	NRT	NR
APR	--	1102.29	1102.49	1102.18	1101.93	1102.06	1101.91	NSW	1101.89	1101.92	NR
MAY	1102.35	1102.25	1102.03	NSW	NSW	NSW	NSW	1101.84	NSW	1101.93	1102.06
JUN	1102.28	1102.26	NSW	NSW	NSW	NSW	NSW	NSW	NSW	1102.01	NR
JUL	1102.23	1101.90	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NR
AUG	NSW	1102.21	NSW	NSW	NSW	NSW	NSW	NSW	1102.09	NSW	NSW
SEP	1102.33	1102.46	1101.92	NSW	NSW	NSW	NSW	NSW	NSW	NSW	NR
OCT	1102.32	1102.37	NSW	NSW	1101.97	NSW	NSW	NSW	NSW	NSW	1101.91
NOV	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NSW	NSW	NSW	NR
DEC	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NRT	NR

NRT = No Reading Taken Due to Frozen Conditions
NSW = No Standing Water
NR= Not Required

During April and June 2001, wetland water quality samples were collected from onsite wetlands and a recovering groundwater seep in Wetland 1 to provide baseline data. The results of the analyses were submitted to the Department on January 24, 2002. Table 4-7 summarizes the analytical results from the 8.5-acre wetland, 1.7-acre biofilter, 0.9-acre biofilter, and Wetland 1. Results are comparable between the sample locations with the exception of copper and manganese at the 0.9-acre biofilter that serves the industrial outlot. During the April 2001 monitoring, the results for barium, manganese and zinc from the 0.9-acre biofilter were inconsistent with past results. The 0.9-acre biofilter was resampled in June 2001 and subsequent results were similar to results from previous years monitoring.

4.3 Surface Subsidence

Pursuant to Section 3.1.7 of the Updated Monitoring Plan (July 1991), with 2001 being the third year after reclamation activities were performed in the area of the pit, a review of the surface topography in the area of the pit was performed and compared to the 1998 aerial mapping topography determined immediately after completion of reclamation activities. Figure 4-4 shows the topography of the ground in the area of the pit as determined by the aerial photography performed in August 2001. Figure 4-5 shows the difference in topography (isopach) of the ground within the area of the pit between August 2001 and September 1998. As shown in Figure 4-5, the general subsidence across the site is less than one half a foot which is within the accuracy of the mapping technique. This is supported by onsite observations of the backfilled pit area where no cracks and no differential settlement of the in-pit wells has been observed. The largest settlement observed in isolated areas by mapping is 1.5 feet. This amount of settlement is much less than the "less than 5%" (approximately 12 feet) anticipated in the Mine Permit Application (December 1989) (MPA, Section 5.7.2.3). This is due primarily to Flambeau's aggressive quality control procedures for compaction used during pit backfilling.

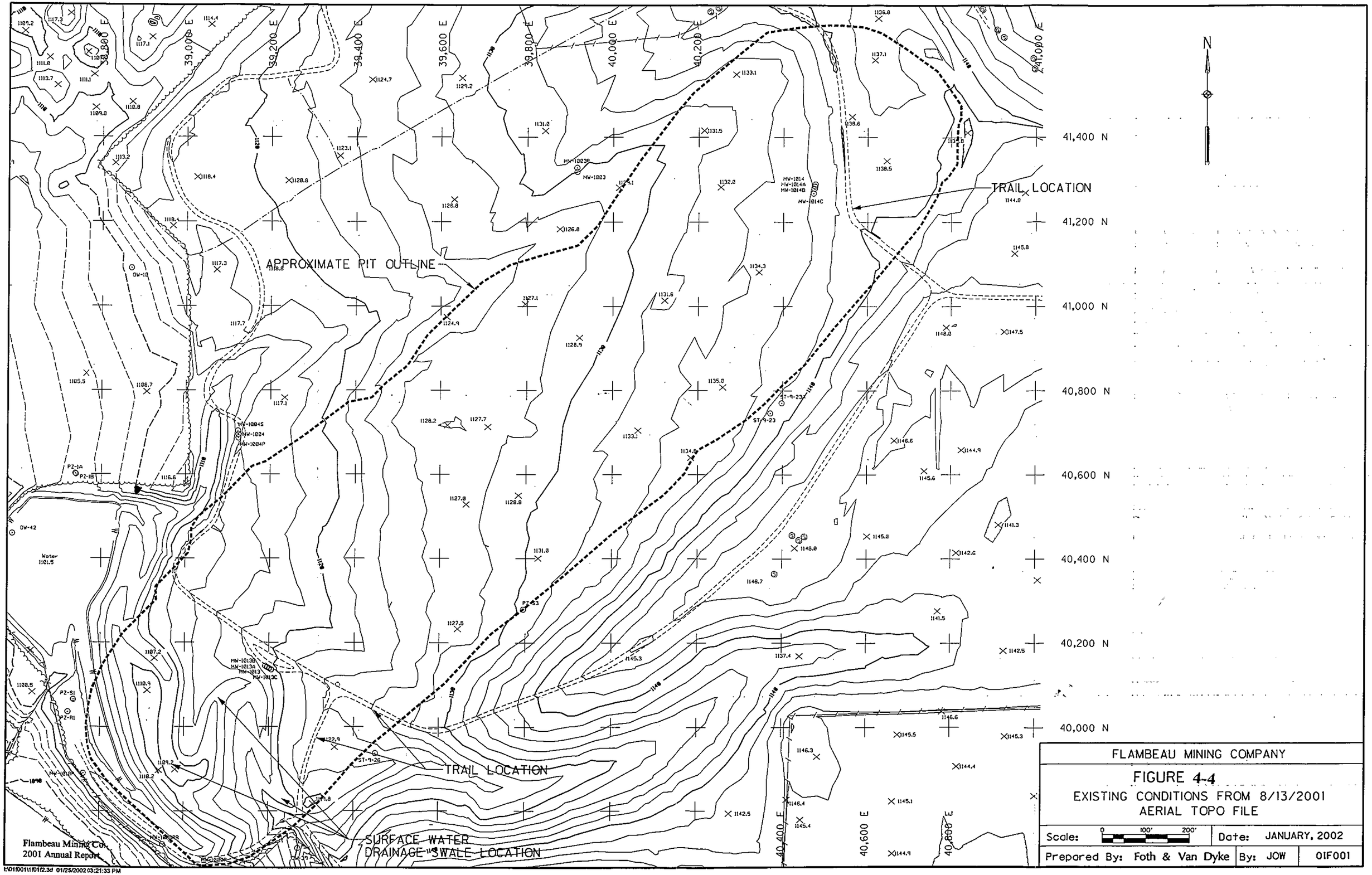
4.4 Aerial Photography (Color and Infrared)

Aerial and color infrared photographs were taken of the mine project area and surrounding areas during late summer on August 13, 2001. The aerial photography followed procedures described in the Miner Permit Application (December 1989) and the Updated Monitoring Plan (July 1991). When comparing the 2001 color and infrared photographs to those taken in 1991, there were no changes in vegetative cover due to mine activities. Changes in vegetative cover were noted at peripheral locations and were due to land use practices at these locations. There was no evidence of erosion, sedimentation, or vegetative stress associated with the mining activity within the study area. Aerial photographs and Foth & Van Dyke's memorandum Interpretation of Aerial Photography were submitted to the Department on January 23, 2002 and incorporated by reference.

Table 4-7

2001 Wetland and Biofilter Baseline Monitoring

		April 17				June 21
Parameter	Units	Wetland 1 Seep	8.5-Acre Wetland	1.7-Acre Biofilter	0.9-Acre Biofilter	0.9-Acre Biofilter
Alkalinity	mg/l	33	17	20	24	24
Arsenic	ug/l	<2.3	<2.3	<2.3	<2.3	<2.3
Barium	ug/l	7	10	13	210	19
Cadmium	ug/l	<0.23	<0.23	<0.23	<0.23	<0.23
Chromium	ug/l	<0.57	<0.57	<0.57	<0.57	<0.57
Copper	ug/l	<2.7	<2.7	<2.7	85	73
Hardness	mg/l	49	17	18	31	32
Iron	mg/l	0.011	0.36	0.24	0.38	0.41
Lead	ug/l	<0.92	<0.92	<0.92	<0.92	<0.92
Manganese	ug/l	<2	8.8	2.8	380	86
Mercury	ug/l	<0.05	<0.05	<0.05	<0.05	<0.05
Oil & Grease	mg/l	<1.4	<1.4	<1.4	<1.4	5.4
pH, Lab	s.u.	6.4	7.2	6.7	6.7	6.9
pH, Field	s.u.	6.0	6.7	6.7	6.6	6.6
Selenium	ug/l	<1.6	<1.6	<1.6	<1.6	<1.6
Silver	ug/l	<0.56	<0.56	<0.56	<0.56	<0.56
Solids, tot. dis.	mg/l	87	75	47	84	98
Solids, tot. susp.	mg/l	<1	7	4	20	14
Sulfate	mg/l	12	<5	<5	12	9.4
Zinc	ug/l	<12	<12	<12	51	<12
Conductivity, Lab	uS	130	76	54	130	80
Conductivity, Field	uS	117	62	47	116	63
Temp. (Field)	°C	6.6	8.9	7.8	10.1	20.9



FLAMBEAU MINING COMPANY

FIGURE 4-4

EXISTING CONDITIONS FROM 8/13/2001 AERIAL TOPO FILE

Scale: 0 100' 200'	Date: JANUARY, 2002	
Prepared By: Foth & Van Dyke	By: JOW	01F001

Flambeau Mining Co.
2001 Annual Report

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38,800 E
39,000 E
39,200 E
39,400 E
39,600 E
39,800 E
40,000 E
40,200 E
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40,800 E
41,000 E

41,400 N
41,200 N
41,000 N
40,800 N
40,600 N
40,400 N
40,200 N
40,000 N

N

APPROXIMATE PIT OUTLINE

TRAIL LOCATION

TRAIL LOCATION

SURFACE WATER
DRAINAGE SWALE LOCATION

ISOPACH MAP BETWEEN 7F11F98.DTM
9/16/98 AERIAL FLIGHT VS 1F01F01.DTM
8/13/01 AERIAL FLIGHT
CONTOUR INTERVAL IS 0.5'

FLAMBEAU MINING COMPANY

FIGURE 4-5

SUBSIDENCE/ISOPACH MAP
FALL, 2001

Scale: 0 100' 200'	Date: JANUARY, 2002	
Prepared By: Foth & Van Dyke	By: JOW	01F001

E:\01f001\11f01f1.3d 01/25/2002 03:22:16 PM

REFERENCES

2000 Annual Report	January 2001
2000 Annual Reclamation Report	November 2000
2001 Annual Reclamation Report	November 2001
Local Agreement	August 1988
Mining Permit	January 1991
Revised Mining Permit Quality Assurance/Quality Control Plan	August 1991
Updated Monitoring Plan	July 1991

SUBMITTALS

DOCUMENT	DATE	DEPARTMENT SUBMITTEE
Section 2.0 Operating Activities		
2000 Annual Report	January 2001	Larry Lynch [1]
Tabular Summary of Backfill Well Monitoring Data – Addendum to 2000 Annual Report	June 2001	Larry Lynch [1]
July 2001 Surface Water Withdrawal	August 2001	Larry Lynch [1]
August & September 2001 Surface Water Withdrawal	September 2001	Larry Lynch [1]
Section 3.0 Reclamation Activities		
List of Anticipated 2001Reclamation Activities	January 2001	Larry Lynch [1]
Prescribed Burning on Reclaimed Flambeau Mine	April 2001	Larry Lynch [1]
Addendum to List of Anticipated 2001 Reclamation Activities	May 2001	Larry Lynch [1]
Notice of Completion	September 2001	Larry Lynch [1]
MidSummer Progress Report, 2001	November 2001	Larry Lynch [1]
2001 Annual Reclamation Report	November 2001	Larry Lynch [1]

SUBMITTALS (CONT'D)

DOCUMENT	DATE	DEPARTMENT SUBMITTEE
Section 4.0 Site Monitoring		
Environmental Monitoring (First Quarter 2001)	March 2001	Larry Lynch [1]
Surface Water Quality Results – Spring 2001	May 2001	Larry Lynch [1]
Wetland Area Hydrographic Assessment	May 2001	Larry Lynch [1]
Environmental Monitoring (Second Quarter 2001)	June 2001	Larry Lynch [1]
Well Construction Documentation (MW-1015A/MW-1015B)	June 2001	Larry Lynch [1]
Well Nest MW1015 (Second Month Baseline)	July 2001	Larry Lynch [1]
Well Nest MW1015 (Third Month Baseline)	August 2001	Larry Lynch [1]
Baseline Crayfish Tissue Analysis	August 2001	Larry Lynch [1]
Environmental Monitoring (Third Quarter 2001)	September 2001	Larry Lynch [1]
Well Nest MW1015 (Fifth Month Baseline)	December 2001	Larry Lynch [1]
Well Nest MW1015 (Sixth Month Baseline)	December 2001	Larry Lynch [1]
Surface Water Quality Results – Fall 2001	December 2001	Larry Lynch [1]
Environmental Monitoring (Fourth Quarter 2001)	December 2001	Larry Lynch [1]
Well Nest MW1015 (Eighth Month Baseline)	December 2001	Larry Lynch [1]
2001 Aerial and Color Infrared Photography	January 2002	Larry Lynch [1]
Wetland and Biofilter Baseline Monitoring – Spring 2001	January 2002	Larry Lynch [1]
Well Nest MW1015 (Ninth Month Baseline)	January 2002	Larry Lynch [1]

1 Wisconsin Department of Natural Resources
Bureau of Waste Management

Appendix A

Backfilled Pit Water Quality Assessment

SRK Consulting
Engineers and Scientists

Steffen Robertson and Kirsten (Canada.) Inc.
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Vancouver, BC.
V6C 3B6

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Fax: 604.687.5532

MEMORANDUM

DATE: January 15, 2002

TO: G. Sevick, PE
Foth and Van Dyke, Green Bay

FROM: John Chapman, Daryl Hockley

RE: FLAMBEAU PROJECT
Monitoring Results

1. INTRODUCTION

Since backfilling of the Flambeau pit was completed in the fall of 1997, groundwater elevation in the area around the backfill has been monitored, and samples from various elevations have been analyzed to assess the development of pore water quality. Surface water samples in the Flambeau River have also been collected and analyzed.

Water quality data collected to the end of the year 2000 were evaluated and discussed in a Foth & Van Dyke memorandum to Jana Murphy, Flambeau Mining Company, dated October 12, 2000. In brief, the 2000 review recommended that:

- Flambeau continue to monitor Flambeau River water quality;
- Monitoring of groundwater within and around the backfilled pit should continue in accordance with the approved monitoring plan, and an annual review of the data should be performed to verify that conditions affecting the conclusions reached in the October 12 memorandum have not changed significantly;
- Dissolved carbon dioxide (CO_2) be monitored for one more sampling period to verify that CO_2 and alkalinity data can be correlated; and,
- Eh measurements should be continued quarterly until trends in the results become evident.

This memorandum reviews results from the 2001 monitoring of pore water quality.

2. SUMMARY OF DATA COLLECTED IN 2001

Sampling locations, procedures and analytical methods are presented and discussed in the 2000 memorandum and are not repeated herein. The 2001 analyses for samples from the backfill were as follows:

- January 2001: quarterly program, redox, alkalinity
- April 2001: quarterly program, dissolved carbon dioxide, redox, alkalinity
- July 2001: annual program, redox, alkalinity
- October 2001: annual program, redox, alkalinity

Note: See Table 2 of the October 12, 2000 Foth & Van Dyke memorandum for parameters in the quarterly and annual programs.

Parameters from previous programs that were omitted in the 2001 program included chlorine, sodium and potassium. The complete data sets for the monitoring wells located in the backfill (MW-1013B, MW-1013C; MW-1014A, MW-1014B, and MW-1014C) as well as the up-gradient Well MW-1005P, are provided in Attachment 1.

3. RESULTS AND DISCUSSION

3.1 Carbon Dioxide, Alkalinity, and Total Inorganic Carbon

As discussed in the 2000 memorandum, carbon dioxide and alkalinity can be related to total inorganic carbon. The April 2001 CO_2 measurements and alkalinity measurements are converted to units of total inorganic carbon, and presented together with the previous results in Table 1.

The average temperature of 13.2 °C for the 2001 data was higher than for previous years. Therefore, a simple linear interpolation was used to estimate log K values at 13 °C, which were then used in the 2001 calculations. It should be noted that the calculations reported for 2000 and 1999 were for log K values at 5 °C.

As was the case for the April 2000 data, the table shows that the April 2001 measurements of carbon dioxide and alkalinity lead to similar calculated values of total inorganic carbon. The results for April 2001 verify that the alkalinity and dissolved CO_2 measures are closely correlated. The consistency between the alkalinity and dissolved CO_2 measurements from April 2000 and April 2001 with the alkalinity measurements from October 1999 supports the earlier

conclusion that the October 1999 measurements of carbon dioxide were not reliable. Consequently, the October 1999 carbon dioxide measurements cannot be used to discern temporal trends.

Since it has been shown that the alkalinity data can be related to the dissolved CO_2, the alkalinity data can be used to assess temporal patterns in dissolved CO_2 concentrations. Figures 1 and 2 provide time series of the alkalinity measurements. As the figures indicate, the results vary slightly in both data sets, perhaps indicating a seasonal pattern, but there is no significant upwards or downwards trend.

3.2 Estimation of Carbon Dioxide Partial Pressure

The concentration of CO_2 in a gas in equilibrium with the April 2001 samples was calculated with the Henry's Law method discussed in the 2000 memorandum. The results are shown in Table 2. The resulting estimates of CO_2 gas concentration for the April 2001 samples are in general agreement with the April 2000 samples.

3.3 Major Ions

Since major cation (i.e., Ca, Mg) concentrations were not measured for April 2001 (as was for April 2000), the major ion results were reviewed for the most recent results, i.e. October 2001 through a series of calculations. Ion balance and total dissolved solids calculations were completed to check the internal consistency of each data set. In order to complete the ion balances, total alkalinity was entered as $CaCO_3$ eq. and the pH was fixed at the measured (laboratory) value. The calculations showed that:

- The October 2001 samples from MW-1013B and MW-1014C had ion balances within 5.0%, and measured and calculated TDS values agreed within 10%.
- The October 2001 samples from MW-1013C, MW-1014A and MW-1014C were slightly cation deficient, and had ion balances of 6.5%, 8.7% and 8.2%, which are within acceptable levels.
- The July 2001 sample from MW-1005P showed a 22% anion deficiency (no October 2001 major cation data were available for this well hence the July 2001 data were assessed).

As for the April 2000 samples, the October 2001 backfill samples classify as Ca-Mg-SO_4-CO_3 waters, which is consistent with neutralization of sulfate acidity by limestone. The July 2001 sample from MW-1005P up-gradient of the backfill classifies as a Ca-Mg-CO_3 water.

The geochemical equilibrium model PHREEQ-C was used to compare the solution compositions from the October 2001 samples to solubility limits for expected mineral phases. All runs were completed using the alkalinity data and the measured temperature and redox conditions. Complete results are included in Attachment 2.

Table 3 summarizes the results in terms of saturation indices of calcite and gypsum. A saturation index of greater than zero indicates supersaturation of a mineral phase, and an index less than zero indicates under-saturation. A saturation index near zero indicates that the mineral phase is probably present, and in equilibrium with the solution. The table indicates that most of the backfill samples are in equilibrium with gypsum, and close to saturation with calcite (or aragonite, a similar calcium carbonate phase).

The October 2001 major ion analyses therefore confirm the conclusions from the 2000 assessment which were:

- Sulfate present in the backfill has been converted to gypsum, and the acid that was present in the waste rock has been consumed by limestone dissolution and that the sulfate concentrations are now controlled by gypsum precipitation; and,
- Equilibrium conditions with calcite indicates that acid neutralization is complete.

3.4 Redox Potential, Iron and Manganese

The redox potential profiles as a function of time are illustrated in Figures 3 and 4 respectively for the MW-1013 and MW-1014 wells. The profiles at depth (Wells MW-1013C, MW-1014B and MW-1014C) show an overall decreasing trend, with the deeper wells (MW-1013C and MW-1014C) approaching redox conditions (21 mV and 56 mV respectively) observed in the reference well (MW-1005P – redox of 5 mV). The shallower wells (MW-1013B and MW-1014A) clearly have not yet stabilized. It is therefore recommended that the quarterly measurements of redox potential be continued.

Plots of dissolved iron and manganese concentrations are presented in Figures 5 and 6, respectively. Results indicate a significant decrease in dissolved iron present in Well MW-1014C, and a marginal increase for Well MW-1013C. No significant change in iron concentrations was observed for the remainder of the wells.

The increasingly negative values of the $Fe(OH)_3$ saturation index calculated by the PHREEQ model (see Table 3) indicate that conditions have shifted away from equilibrium with the amorphous iron hydroxide. The pattern suggests that iron hydroxides may be converting to more stable phases such as goethite or hematite. (However, it is not unusual to see some dis-equilibrium in model runs that use a measured redox potential as input since the Fe (II)/Fe(III) redox couple is often out of equilibrium with the measured redox potential.)

The concentration of dissolved iron in Well MW-1014C is decreasing with time. The saturation indices presented in Table 3 indicate that the pore water from this well has become slightly supersaturated with respect to siderite, suggesting siderite may in future become the solubility controlling phase. This is consistent with the decrease in Eh, which causes an increase in the iron present as the ferrous species needed to form siderite.

As shown in Figure 6, dissolved manganese increased in Well MW-1013B, and showed a decrease in well MW-1014B. The concentrations in these two wells are significantly greater than those in the remaining wells. Concentrations in the remaining wells are either steady or decreasing marginally with time, with the exception of well MW1013C, which, overall, has a marginal increasing trend with time.

Saturation indices for rhodochrosite ($MnCO_3$) presented in Table 3 for the October 2001 results indicate a general decrease in the degree of supersaturation, i.e. conditions are closer to equilibrium than they were in April 2000. Of note is that the saturation index for Well MW-1014C has become slightly negative, suggesting equilibrium conditions have been reached. The Mn concentration has decreased from about 4.3 mg/L in February 1999 to about 2.9 mg/L. It should however be noted that the solubility of Mn is influenced by dissolved CO_2, Eh and pH, which may explain why concentrations in well MW-1013B are seen to fluctuate. The water level has reached this well most recently, and conditions likely have not yet fully stabilized.

4. SUMMARY

In summary, the results confirm the findings presented in the year 2000 monitoring results assessment. The current results can be summarized as follows:

- The results for April 2001 verify that the alkalinity and dissolved CO_2 measures are closely correlated;

- Sulfate present in the backfill has been converted to gypsum and the sulfate concentrations are now controlled by gypsum precipitation;
- Equilibrium conditions with calcite indicate that acid neutralization is complete;
- Consistent results in samples collected from 1998 through 2001 demonstrate that the concentrations of major ions in the backfill pore water are stable;
- Redox potentials have decreased significantly in some of the wells, but are steady or increasing slightly in others;
- Modeling results suggest that iron oxyhydroxides are converting to more stable phases such as goethite or hematite, and therefore that soluble iron concentrations are unlikely to increase in future; and
- Manganese concentrations are variable and elevated in one well (MW-1013B), increasing marginally in another (MW-1013C), but are nearly constant or slightly decreasing in the remaining wells. Further monitoring is required to determine if solubility controls will limit further changes.

5. RECOMMENDATIONS

Based on the above assessment and conclusions, SRK recommend that:

- With the exception of the two items listed below, monitoring of groundwater within and around the backfilled pit should continue to be performed in accordance with the program contained in the project's approved monitoring plan (Foth & Van Dyke, 1991). An annual review of the data should be included in the project's annual report to determine if conditions affecting the conclusions reached in this memorandum remain consistent. As additional data are collected and the continuation of stable conditions is documented, consideration can be given to reducing the frequency of monitoring within the backfilled pit;
- CO_2 sampling be discontinued since alkalinity data can be used to assess changes in CO_2 concentrations in the backfill pore water; and,
- Eh measurements should continue to be taken each quarterly sampling event until stable conditions are observed.

Table 1
Comparison of Carbon Dioxide and Alkalinity Measurements

Well	Sample Date	Temperature ^0C	Measured H_2CO_3* (mmol/L)	Measured Alkalinity (meq/L)	Total Inorganic Carbon (mmol/L)	
					Calculated from CO_2	Calculated from Alkalinity
MW-1013B	Apr-01	14.0	9.3	10.6	20	20
MW-1013C	Apr-01	13.8	5.9	8.8	13	17
MW-1014A	Apr-01	12.1	4.1	8.6	11	13
MW-1014B	Apr-01	13.5	10.7	10.4	18	25
MW-1014C	Apr-01	12.8	5.0	6.6	11	12
MW-1005P	Apr-01	12.2	0.5	4.8	4.0	5.5
MW-1013B	Apr-00	8.7	10.7	10.4	24	18
MW-1013C	Apr-00	8.7	6.1	9.2	16	15
MW-1014A	Apr-00	11.2	3.4	7.8	13	11
MW-1014B	Apr-00	14.2	12.6	9.6	24	20
MW-1014C	Apr-00	11.9	5.8	6.4	16	10
MW-1005P	Apr-00	6.4	0.7	5.0	5.4	5.8
MW-1013B	Oct-99	14.2	4.1	10.8	10	18
MW-1013C	Oct-99	9.6	3.2	8.0	10	12
MW-1014B	Oct-99	12.1	6.8	11.4	13	24
MW-1014C	Oct-99	9.9	3.6	7.6	8.6	13
MW-1005P	Oct-99	9.8	0.6	4.8	4.6	5.5

Note: Data for monitoring wells MW-1013, MW-1013A, MW-1014, and MW-1014A are not available in October 1999 since the wells were dry at the time of sample collection. Similarly, monitoring data for monitoring wells MW-1013, MW-1013A, and MW-1014 are not available for the April 2000 and April 2001 sampling events.

Note: $H_2CO_3^* = CO_2(aq) + H_2CO_3$

Table 2

Estimates of Carbon Dioxide Gas in Equilibrium with April 2000 and April 2001 Samples

Well	Sample Date	H_2CO_3* (mmol/L)	K_H[1] (mol atm^{-1})	pCO_2 (atm)	Head on Sample (feet)	P^2 (atm)	Mole Fraction CO_2 in gas
MW-1013B	Apr-01	9.30	-16.9	0.144	55	2.62	5.5%
MW-1013C	Apr-01	5.90	-16.9	0.092	170	6.01	1.5%
MW-1014A	Apr-01	4.10	-16.9	0.063	28.9	1.85	3.4%
MW-1014B	Apr-01	10.70	-16.9	0.165	70	3.06	5.4%
MW-1014C	Apr-01	5.00	-16.9	0.077	123	4.63	1.7%
MW-1005P	Apr-01	0.50	-16.9	0.008	80	3.36	0.3%
MW-1013B	Apr-00	7.7	17.8	0.138	55	2.62	5.2%
MW-1013C	Apr-00	5.6	17.8	0.100	171	6.04	1.7%
MW-1014A	Apr-00	2.9	19.2	0.055	28	1.83	3.0%
MW-1014B	Apr-00	10.3	20.5	0.211	68	3.01	7.0%
MW-1014C	Apr-00	3.6	19.7	0.071	116	4.42	1.6%
MW-1005P	Apr-00	0.8	16.2	0.013	83	3.45	0.4%

1 Corrected for sample temperature.

2 Absolute pressure at sample depth.

Table 3

Summary of PHREEQ-C Runs to Check Saturation of Calcite and Gypsum

Date	Sample Data Set	Conditions			Saturation Index				
		T (°C)	pH	PE	Calcite/ Aragonite	Gypsum	$Fe(OH)_3$ (am)	Siderite	Rhodocrosite
Oct 2001	MW-1013B	14.4	6.1	3.4	-0.30 / -0.45	-0.04	-1.99	-1.10	0.90
Oct 2001	MW-1013C	12.6	6.2	0.4	-0.33 / -0.48	-0.05	-4.11	-0.47	0.32
Oct 2001	MW-1014A	14.3	6.3	2.6	-0.38 / -0.53	-0.36	-1.76	-0.56	0.33
Oct 2001	MW-1014B	13.4	6.1	3.7	-0.40 / -0.55	-0.08	-2.35	-1.78	0.59
Oct 2001	MW-1014C	12.2	6.2	0.9	-0.68 / -0.83	-0.75	-2.91	0.13	-0.10
Jul 2001	MW-1005P[5]	9.9	6.6	0.1	-0.86 / -1.01	-2.98	-3.52	-0.59	-1.28
April 2000	MW-1013B[1]	8.7	6.63	4.11	0.24 / 0.08	-0.03	-0.23	-1.01	1.36
April 2000	MW-1013C[2]	8.5	6.73	3.17	0.15 / 0.00	-0.01	-0.08	-0.25	0.73
April 2000	MW-1014A	11.2	6.87	2.93	0.13 / -0.02	-0.36	-0.23	-0.49	0.91
April 2000	MW-1014B[3]	14.2	6.43	5.09	-0.02 / -0.17	-0.07	-0.34	-1.16	0.99
April 2000	MW-1014C	11.9	6.65	1.56	-0.02 / 0.17	-0.64	-0.82	0.76	0.49
April 2000[4]	MW-1005P[4]	15.9	6.91	1.08	-0.37 / -0.52	-2.83	-2.66	-1.24	-1.00

Notes:

1. April 2000 data with sulfate adjusted upwards to 1500 mg/L to improve ion balance.
2. April 2000 data with calcium adjusted upwards to 290 mg/L to improve ion balance.
3. In the April 2000 data, the iron detection limit was anomalously high (0.15 mg/L). In the PHREEQ runs, the iron concentration was set to 0.06 mg/L, as measured in other samples from this well.
4. Combination of analytical data from the July 1999 sample with Eh and alkalinity data from the April 2000 sample.
5. July 2001 data.

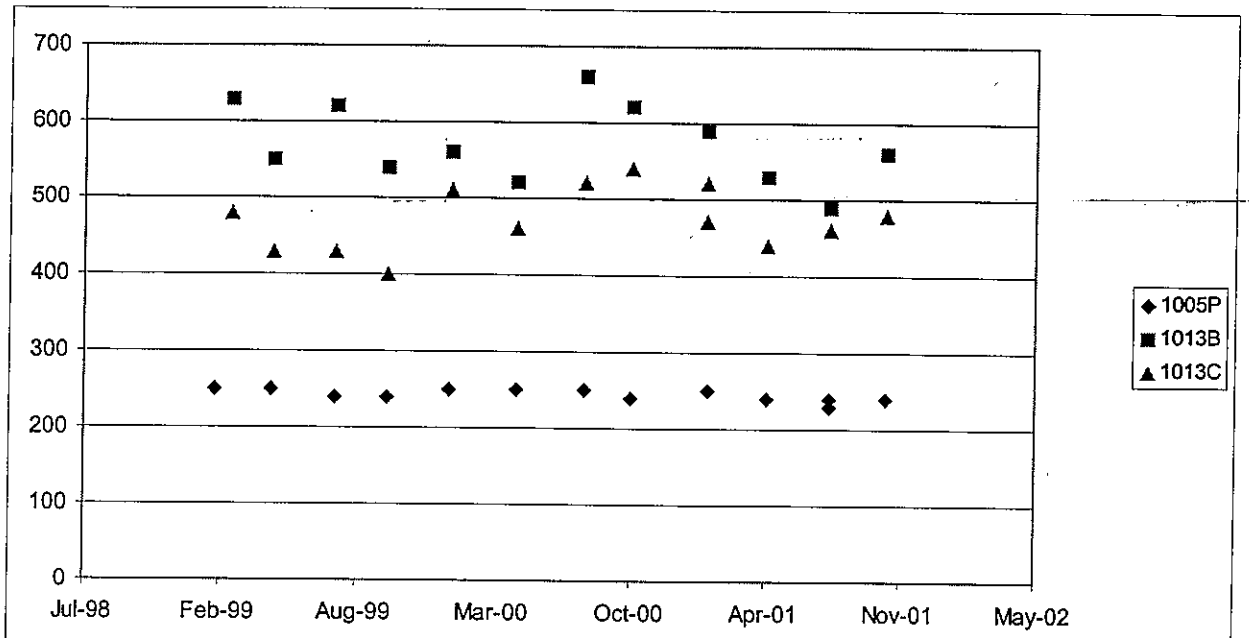

Figure 1. Dissolved Alkalinity in Wells 1013B and -C

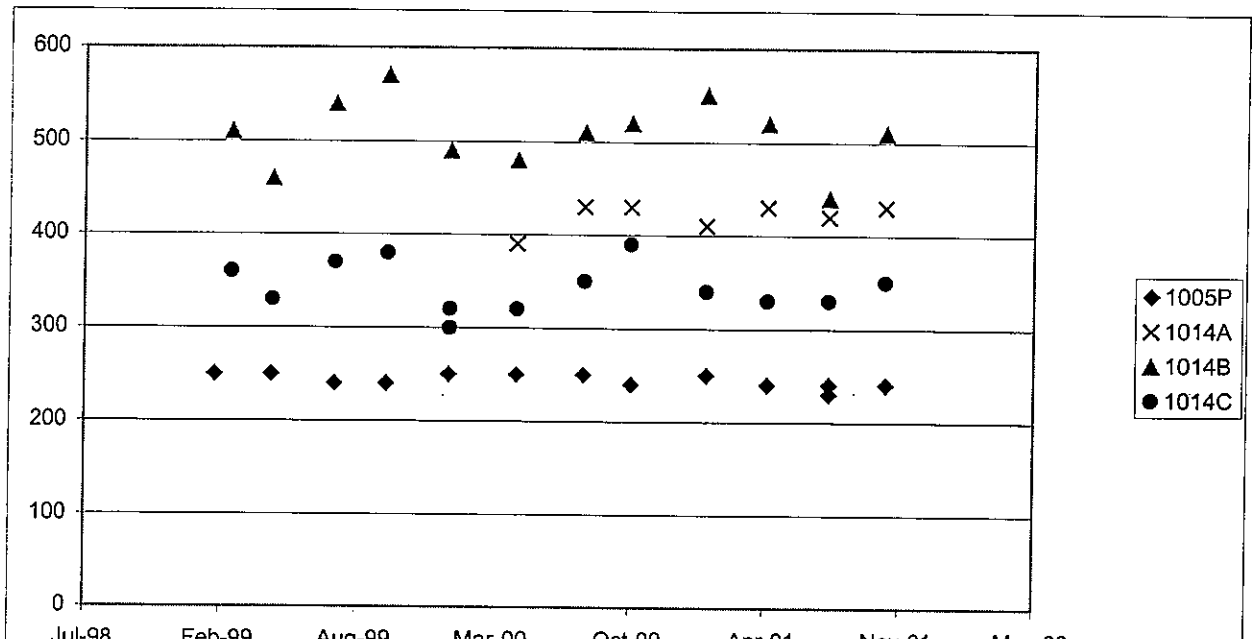

Figure 2. Dissolved Alkalinity in Wells 1014A, -B and -C

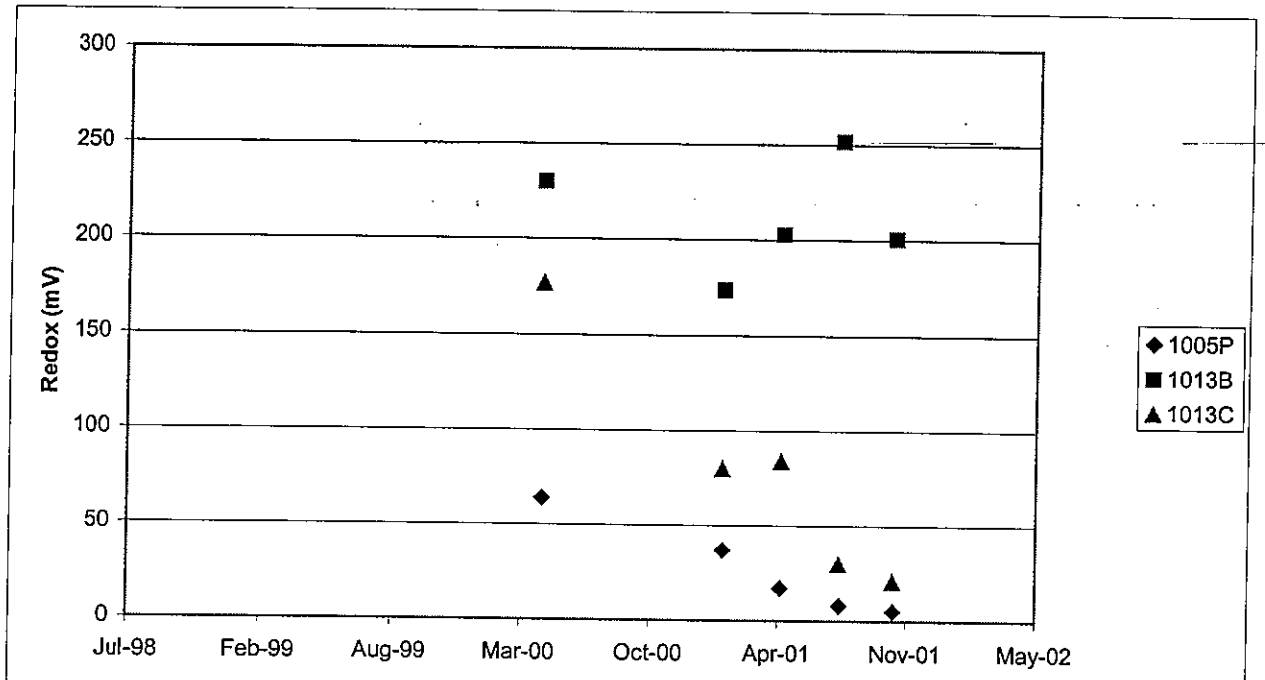

Figure 3 Redox Potential Profiles in Wells MW-1013B and -C

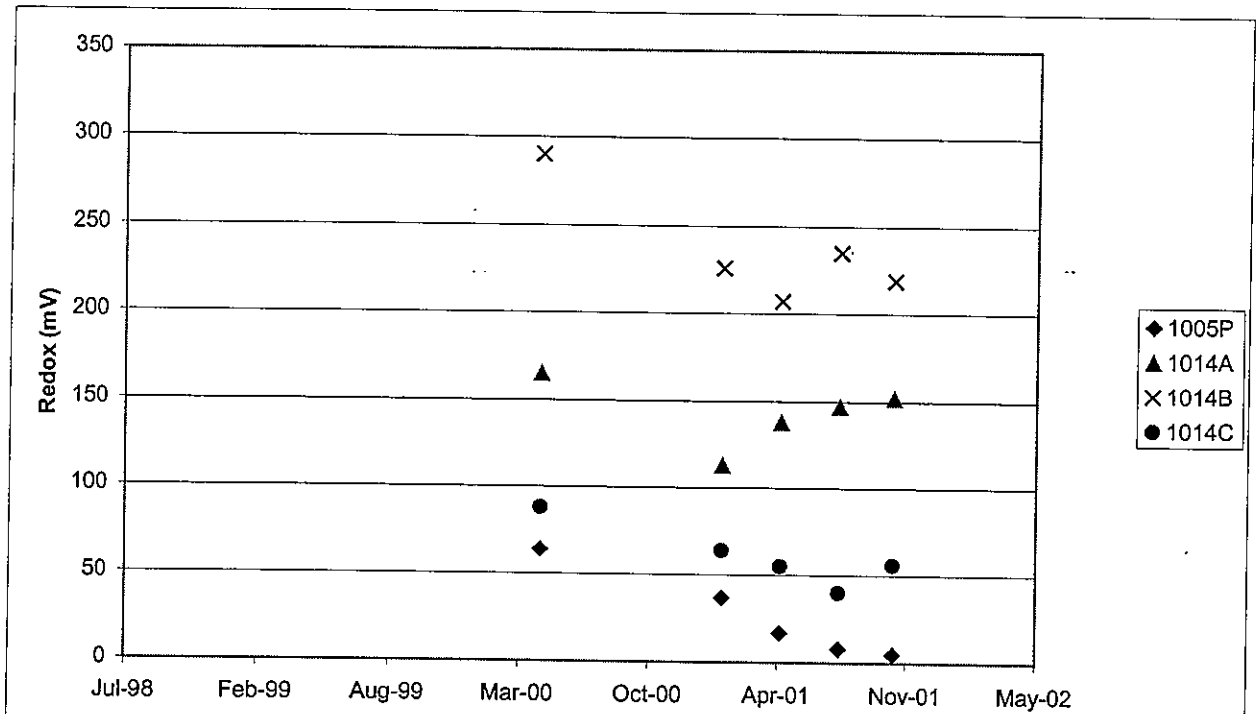

Figure 4 Redox Potential Profiles in Wells MW-1014A, -B and -C

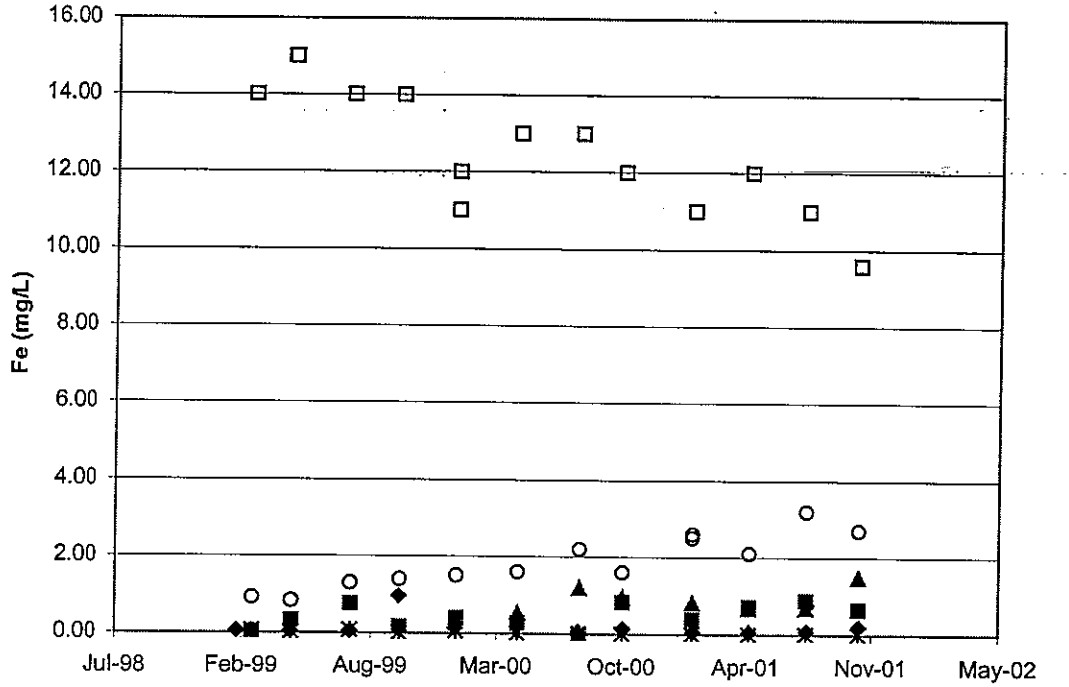

Figure 5 Dissolved Iron Concentrations

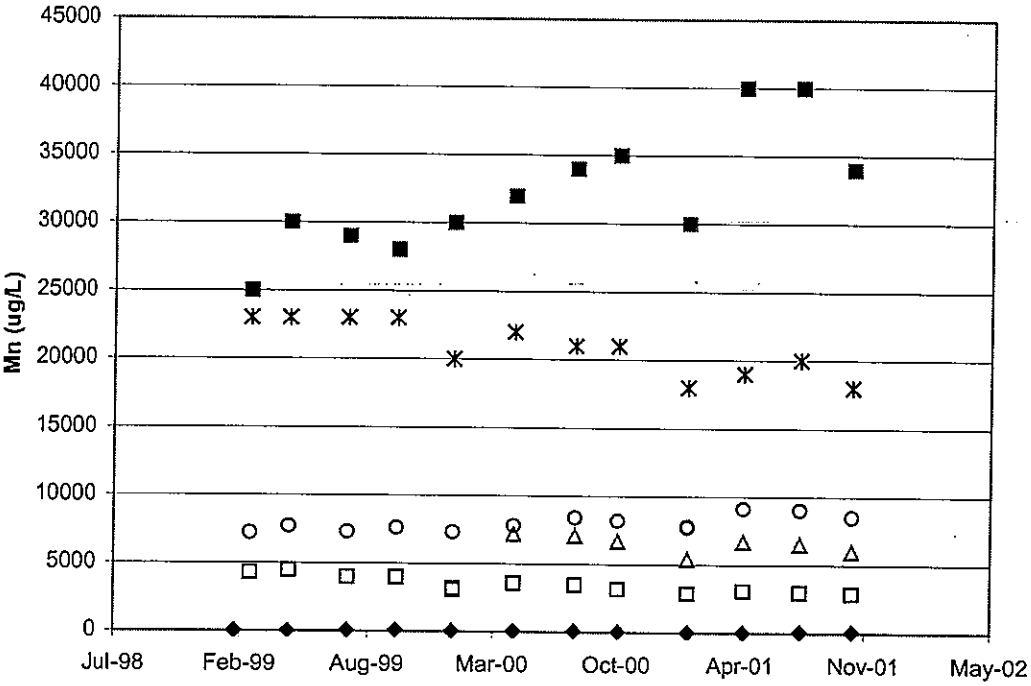

Figure 6 Dissolved Manganese Concentrations

Attachment 1
Monitoring Results Database

MW1005P

Well MW-1005P Well Depth: 93.46'

	Alk (mg/l)	As (ug/l)	Ba (ug/l)	Cd (ug/l)	Ca (mg/l)	Cl (mg/l)	Cr (ug/l)	Cu (ug/l)	Hard (mg/l)	Fe (mg/l)	Pb (ug/l)	Mg (mg/l)	Mn (ug/l)	CO2 (ug/l)	Hg (ug/l)	Field pH (s.u.)
Jul-91	260							<14	230	1.2			220			
Oct-91	260							<14	230	1.0			150			
Jan-92	260							<14	240	0.75			160			
Apr-92	260							<14	240	1.0			130			
Jul-92	270							<14	260	0.95			150			
Oct-92	270							<14	260	12			100			
Jan-93	260							<14	240	1.1			110			
Apr-93	250							<10	250	0.46			150			
Jul-93	250							<12	230	0.61			140			
Oct-93	250							<12	220	0.17			69			7.5
Jan-94	250							<12	230	0.19			35			7.3
Apr-94	240							<12	230	0.20			160			7.2
Jul-94	250							<12	230	0.22			100			6.9
Oct-94	270							<1.6	250	0.24			62			7.2
Jan-95	270							4.4	230	0.04			41			7.1
Apr-95	280							3.7	200	0.08			41			7.5
Jul-95	260							1.8	200	0.07			90			7.2
Oct-95	240							2.1	230	0.17			72			7.2
Jan-96	250							<0.68	210	0.28			97			7.3
Apr-96	240							<0.68	210	0.049			35			6.9
Jul-96	260							3.9	210	0.064			140			6.9
Oct-96	260							8.2	200	0.37			67			7.2
Jan-97	250							2.7	210	0.073			24			7.0
Apr-97	240							1.6	220	0.41			77			7.0
Jul-97	240							2.0	230	0.087			66			7.0
Oct-97	250							<0.54	230	0.17			62			6.9
Jan-98	240							0.7	220	0.41			72			7.1
Apr-98	260							1.1	210	0.077			29			7.4
Jul-98	230							<0.54	220	0.34			100			7.0
Oct-98	250							1.9	220	0.17			63			7.0
Feb-99	250							<0.54	220	0.066			27			7.6
Apr-99	240	<4.2	64	<2.1	52	3.5	<0.42	1.1	210	0.049			23			7.0
Jul-99	240							<4.7	220	0.054	<1.4	21	51		<0.050	6.9
Oct-99	250							<0.47	220	0.97			88	26000		7.3
Jan-00	250							<0.47	200	0.14			47			6.7
Apr-00	250	<1.7	70	0.28			<0.74	<0.60	220	0.37			80	32000		7.3
Jul-00	240							<0.53	230	0.058	<1.4		75		<0.050	6.5
Oct-00	250							0.74	220	0.13			38			7.3
Jan-01	240							<0.53	210	0.058			24			7.2
Apr-01	230	<2.3	69	0.40	56		0.58	<2.7	220	0.055			27	24000		6.7
Jul-01	240	<2.3	68	<0.23	56		<0.57	<2.7	230	0.087	<0.92	22	49		<0.050	7.1
Jul-01 D	240							<2.7	230	0.77	<0.92	22	80		<0.050	
Oct-01								<2.7	200	0.20			68			6.6

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MW1005P

	Lab pH (s.u.)	K	Se (ug/l)	Ag (ug/l)	Na (mg/l)	TDS (mg/l)	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (°C)	Grd Water El (Feet)
Jul-91	7.2					290	<10									
Oct-91	7.1					440	<10									
Jan-92	6.8					280	<10									
Apr-92	7.0					350	<10									
Jul-92	6.9					270	<10									
Oct-92	7.6					320	<10									
Jan-93	7.4					220	<10									
Apr-93	6.9					240	2									
Jul-93	6.6					260	3									
Oct-93	7.3					300	<2			462						1139.85
Jan-94	7.4					260	<2			487						1138.88
Apr-94	7.1					270	<2			487						1139.44
Jul-94	7.0					270	<2			456						1138.96
Oct-94	7.2					280	2.5		None	452			V. Sl.	V. Sl.		1137.79
Jan-95	7.4					340	<0.56		None	511			None	None		1137.14
Apr-95	7.3					300	<0.56		None	420			None	None		1137.45
Jul-95	7.0					290	<0.56		None	454			Slight	None		1137.47
Oct-95	7.1					260	5.3		None	470			None	None		1137.79
Jan-96	6.9					270	0.93		None	464			None	None		1137.39
Apr-96	7.2					300	2.2		None	486			None	None		1139.37
Jul-96	7.1					300	2.6		None	441			None	None		1139.57
Oct-96	7.1					280	3.6		None	471			None	None		1137.46
Jan-97	7.4					280	5.4		None	462			None	None		1137.41
Apr-97	6.7					320	5.8		None	480			None	None		1138.85
Jul-97	6.8					280	6.7		None	448			None	None		1137.66
Oct-97	7.1					260	<5.0		None	505			None	None		1137.77
Jan-98	7.1					270	11		None	456			None	None		1136.00
Apr-98	7.4					280	9.6		None	461			None	None		1137.92
Jul-98	7.3					270	12		None	458			None	None		1137.63
Oct-98	6.6					250	9.4		None	477			None	None		1136.19
Feb-99	7.3					250	7.8		None	449			None	None		1135.35
Apr-99	7.7					230	7.8		None	464			None	None	6.7	1136.65
Jul-99	7.0	8.1	<1.3	<0.45	9.0	250	7.3	<12	None	501			None	None	11.0	1138.09
Oct-99	7.4					260	<1.5		None	460			None	None	15.9	1137.64
Jan-00	7.1					280	<5.0		None	480			Slight	None	9.8	1136.65
Apr-00	7.0					220	<5.0		None	483		64	Moderate	None	----	1137.05
Jul-00	7.1		<1.6	<0.55		290	<5.0	<12	None	460	470		None	None	6.4	1138.08
Oct-00	7.4					260	<5.0	<12	None	448	450		None	Slight	12.5	1137.56
Jan-01	6.9					260	<5.0	<12	None	454	450	37	None	None	10.5	1136.65
Apr-01	7.3					290	<5	<12	None	430	450	17	None	None	8.4	1138.80
Jul-01	7.2		<1.6	<0.56		250	<5.0	<12	None	428	460	8	None	None	12.8	1140.03
Jul-01 D	7.2		<1.6	<0.56		210	<5.0	<12			470				12.2	
Oct-01	7.1					270	<5.0	<12	None	424	470	5	None	None	9.9	1138.59

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MW-1013B

	Well MW-1013B Well Depth: 86.3'															
	Alk	As	Ba	Cd	Ca	Cl	Cr	Cu	Hard	Fe	Pb	Mg	Mn	CO2	Hg	Field pH
	(mg/l)	(ug/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(mg/l)	(ug/l)	[ug/l]	(ug/l)	(s.u.)
Feb-99	630							36	2300	0.045			25000			6.2
Apr-99	550							16	2300	0.33			30000			6.2
Jul-99	620	<42	<50	<21	630	35	16	33	2200	0.76	<14	150	29000		<0.050	6.4
Oct-99	540	<42	<50	<4.2	650	35	14	<9.4	2200	0.17	<14	150	28000	180000	<0.050	6.6
Jan-00	560	17	<50	<2.1	600	28	18	<4.7	2100	0.41	<14	150	30000		<0.050	6.4
Apr-00	520	12	<50	<3.1	630	35	<6.2	19	2200	0.27	<24	150	32000	470000	<0.050	6.6
Jul-00	660	<21	<50	<2.3	670	<40	5.1	14	2300	<0.36	<9.6	160	34000		<0.050	6.3
Oct-00	620							<12	2200	0.84			35000			6.3
Jan-01	590							<12	1900	0.41			30000			6.1
Apr-01	530							35	2300	0.72			40000	410000		6.0
Jul-01	490	<15	<50	3.3	700		6.4	33	2400	0.89	<7.9	160	40000		<0.050	6.1
Oct-01	560	18	<50	<1.7	600		4.8	69	2000	0.66	<7.9	130	34000		<0.050	6.1

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MW-1013B

	Lab pH (s.u.)	K	Se (ug/l)	Ag (ug/l)	Na (ug/l)	TDS (mg/l)	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (°C)	Grd Water El (Feet)
Feb-99	6.5					3100	1400		None	3540			None	None		1093.95
Apr-99	6.4					3700	770		Slight	3130			None	Moderate	16.0	1094.58
Jul-99	6.5	8.2	1.7	<4.5	35	3800	1600	<120	None	3020			Slight	Slight	18.3	1095.20
Oct-99	6.8	6.9	<1.3	<4.5	26	3700	1900	<120	None	3200			Slight	Slight	14.2	1095.49
Jan-00	6.4	6.4	<1.3	<4.5	33	3300	1700	<120	None	3000			None	Slight	12.6	1095.59
Apr-00	6.3	8.5	<7.8	<4.7	27	3600	1200	<120	None	3120		230	None	Slight	8.7	1095.54
Jul-00	6.3	7.2	<17	<5.5	34	3200	1600	<120	None	3000	2800		None	Slight	16.0	1096.09
Oct-00	6.9					3200	1500	<120	None	3180	1800		None	Slight	13.9	1096.45
Jan-01	6.3					3300	1600	<120	None	3230	2700	174	None	V.Slight	11.2	1095.86
Apr-01	6.5					3300	1600	<120	None	3400	2600	203	None	V.Slight	14.0	1097.57
Jul-01	6.3		<10	6.5		3500	1600	130	None	3290	2700	252	None	V.Slight	15.7	1097.63
Oct-01	6.3		<16	6.0		3200	1600	130	None	3320	3000	201	None	V.Slight	14.4	1097.19

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MW-1013C

		Well MW-1013C Well Depth: 201.5'															
		Alk	As	Ba	Cd	Ca	Cl	Cr	Cu	Hard	Fe	Pb	Mg	Mn	CO2	Hg	Field pH
		(mg/l)	(ug/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(mg/l)	(ug/l)	[ug/l]	(ug/l)	(s.u.)
Feb-99		480							100	2100	0.92			7200			6.3
Apr-99		430							75	2200	0.84			7700			6.4
Jul-99		430	83	<50	<21	570	50	<4.2	50	2100	1.3	<14	160	7300		<0.050	6.4
Oct-99		400	<42	<50	<4.2	610	50	7.2	<9.4	2200	1.4	<14	170	7600	140000	<0.050	6.8
Jan-00		510	<15	<50	2.1	560	58	<4.2	<4.7	2100	1.5	<14	170	7300		<0.050	6.5
Apr-00		460	14	<50	<3.1	590	50	<6.2	11	2200	1.6	<24	170	7800	270000	<0.050	6.7
Jul-00		520	<21	<50	<2.3	620	56	<4.0	<12	2300	2.2	<9.6	180	8400		<0.050	6.3
Oct-00		540							<12	2200	1.6			8200			6.4
Jan-01		520							<12	2100	2.6			7800			6.3
Jan-01	D	470							<12	2000	2.5			7700			
Apr-01		440							<13	2300	2.1			9100	260000		6.3
Jul-01		460	<15	<50	<1.7	630		<3.4	<13	2300	3.2	<7.9	180	9000		<0.050	6.3
Oct-01		480	22	<50	<1.7	550		<3.4	<13	2000	2.7	<7.9	160	8500		<0.050	6.2

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MW-1013C

		Lab pH	K	Se	Ag	Na	TDS	Sulf	Zn	Color	Field Cond	Lab Cond	Redox	Odor	Turbidity	Temp	Grd Water
		(s.u.)	(ug/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(mg/l)	(ug/l)	(After Filter)	(umho)	(umho)	(mV)		(Purging)	(°C)	El (Feet)
Feb-99		6.6					3000	1300		None	3170			None	None		1095.27
Apr-99		6.6					3300	920		None	3030			None	None	13.5	1095.73
Jul-99		6.7	23	3.0	<4.5	35	2700	870	660	Slight	3020			None	VSlight	------	1096.67
Oct-99		6.7	26	<1.3	<4.5	29	3000	2000	660	None	3300			None	Moderate	9.6	1096.97
Jan-00		6.4	23	<1.3	5.2	39	2900	1700	630	None	2700			Vslight	Slight	10.4	1097.10
Apr-00		6.4	25	<7.8	<4.7	34	2900	1700	610	None	3370		177	None	Moderate	8.5	1097.39
Jul-00		6.4	24	<17	<5.5	45	3300	1600	620	None	3100	2800		None	VSlight	13.8	1097.84
Oct-00		6.9					3200	1600	370	None	3310	2500		None	VSlight	11.9	1097.86
Jan-01		6.4					3200	1600	480	None	3310	2800	80	None	VSlight	11.4	1098.03
Jan-01	D	6.4					3000	1600	470			2800					
Apr-01		6.5					3000	1600	330	None	3000	2700	84	None	Vslight	13.8	1100.12
Jul-01		6.6		<10	<3.1		3500	1600	570	None	3400	2800	30	None	VSlight	15.0	1099.39
Oct-01		6.5		<16	6.8		3200	1700	510	None	3380	3100	21	None	VSlight	12.6	1099.04

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MW-1014A

Well MW-1014A Well Depth: 63.9'

	Alk (mg/l)	As (ug/l)	Ba (ug/l)	Cd (ug/l)	Ca (mg/l)	Cl (mg/l)	Cr (ug/l)	Cu (ug/l)	Hard (mg/l)	Fe (mg/l)	Pb (ug/l)	Mg (mg/l)	Mn (ug/l)	CO2 [ug/l]	Hg (ug/l)	Field pH (s.u.)	Lab pH (s.u.)	K (ug/l)	Se (ug/l)
Apr-99																			
Jul-99																			
Oct-99	Previous to April 2000, well not recovered sufficiently to collect groundwater sample.																		
Jan-00																			
Apr-00	390	15	59	<3.1	330	<50	<6.2	<6.0	1300	0.55	<24	120	7200	150000	<0.050	6.9	6.6	12	<7.8
Jul-00	430	<21	58	<2.3	360	<25	12	<12	1400	1.2	<9.6	130	7100		<0.050	6.6	6.6	12	<17
Oct-00	430							<12	1400	0.96			6700			6.7	6.9		
Jan-01	410							<12	1200	0.83			5400			6.5	6.6		
Apr-01	430							<13	1400	0.69			6700	180000		6.3	6.7		
Jul-01	420	<15	<50	<1.7	370		5.3	<13	1500	0.70	<7.9	130	6500		<0.050	6.2	6.6		<10
Oct-01	430	37	<50	<1.7	330		<3.4	<13	1300	1.5	<7.9	110	6000		<0.050	6.3	6.7		<16

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MW-1014A

	Ag (ug/l)	Na (mg/l)	TDS (mg/l)	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (°C)	Grd Water El (Feet)
Apr-99													1103.93
Jul-99													1106.42
Oct-99													1107.87
Jan-00													1109.22
Apr-00	<4.7	34	1800	970	<120	None	2220		165	None	None	11.2	1109.24
Jul-00	<5.5	35	2200	960	<120	None	2000	2000		None	None	15.4	1110.50
Oct-00			2300	880	<120	None	2250	1800		None	Vslight	14.1	1111.39
Jan-01			1900	970	<120	None	2310	1900	113	Slight	VSlight	NA	1111.59
Apr-01			1700	920	<120	None	2300	1900	138	None	Slight	12.1	1112.51
Jul-01	<3.1		2000	960	<120	None	2250	2000	147	None	Slight	17.4	1112.88
Oct-01	<3.1		1900	1000	<120	None	2280	2200	152	Vslight	Slight	14.3	1114.03

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MW-1014B

Well MW-1014B Well Depth: 104.9'																		
	Alk	As	Ba	Cd	Ca	Cl	Cr	Cu	Hard	Fe	Pb	Mg	Mn	CO2	Hg	Field pH	Lab pH	K	Se
	(mg/l)	(ug/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(ug/l)	(mg/l)	(mg/l)	(ug/l)	(mg/l)	(ug/l)	[ug/l]	(ug/l)	(s.u.)	(s.u.)	(ug/l)	(ug/l)
Feb-99	510							810	2100	0.062			23000			6.2	6.3		
Apr-99	460							420	2100	0.033			23000			6.2	6.4		
Jul-99	540	70	<50	31	580	49	13	520	2100	0.072	<14	170	23000		<0.050	6.3	6.4	25	2.2
Oct-99	570	<42	<50	10	640	43	7.4	530	2200	<0.010	<14	160	23000	300000	<0.050	6.4	6.5	17	1.4
Jan-00	490	<15	<50	10	550	<100	<4.2	500	1900	0.055	<14	140	20000		<0.050	6.5	6.2	18	2.6
Apr-00	480	<7.5	<50	10	600	42	<6.2	520	2100	<0.15	<24	150	22000	560000	<0.050	6.4	6.2	23	<7.8
Jul-00	510	<21	<50	8.9	600	38	<4.0	330	2200	<0.36	<9.6	160	21000		<0.050	6.3	6.4	22	<17
Oct-00	520							430	2200	<0.36			21000			6.3	6.6		
Jan-01	550							450	1900	<0.36			18000			6.3	6.3		
Apr-01	520							530	2000	<0.15			19000	470000		6.1	6.3		
Jul-01	440	<15	<50	6.2	600		8.9	480	2200	<0.15	<7.9	160	20000		<0.050	6.0	6.3		<10
Oct-01	510	20	<50	4.3	530		<3.4	490	1900	<0.15	<7.9	140	18000		<0.050	6.1	6.4		<16

MW-1014B

	Ag (ug/l)	Na (mg/l)	TDS (mg/l)	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (°C)	Grd Water El (Feet)
Feb-99			2900	1200		None	3280			None	Slight		1105.62
Apr-99			3300	770		None	2890			None	None	14.2	1106.23
Jul-99	<45	93	3100	580	2500	None	3540			None	Moderate	17.4	1107.13
Oct-99	<4.5	24	3100	1600	5000	None	3200			None	Moderate	12.1	1108.33
Jan-00	<4.5	27	3200	1400	4100	None	3000			None	Slight	12.1	1108.88
Apr-00	<4.7	26	3200	1600	3700	None	2940		290	None	Slight	14.2	1108.86
Jul-00	<6.5	42	3000	1600	2500	None	3000	2700		None	Slight	15.1	1109.47
Oct-00			2900	1500	2100	None	3240	2400		None	Moderate	13.1	1110.09
Jan-01			2600	1400	2800	None	3140	2600	226	None	Slight	10.5	1109.89
Apr-01			3300	1400	3500	None	3200	2500	207	None	Moderate	13.5	1111.14
Jul-01	<3.1		3000	1500	1900	None	2990	2700	235	None	Moderate	16.5	1112.02
Oct-01	7.2		2900	1600	1600	None	3150	2900	219	None	Moderate	13.4	1112.38

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MW-1014C

D = Field Duplicate Sample

Well MW-1014C Well Depth: 156.6'

		Alk (mg/l)	As (ug/l)	Ba (ug/l)	Cd (ug/l)	Ca (mg/l)	Cl (mg/l)	Cr (ug/l)	Cu (ug/l)	Hard (mg/l)	Fe (mg/l)	Pb (ug/l)	Mg (mg/l)	Mn (ug/l)	CO2 (ug/l)	Hg (ug/l)	Field pH (s.u.)	Lab pH (s.u.)
Feb-99		360							<4.7	980	14			4300			6.3	6.5
Apr-99		330							<4.7	1000	15			4500			6.3	6.5
Jul-99		370	<42	<50	<21	280	32	<4.2	16	930	14	<14	56	4000		<0.050	6.4	6.5
Oct-99		380	<42	<50	<4.2	290	33	<4.2	<9.4	960	14	<14	56	4000	160000	<0.050	6.6	6.7
Jan-00		320	<15	25	<0.21	250	31	<0.42	<0.47	810	12	<1.4	48	3200		<0.050	6.6	6.5
Jan-00	D	300	<15	25	<0.21	230	30	2.0	<0.47	820	11	2.0	46	3100		<0.050	----	6.4
Apr-00		320	14	<50	<3.1	260	33	<6.2	<6.0	870	13	<24	51	3600	260000	<0.050	6.7	6.3
Jul-00		350	39	<50	<2.3	270	36	4.2	<12	890	13	<9.6	54	3500		<0.050	6.4	6.5
Oct-00		390							<12	840	12			3200			6.4	6.7
Jan-01		340							<12	760	11			2900			6.5	6.4
Apr-01		330							<13	830	12			3100	220000		6.2	6.5
Apr-01	D														220000			
Jul-01		330	21	<50	<1.7	240		4.7	<13	810	11	<7.9	49	3000		<0.050	6.2	6.5
Oct-01		350	15	<50	<1.7	210		<3.4	<13	710	9.6	<7.9	44	2900		<0.050	6.2	6.6

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MW-1014C

	K	Se (ug/l)	Ag (ug/l)	Na (mg/l)	TDS (mg/l)	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (°C)	Grd Water El (Feet)
Feb-99					1200	520		None	1900			None	None		1103.39
Apr-99					1200	440		None	1623			None	None	13.5	1102.83
Jul-99	4.8	1.8	<45	11	1200	370	2200	None	1657			None	None	13.2	1103.90
Oct-99	4.0	<1.3	<4.5	9.6	1200	700	2100	None	1600			None	None	9.9	1104.81
Jan-00	6.3	1.9	<0.45	12	1200	540	1700	None	1500			None	None	10.5	1105.18
Jan-00	6.3	1.6	<0.45	11	1300	560	1600	----	----			----	----	----	----
Apr-00	7.6	<7.8	<4.7	9.4	1000	440	1800	None	1470		88	None	None	11.9	1106.25
Jul-00	7.4	<17	<5.6	12	1400	480	1700	None	1400	1400		None	None	13.7	1105.82
Oct-00					1300	450	1500	None	1490	1200		None	None	11.5	1106.21
Jan-01					1100	460	1200	None	1452	1300	64	None	None	10.9	1106.15
Apr-01					1100	420	1300	None	1400	1300	65	None	None	12.8	1107.65
Apr-01															
Jul-01		<10	<3.1		1100	420	1200	None	1360	1300	40	None	None	13.7	1108.11
Oct-01		<1.6	4.6		990	410	1100	None	1354	1300	56	None	None	12.2	1108.10

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Attachment 2
PHREEQC – In and Output Files

```
   Input file: C:\Projects\Flambeau\2001\End of Year
Report\AlkalinityandpHandPE.pqi
  Output file: C:\Projects\Flambeau\2001\End of Year
Report\AlkalinityandpHandPE.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive 2.4.2
Alpha\phreeqc.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      PHASES
      EXCHANGE_MASTER_SPECIES
      EXCHANGE_SPECIES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      RATES
      END
-----------------------------------
Reading input data for simulation 1.
-----------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive 2.4.2
Alpha\phreeqc.dat
      SOLUTION 1 1013B - Oct 2001
          temp      14.4
          pH        6.1
          pe        3.4
          redox     pe
          units     mg/l
          density   1
          Alkalinity 560
          Ca        600
          Cu        0.069
          Fe        0.66
          S(6)      1600
          Zn        0.13
          Mn        34
          Mg        130
          water    1 # kg
     SOLUTION 2 1013C-October 2001
          temp      12.6
          pH        6.2
          pe        0.4
          redox     pe
          units     mg/l
          density   1
          Alkalinity 480
          Cu        0.013
          Ca        550
          Fe        2.7
          Mg        160
          Mn        8.5
          S(6)      1700
          Zn        0.51
```

```
    water    1 # kg
SOLUTION 3 1014A - October 2001
    temp      14.3
    pH        6.3
    pe        2.6
    redox     pe
    units     mg/l
    density   1
    Alkalinity 430
    Ca        330
    Cu        0.013
    Fe        1.5
    Mg        110
    Mn        6
    S(6)      1000
    Zn        0.12
    water    1 # kg
SOLUTION 4 1014B - October 2001
    temp      13.4
    pH        6.1
    pe        3.7
    redox     pe
    units     mg/l
    density   1
    Alkalinity 510
    Ca        530
    Cu        0.49
    Fe        0.15
    Mg        140
    Mn        18
    Zn        1.6
    S(6)      1600
    water    1 # kg
SOLUTION 5 1014C-October 2001
    temp      12.2
    pH        6.2
    pe        0.9
    redox     pe
    units     mg/l
    density   1
    Alkalinity 350
    Ca        210
    Cu        0.13
    Fe        9.6
    Mg        44
    Mn        2.9
    S(6)      410
    Zn        1.1
    water    1 # kg
SOLUTION 6 1005P - October 2001
    temp      9.9
    pH        6.6
    pe        0.1
    redox     pe
    units     mg/l
    density   1
    Alkalinity 240
```

Ca	56
Cu	0.0027
Fe	0.77
Mg	22
Mn	0.08
S(6)	5
Zn	0.012
water	1 # kg

Beginning of initial solution calculations.

Initial solution 1. 1013B - Oct 2001

----------Solution composition----------

Elements	Molality	Moles
Alkalinity	1.122e-002	1.122e-002
Ca	1.501e-002	1.501e-002
Cu	1.089e-006	1.089e-006
Fe	1.185e-005	1.185e-005
Mg	5.363e-003	5.363e-003
Mn	6.207e-004	6.207e-004
S(6)	1.670e-002	1.670e-002
Zn	1.995e-006	1.995e-006

----------Description of solution----------

pH	= 6.100
pe	= 3.400
Activity of water	= 0.999
Ionic strength	= 5.601e-002
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 2.896e-002
Total CO2 (mol/kg)	= 2.896e-002
Temperature (deg C)	= 14.400
Electrical balance (eq)	= -2.607e-003
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -4.23
Iterations	= 11
Total H	= 1.110236e+002
Total O	= 5.564216e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	9.330e-007	7.943e-007	-6.030	-6.100	-0.070
OH-	6.680e-009	5.389e-009	-8.175	-8.268	-0.093
H2O	5.551e+001	9.990e-001	-0.000	-0.000	0.000
C(4)	2.896e-002				
CO2	1.774e-002	1.797e-002	-1.751	-1.745	0.006
HCO3-	1.033e-002	8.520e-003	-1.986	-2.070	-0.084

	CaHCO3+	5.149e-004	4.247e-004	-3.288	-3.372	-0.084
	MgHCO3+	2.054e-004	1.680e-004	-3.687	-3.775	-0.087
	MnHCO3+	1.529e-004	1.251e-004	-3.815	-3.903	-0.087
	MnCO3	5.085e-006	5.151e-006	-5.294	-5.288	0.006
	FeHCO3+	3.193e-006	2.611e-006	-5.496	-5.583	-0.087
	CaCO3	2.644e-006	2.678e-006	-5.578	-5.572	0.006
	CO3-2	8.504e-007	3.938e-007	-6.070	-6.405	-0.334
	ZnHCO3+	5.519e-007	4.513e-007	-6.258	-6.346	-0.087
	MgCO3	5.500e-007	5.571e-007	-6.260	-6.254	0.006
	ZnCO3	3.263e-008	3.305e-008	-7.486	-7.481	0.006
	FeCO3	2.858e-008	2.895e-008	-7.544	-7.538	0.006
	Zn(CO3)2-2	6.225e-010	2.783e-010	-9.206	-9.556	-0.350
Ca		1.501e-002				
	Ca+2	1.030e-002	4.789e-003	-1.987	-2.320	-0.333
	CaSO4	4.197e-003	4.251e-003	-2.377	-2.371	0.006
	CaHCO3+	5.149e-004	4.247e-004	-3.288	-3.372	-0.084
	CaCO3	2.644e-006	2.678e-006	-5.578	-5.572	0.006
	CaHSO4+	2.150e-008	1.758e-008	-7.668	-7.755	-0.087
	CaOH+	1.222e-009	9.995e-010	-8.913	-9.000	-0.087
Cu(1)		7.788e-008				
	Cu+	7.788e-008	6.196e-008	-7.109	-7.208	-0.099
Cu(2)		1.011e-006				
	Cu+2	6.926e-007	3.286e-007	-6.160	-6.483	-0.324
	CuSO4	3.027e-007	3.066e-007	-6.519	-6.513	0.006
	Cu(OH)2	1.072e-008	1.086e-008	-7.970	-7.964	0.006
	CuOH+	5.091e-009	4.133e-009	-8.293	-8.384	-0.091
	Cu(OH)3-	1.006e-015	8.229e-016	-14.997	-15.085	-0.087
	Cu(OH)4-2	4.619e-022	2.065e-022	-21.335	-21.685	-0.350
Fe(2)		1.185e-005				
	Fe+2	6.460e-006	3.065e-006	-5.190	-5.514	-0.324
	FeHCO3+	3.193e-006	2.611e-006	-5.496	-5.583	-0.087
	FeSO4	2.170e-006	2.198e-006	-5.664	-5.658	0.006
	FeCO3	2.858e-008	2.895e-008	-7.544	-7.538	0.006
	FeOH+	6.557e-010	5.362e-010	-9.183	-9.271	-0.087
	FeHSO4+	1.376e-011	1.125e-011	-10.861	-10.949	-0.087
Fe(3)		6.250e-010				
	Fe(OH)2+	5.746e-010	4.698e-010	-9.241	-9.328	-0.087
	Fe(OH)3	4.654e-011	4.714e-011	-10.332	-10.327	0.006
	FeOH+2	3.829e-012	1.712e-012	-11.417	-11.767	-0.350
	Fe(OH)4-	4.252e-014	3.476e-014	-13.371	-13.459	-0.087
	FeSO4+	2.087e-014	1.706e-014	-13.681	-13.768	-0.087
	Fe(SO4)2-	2.156e-015	1.763e-015	-14.666	-14.754	-0.087
	Fe+3	1.713e-015	4.026e-016	-14.766	-15.395	-0.629
	FeHSO4+2	8.303e-020	3.712e-020	-19.081	-19.430	-0.350
	Fe2(OH)2+4	3.109e-021	1.242e-022	-20.507	-21.906	-1.399
	Fe3(OH)4+5	5.148e-027	3.360e-029	-26.288	-28.474	-2.185
H(0)		1.559e-022				
	H2	7.797e-023	7.898e-023	-22.108	-22.102	0.006
Mg		5.363e-003				
	Mg+2	3.657e-003	1.745e-003	-2.437	-2.758	-0.321
	MgSO4	1.500e-003	1.519e-003	-2.824	-2.818	0.006
	MgHCO3+	2.054e-004	1.680e-004	-3.687	-3.775	-0.087
	MgCO3	5.500e-007	5.571e-007	-6.260	-6.254	0.006
	MgOH+	3.611e-009	2.953e-009	-8.442	-8.530	-0.087
Mn(2)		6.207e-004				
	Mn+2	3.471e-004	1.647e-004	-3.460	-3.783	-0.324
	MnHCO3+	1.529e-004	1.251e-004	-3.815	-3.903	-0.087

	MnSO4	1.156e-004	1.171e-004	-3.937	-3.932	0.006
	MnCO3	5.085e-006	5.151e-006	-5.294	-5.288	0.006
	MnOH+	2.658e-009	2.173e-009	-8.575	-8.663	-0.087
Mn(3)		1.571e-026				
	Mn+3	1.571e-026	2.568e-027	-25.804	-26.590	-0.787
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-51.729	-51.723	0.006
S(6)		1.670e-002				
	SO4-2	1.089e-002	4.930e-003	-1.963	-2.307	-0.344
	CaSO4	4.197e-003	4.251e-003	-2.377	-2.371	0.006
	MgSO4	1.500e-003	1.519e-003	-2.824	-2.818	0.006
	MnSO4	1.156e-004	1.171e-004	-3.937	-3.932	0.006
	FeSO4	2.170e-006	2.198e-006	-5.664	-5.658	0.006
	ZnSO4	4.411e-007	4.468e-007	-6.355	-6.350	0.006
	HSO4-	3.734e-007	3.053e-007	-6.428	-6.515	-0.087
	CuSO4	3.027e-007	3.066e-007	-6.519	-6.513	0.006
	Zn(SO4)2-2	4.359e-008	1.949e-008	-7.361	-7.710	-0.350
	CaHSO4+	2.150e-008	1.758e-008	-7.668	-7.755	-0.087
	FeHSO4+	1.376e-011	1.125e-011	-10.861	-10.949	-0.087
	FeSO4+	2.087e-014	1.706e-014	-13.681	-13.768	-0.087
	Fe(SO4)2-	2.156e-015	1.763e-015	-14.666	-14.754	-0.087
	FeHSO4+2	8.303e-020	3.712e-020	-19.081	-19.430	-0.350
Zn		1.995e-006				
	Zn+2	9.244e-007	4.207e-007	-6.034	-6.376	-0.342
	ZnHCO3+	5.519e-007	4.513e-007	-6.258	-6.346	-0.087
	ZnSO4	4.411e-007	4.468e-007	-6.355	-6.350	0.006
	Zn(SO4)2-2	4.359e-008	1.949e-008	-7.361	-7.710	-0.350
	ZnCO3	3.263e-008	3.305e-008	-7.486	-7.481	0.006
	Zn(CO3)2-2	6.225e-010	2.783e-010	-9.206	-9.556	-0.350
	ZnOH+	3.082e-010	2.520e-010	-9.511	-9.599	-0.087
	Zn(OH)2	8.270e-012	8.377e-012	-11.082	-11.077	0.006
	Zn(OH)3-	4.075e-017	3.332e-017	-16.390	-16.477	-0.087
	Zn(OH)4-2	1.485e-023	6.641e-024	-22.828	-23.178	-0.350

----------Saturation indices----------
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Phase	SI	log IAP	log KT	
Anhydrite	-0.29	-4.63	-4.33	CaSO4
Aragonite	-0.45	-8.72	-8.28	CaCO3
Calcite	-0.30	-8.72	-8.43	CaCO3
CO2(g)	-0.41	-18.60	-18.19	CO2
Dolomite	-1.05	-17.89	-16.84	CaMg(CO3)2
Fe(OH)3(a)	-1.99	16.19	18.17	Fe(OH)3
Goethite	3.51	16.19	12.67	FeOOH
Gypsum	-0.04	-4.63	-4.59	CaSO4:2H2O
H2(g)	-19.00	-19.00	0.00	H2
H2O(g)	-1.79	-0.00	1.79	H2O
Hausmannite	-19.50	44.25	63.75	Mn3O4
Hematite	8.98	32.37	23.39	Fe2O3
Manganite	-7.42	17.92	25.34	MnOOH
Melanterite	-5.48	-7.82	-2.35	FeSO4:7H2O
O2(g)	-48.81	38.00	86.81	O2
Pyrochroite	-6.78	8.42	15.20	Mn(OH)2
Pyrolusite	-15.72	27.42	43.14	MnO2
Rhodochrosite	0.90	-10.19	-11.09	MnCO3

Siderite	-1.10	-11.92	-10.82	FeCO3
Smithsonite	-2.90	-12.78	-9.88	ZnCO3
Zn(OH)2(e)	-5.68	5.82	11.50	Zn(OH)2

Initial solution 2. 1013C-October 2001

----------Solution composition----------

Elements	Molality	Moles
Alkalinity	9.619e-003	9.619e-003
Ca	1.376e-002	1.376e-002
Cu	2.052e-007	2.052e-007
Fe	4.849e-005	4.849e-005
Mg	6.600e-003	6.600e-003
Mn	1.552e-004	1.552e-004
S(6)	1.775e-002	1.775e-002
Zn	7.824e-006	7.824e-006

----------Description of solution----------

pH	= 6.200
pe	= 0.400
Activity of water	= 0.999
Ionic strength	= 5.622e-002
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 2.228e-002
Total CO2 (mol/kg)	= 2.228e-002
Temperature (deg C)	= 12.600
Electrical balance (eq)	= -3.967e-003
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -6.50
Iterations	= 10
Total H	= 1.110220e+002
Total O	= 5.563138e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	7.410e-007	6.310e-007	-6.130	-6.200	-0.070
OH-	7.209e-009	5.817e-009	-8.142	-8.235	-0.093
H2O	5.551e+001	9.991e-001	-0.000	-0.000	0.000
C(4)	2.228e-002				
CO2	1.266e-002	1.283e-002	-1.897	-1.892	0.006
HCO3-	8.956e-003	7.389e-003	-2.048	-2.131	-0.084
CaHCO3+	3.873e-004	3.196e-004	-3.412	-3.495	-0.084
MgHCO3+	2.180e-004	1.783e-004	-3.662	-3.749	-0.087
MnHCO3+	3.400e-005	2.781e-005	-4.469	-4.556	-0.087
FeHCO3+	1.166e-005	9.533e-006	-4.933	-5.021	-0.087
CaCO3	2.449e-006	2.481e-006	-5.611	-5.605	0.006
ZnHCO3+	1.912e-006	1.564e-006	-5.718	-5.806	-0.087
MnCO3	1.357e-006	1.374e-006	-5.868	-5.862	0.006
CO3-2	8.842e-007	4.097e-007	-6.053	-6.388	-0.334

	MgCO3	6.836e-007	6.925e-007	-6.165	-6.160	0.006
	ZnCO3	1.357e-007	1.374e-007	-6.867	-6.862	0.006
	FeCO3	1.252e-007	1.268e-007	-6.902	-6.897	0.006
	Zn(CO3)2-2	2.690e-009	1.204e-009	-8.570	-8.919	-0.349
Ca		1.376e-002				
	Ca+2	9.331e-003	4.342e-003	-2.030	-2.362	-0.332
	CaSO4	4.042e-003	4.095e-003	-2.393	-2.388	0.006
	CaHCO3+	3.873e-004	3.196e-004	-3.412	-3.495	-0.084
	CaCO3	2.449e-006	2.481e-006	-5.611	-5.605	0.006
	CaHSO4+	1.616e-008	1.322e-008	-7.791	-7.879	-0.087
	CaOH+	1.395e-009	1.141e-009	-8.855	-8.943	-0.087
Cu(1)		2.024e-007				
	Cu+	2.024e-007	1.611e-007	-6.694	-6.793	-0.099
Cu(2)		2.749e-009				
	Cu+2	1.832e-009	8.700e-010	-8.737	-9.060	-0.323
	CuSO4	8.552e-010	8.664e-010	-9.068	-9.062	0.006
	Cu(OH)2	4.499e-011	4.558e-011	-10.347	-10.341	0.006
	CuOH+	1.696e-011	1.378e-011	-10.770	-10.861	-0.090
	Cu(OH)3-	5.316e-018	4.348e-018	-17.274	-17.362	-0.087
	Cu(OH)4-2	3.070e-024	1.374e-024	-23.513	-23.862	-0.349
Fe(2)		4.849e-005				
	Fe+2	2.717e-005	1.290e-005	-4.566	-4.889	-0.323
	FeHCO3+	1.166e-005	9.533e-006	-4.933	-5.021	-0.087
	FeSO4	9.534e-006	9.658e-006	-5.021	-5.015	0.006
	FeCO3	1.252e-007	1.268e-007	-6.902	-6.897	0.006
	FeOH+	3.004e-009	2.457e-009	-8.522	-8.610	-0.087
	FeHSO4+	4.802e-011	3.928e-011	-10.319	-10.406	-0.087
Fe(3)		3.137e-012				
	Fe(OH)2+	2.853e-012	2.334e-012	-11.545	-11.632	-0.087
	Fe(OH)3	2.674e-013	2.708e-013	-12.573	-12.567	0.006
	FeOH+2	1.624e-014	7.270e-015	-13.789	-14.138	-0.349
	Fe(OH)4-	2.843e-016	2.325e-016	-15.546	-15.634	-0.087
	FeSO4+	8.178e-017	6.689e-017	-16.087	-16.175	-0.087
	Fe(SO4)2-	9.071e-018	7.420e-018	-17.042	-17.130	-0.087
	Fe+3	6.470e-018	1.523e-018	-17.189	-17.817	-0.628
	FeHSO4+2	2.603e-022	1.165e-022	-21.585	-21.934	-0.349
	Fe2(OH)2+4	6.053e-026	2.428e-027	-25.218	-26.615	-1.397
	Fe3(OH)4+5	5.944e-034	3.907e-036	-33.226	-35.408	-2.182
H(0)		1.003e-016				
	H2	5.016e-017	5.081e-017	-16.300	-16.294	0.006
Mg		6.600e-003				
	Mg+2	4.487e-003	2.143e-003	-2.348	-2.669	-0.321
	MgSO4	1.895e-003	1.920e-003	-2.722	-2.717	0.006
	MgHCO3+	2.180e-004	1.783e-004	-3.662	-3.749	-0.087
	MgCO3	6.836e-007	6.925e-007	-6.165	-6.160	0.006
	MgOH+	4.682e-009	3.830e-009	-8.330	-8.417	-0.087
Mn(2)		1.552e-004				
	Mn+2	8.893e-005	4.223e-005	-4.051	-4.374	-0.323
	MnHCO3+	3.400e-005	2.781e-005	-4.469	-4.556	-0.087
	MnSO4	3.089e-005	3.129e-005	-4.510	-4.505	0.006
	MnCO3	1.357e-006	1.374e-006	-5.868	-5.862	0.006
	MnOH+	7.319e-010	5.986e-010	-9.136	-9.223	-0.087
Mn(3)		3.024e-030				
	Mn+3	3.024e-030	4.954e-031	-29.519	-30.305	-0.786
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-63.974	-63.968	0.006
S(6)		1.775e-002				

SO4-2	1.177e-002	5.333e-003	-1.929	-2.273	-0.344
CaSO4	4.042e-003	4.095e-003	-2.393	-2.388	0.006
MgSO4	1.895e-003	1.920e-003	-2.722	-2.717	0.006
MnSO4	3.089e-005	3.129e-005	-4.510	-4.505	0.006
FeSO4	9.534e-006	9.658e-006	-5.021	-5.015	0.006
ZnSO4	1.878e-006	1.903e-006	-5.726	-5.721	0.006
HSO4-	3.096e-007	2.532e-007	-6.509	-6.596	-0.087
Zn(SO4)2-2	2.036e-007	9.111e-008	-6.691	-7.040	-0.349
CaHSO4+	1.616e-008	1.322e-008	-7.791	-7.879	-0.087
CuSO4	8.552e-010	8.664e-010	-9.068	-9.062	0.006
FeHSO4+	4.802e-011	3.928e-011	-10.319	-10.406	-0.087
FeSO4+	8.178e-017	6.689e-017	-16.087	-16.175	-0.087
Fe(SO4)2-	9.071e-018	7.420e-018	-17.042	-17.130	-0.087
FeHSO4+2	2.603e-022	1.165e-022	-21.585	-21.934	-0.349
Zn	7.824e-006				
Zn+2	3.691e-006	1.681e-006	-5.433	-5.774	-0.341
ZnHCO3+	1.912e-006	1.564e-006	-5.718	-5.806	-0.087
ZnSO4	1.878e-006	1.903e-006	-5.726	-5.721	0.006
Zn(SO4)2-2	2.036e-007	9.111e-008	-6.691	-7.040	-0.349
ZnCO3	1.357e-007	1.374e-007	-6.867	-6.862	0.006
Zn(CO3)2-2	2.690e-009	1.204e-009	-8.570	-8.919	-0.349
ZnOH+	1.338e-009	1.094e-009	-8.874	-8.961	-0.087
Zn(OH)2	5.239e-011	5.307e-011	-10.281	-10.275	0.006
Zn(OH)3-	3.249e-016	2.657e-016	-15.488	-15.576	-0.087
Zn(OH)4-2	1.490e-022	6.669e-023	-21.827	-22.176	-0.349

----------Saturation indices----------

Phase	SI	log IAP	log KT	
Anhydrite	-0.30	-4.64	-4.33	CaSO4
Aragonite	-0.48	-8.75	-8.27	CaCO3
Calcite	-0.33	-8.75	-8.42	CaCO3
CO2(g)	-0.58	-18.79	-18.20	CO2
Dolomite	-1.02	-17.81	-16.79	CaMg(CO3)2
Fe(OH)3(a)	-4.11	-14.11	18.22	Fe(OH)3
Goethite	1.32	14.11	12.79	FeOOH
Gypsum	-0.05	-4.64	-4.59	CaSO4:2H2O
H2(g)	-13.20	-13.20	0.00	H2
H2O(g)	-1.85	-0.00	1.84	H2O
Hausmannite	-26.96	37.28	64.23	Mn3O4
Hematite	4.59	28.22	23.63	Fe2O3
Manganite	-10.72	14.62	25.34	MnOOH
Melanterite	-4.79	-7.17	-2.37	FeSO4:7H2O
O2(g)	-61.07	26.40	87.47	O2
Pyrochroite	-7.18	8.02	15.20	Mn(OH)2
Pyrolusite	-22.23	21.22	43.45	MnO2
Rhodochrosite	0.32	-10.76	-11.08	MnCO3
Siderite	-0.47	-11.28	-10.81	FeCO3
Smithsonite	-2.30	-12.16	-9.86	ZnCO3
Zn(OH)2(e)	-4.88	6.62	11.50	Zn(OH)2

Initial solution 3. 1014A - October 2001

----------Solution composition----------

Elements	Molality	Moles
Alkalinity	8.608e-003	8.608e-003
Ca	8.249e-003	8.249e-003
Cu	2.050e-007	2.050e-007
Fe	2.691e-005	2.691e-005
Mg	4.533e-003	4.533e-003
Mn	1.094e-004	1.094e-004
S(6)	1.043e-002	1.043e-002
Zn	1.839e-006	1.839e-006

----------Description of solution----------

pH	= 6.300
pe	= 2.600
Activity of water	= 0.999
Ionic strength	= 3.751e-002
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 1.772e-002
Total CO2 (mol/kg)	= 1.772e-002
Temperature (deg C)	= 14.300
Electrical balance (eq)	= -3.626e-003
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -8.67
Iterations	= 9
Total H	= 1.110210e+002
Total O	= 5.559198e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	5.778e-007	5.012e-007	-6.238	-6.300	-0.062
OH-	1.017e-008	8.472e-009	-7.993	-8.072	-0.079
H2O	5.551e+001	9.994e-001	-0.000	-0.000	0.000
C(4)	1.772e-002				
CO2	9.116e-003	9.195e-003	-2.040	-2.036	0.004
HCO3-	8.147e-003	6.898e-003	-2.089	-2.161	-0.072
CaHCO3+	2.599e-004	2.201e-004	-3.585	-3.657	-0.072
MgHCO3+	1.591e-004	1.336e-004	-3.798	-3.874	-0.076
MnHCO3+	2.496e-005	2.097e-005	-4.603	-4.678	-0.076
FeHCO3+	6.748e-006	5.670e-006	-5.171	-5.246	-0.076
CaCO3	2.177e-006	2.196e-006	-5.662	-5.658	0.004
MnCO3	1.354e-006	1.366e-006	-5.868	-5.865	0.004
CO3-2	9.806e-007	5.040e-007	-6.009	-6.298	-0.289
MgCO3	6.938e-007	6.998e-007	-6.159	-6.155	0.004
ZnHCO3+	4.818e-007	4.048e-007	-6.317	-6.393	-0.076
FeCO3	9.851e-008	9.936e-008	-7.007	-7.003	0.004
ZnCO3	4.647e-008	4.687e-008	-7.333	-7.329	0.004
Zn(CO3)2-2	1.013e-009	5.050e-010	-8.994	-9.297	-0.302
Ca	8.249e-003				
Ca+2	5.969e-003	3.072e-003	-2.224	-2.513	-0.288
CaSO4	2.018e-003	2.036e-003	-2.695	-2.691	0.004
CaHCO3+	2.599e-004	2.201e-004	-3.585	-3.657	-0.072

	CaCO3	2.177e-006	2.196e-006	-5.662	-5.658	0.004
	CaHSO4+	6.314e-009	5.305e-009	-8.200	-8.275	-0.076
	CaOH+	1.210e-009	1.017e-009	-8.917	-8.993	-0.076
Cu(1)		7.120e-008				
	Cu+	7.120e-008	5.872e-008	-7.148	-7.231	-0.084
Cu(2)		1.338e-007				
	Cu+2	9.439e-008	4.941e-008	-7.025	-7.306	-0.281
	CuSO4	3.412e-008	3.442e-008	-7.467	-7.463	0.004
	Cu(OH)2	4.069e-009	4.104e-009	-8.391	-8.387	0.004
	CuOH+	1.177e-009	9.852e-010	-8.929	-9.006	-0.077
	Cu(OH)3-	5.869e-016	4.931e-016	-15.231	-15.307	-0.076
	Cu(OH)4-2	3.936e-022	1.962e-022	-21.405	-21.707	-0.302
Fe(2)		2.691e-005				
	Fe+2	1.570e-005	8.219e-006	-4.804	-5.085	-0.281
	FeHCO3+	6.748e-006	5.670e-006	-5.171	-5.246	-0.076
	FeSO4	4.357e-006	4.395e-006	-5.361	-5.357	0.004
	FeCO3	9.851e-008	9.936e-008	-7.007	-7.003	0.004
	FeOH+	2.692e-009	2.261e-009	-8.570	-8.646	-0.076
	FeHSO4+	1.689e-011	1.419e-011	-10.772	-10.848	-0.076
Fe(3)		6.677e-010				
	Fe(OH)2+	5.878e-010	4.939e-010	-9.231	-9.306	-0.076
	Fe(OH)3	7.753e-011	7.820e-011	-10.111	-10.107	0.004
	FeOH+2	2.286e-012	1.139e-012	-11.641	-11.943	-0.302
	Fe(OH)4-	1.084e-013	9.104e-014	-12.965	-13.041	-0.076
	FeSO4+	6.396e-015	5.374e-015	-14.194	-14.270	-0.076
	Fe+3	6.120e-016	1.701e-016	-15.213	-15.769	-0.556
	Fe(SO4)2-	4.936e-016	4.147e-016	-15.307	-15.382	-0.076
	FeHSO4+2	1.480e-020	7.379e-021	-19.830	-20.132	-0.302
	Fe2(OH)2+4	8.956e-022	5.528e-023	-21.048	-22.257	-1.210
	Fe3(OH)4+5	1.233e-027	1.588e-029	-26.909	-28.799	-1.890
H(0)		2.485e-021				
	H2	1.242e-021	1.253e-021	-20.906	-20.902	0.004
Mg		4.533e-003				
	Mg+2	3.270e-003	1.715e-003	-2.485	-2.766	-0.280
	MgSO4	1.103e-003	1.113e-003	-2.957	-2.954	0.004
	MgHCO3+	1.591e-004	1.336e-004	-3.798	-3.874	-0.076
	MgCO3	6.938e-007	6.998e-007	-6.159	-6.155	0.004
	MgOH+	5.425e-009	4.558e-009	-8.266	-8.341	-0.076
Mn(2)		1.094e-004				
	Mn+2	6.518e-005	3.411e-005	-4.186	-4.467	-0.281
	MnHCO3+	2.496e-005	2.097e-005	-4.603	-4.678	-0.076
	MnSO4	1.793e-005	1.808e-005	-4.746	-4.743	0.004
	MnCO3	1.354e-006	1.366e-006	-5.868	-5.865	0.004
	MnOH+	8.421e-010	7.076e-010	-9.075	-9.150	-0.076
Mn(3)		3.976e-028				
	Mn+3	3.976e-028	8.299e-029	-27.401	-28.081	-0.680
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-54.162	-54.158	0.004
S(6)		1.043e-002				
	SO4-2	7.285e-003	3.684e-003	-2.138	-2.434	-0.296
	CaSO4	2.018e-003	2.036e-003	-2.695	-2.691	0.004
	MgSO4	1.103e-003	1.113e-003	-2.957	-2.954	0.004
	MnSO4	1.793e-005	1.808e-005	-4.746	-4.743	0.004
	FeSO4	4.357e-006	4.395e-006	-5.361	-5.357	0.004
	ZnSO4	3.664e-007	3.696e-007	-6.436	-6.432	0.004
	HSO4-	1.710e-007	1.436e-007	-6.767	-6.843	-0.076
	CuSO4	3.412e-008	3.442e-008	-7.467	-7.463	0.004

Zn(SO4)2-2	2.418e-008	1.205e-008	-7.617	-7.919	-0.302
CaHSO4+	6.314e-009	5.305e-009	-8.200	-8.275	-0.076
FeHSO4+	1.689e-011	1.419e-011	-10.772	-10.848	-0.076
FeSO4+	6.396e-015	5.374e-015	-14.194	-14.270	-0.076
Fe(SO4)2-	4.936e-016	4.147e-016	-15.307	-15.382	-0.076
FeHSO4+2	1.480e-020	7.379e-021	-19.830	-20.132	-0.302
Zn	1.839e-006				
Zn+2	9.187e-007	4.662e-007	-6.037	-6.331	-0.295
ZnHCO3+	4.818e-007	4.048e-007	-6.317	-6.393	-0.076
ZnSO4	3.664e-007	3.696e-007	-6.436	-6.432	0.004
ZnCO3	4.647e-008	4.687e-008	-7.333	-7.329	0.004
Zn(SO4)2-2	2.418e-008	1.205e-008	-7.617	-7.919	-0.302
Zn(CO3)2-2	1.013e-009	5.050e-010	-8.994	-9.297	-0.302
ZnOH+	5.227e-010	4.392e-010	-9.282	-9.357	-0.076
Zn(OH)2	2.313e-011	2.333e-011	-10.636	-10.632	0.004
Zn(OH)3-	1.751e-016	1.471e-016	-15.757	-15.832	-0.076
Zn(OH)4-2	9.329e-023	4.650e-023	-22.030	-22.333	-0.302

----------Saturation indices----------
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Phase	SI	log IAP	log KT	
Anhydrite	-0.61	-4.95	-4.33	CaSO4
Aragonite	-0.53	-8.81	-8.28	CaCO3
Calcite	-0.38	-8.81	-8.43	CaCO3
CO2(g)	-0.71	-18.90	-18.19	CO2
Dolomite	-1.04	-17.87	-16.83	CaMg(CO3)2
Fe(OH)3(a)	-1.76	16.41	18.18	Fe(OH)3
Goethite	3.74	16.41	12.68	FeOOH
Gypsum	-0.36	-4.95	-4.59	CaSO4:2H2O
H2(g)	-17.80	-17.80	0.00	H2
H2O(g)	-1.80	-0.00	1.80	H2O
Hausmannite	-21.58	42.20	63.78	Mn3O4
Hematite	9.43	32.83	23.40	Fe2O3
Manganite	-8.31	17.03	25.34	MnOOH
Melanterite	-5.17	-7.52	-2.35	FeSO4:7H2O
O2(g)	-51.25	35.60	86.85	O2
Pyrochroite	-7.07	8.13	15.20	Mn(OH)2
Pyrolusite	-17.22	25.93	43.16	MnO2
Rhodochrosite	0.33	-10.76	-11.09	MnCO3
Siderite	-0.56	-11.38	-10.82	FeCO3
Smithsonite	-2.75	-12.63	-9.88	ZnCO3
Zn(OH)2(e)	-5.23	6.27	11.50	Zn(OH)2

Initial solution 4. 1014B - October 2001

----------Solution composition----------
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Elements	Molality	Moles
Alkalinity	1.022e-002	1.022e-002
Ca	1.326e-002	1.326e-002
Cu	7.733e-006	7.733e-006
Fe	2.693e-006	2.693e-006
Mg	5.775e-003	5.775e-003

Mn	3.286e-004	3.286e-004
S(6)	1.670e-002	1.670e-002
Zn	2.454e-005	2.454e-005

----------Description of solution----------

pH	=	6.100
pe	=	3.700
Activity of water	=	0.999
Ionic strength	=	5.373e-002
Mass of water (kg)	=	1.000e+000
Total carbon (mol/kg)	=	2.693e-002
Total CO2 (mol/kg)	=	2.693e-002
Temperature (deg C)	=	13.400
Electrical balance (eq)	=	-4.827e-003
Percent error, 100*(Cat-|An|)/(Cat+|An|)	=	-8.20
Iterations	=	11
Total H	=	1.110226e+002
Total O	=	5.563710e+001

----------Distribution of species----------

	Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
	H+	9.310e-007	7.943e-007	-6.031	-6.100	-0.069
	OH-	6.112e-009	4.949e-009	-8.214	-8.305	-0.092
	H2O	5.551e+001	9.990e-001	-0.000	-0.000	0.000
C(4)		2.693e-002				
	CO2	1.672e-002	1.692e-002	-1.777	-1.772	0.005
	HCO3-	9.510e-003	7.869e-003	-2.022	-2.104	-0.082
	CaHCO3+	4.102e-004	3.394e-004	-3.387	-3.469	-0.082
	MgHCO3+	2.048e-004	1.680e-004	-3.689	-3.775	-0.086
	MnHCO3+	7.632e-005	6.261e-005	-4.117	-4.203	-0.086
	ZnHCO3+	6.390e-006	5.242e-006	-5.195	-5.281	-0.086
	MnCO3	2.480e-006	2.511e-006	-5.605	-5.600	0.005
	CaCO3	2.087e-006	2.113e-006	-5.681	-5.675	0.005
	CO3-2	7.555e-007	3.541e-007	-6.122	-6.451	-0.329
	FeHCO3+	6.848e-007	5.618e-007	-6.164	-6.250	-0.086
	MgCO3	5.289e-007	5.355e-007	-6.277	-6.271	0.005
	ZnCO3	3.693e-007	3.739e-007	-6.433	-6.427	0.005
	Zn(CO3)2-2	6.252e-009	2.831e-009	-8.204	-8.548	-0.344
	FeCO3	5.991e-009	6.065e-009	-8.223	-8.217	0.005
Ca		1.326e-002				
	Ca+2	9.023e-003	4.245e-003	-2.045	-2.372	-0.327
	CaSO4	3.826e-003	3.873e-003	-2.417	-2.412	0.005
	CaHCO3+	4.102e-004	3.394e-004	-3.387	-3.469	-0.082
	CaCO3	2.087e-006	2.113e-006	-5.681	-5.675	0.005
	CaHSO4+	1.934e-008	1.586e-008	-7.714	-7.800	-0.086
	CaOH+	1.080e-009	8.861e-010	-8.966	-9.053	-0.086
Cu(1)		2.831e-007				
	Cu+	2.831e-007	2.262e-007	-6.548	-6.646	-0.097
Cu(2)		7.450e-006				
	Cu+2	5.037e-006	2.418e-006	-5.298	-5.617	-0.319
	CuSO4	2.296e-006	2.325e-006	-5.639	-5.634	0.005

	Cu(OH)2	7.892e-008	7.990e-008	-7.103	-7.097	0.005
	CuOH+	3.732e-008	3.041e-008	-7.428	-7.517	-0.089
	Cu(OH)3-	7.382e-015	6.055e-015	-14.132	-14.218	-0.086
	Cu(OH)4-2	3.356e-021	1.520e-021	-20.474	-20.818	-0.344
Fe(2)		2.693e-006				
	Fe+2	1.487e-006	7.139e-007	-5.828	-6.146	-0.319
	FeHCO3+	6.848e-007	5.618e-007	-6.164	-6.250	-0.086
	FeSO4	5.148e-007	5.212e-007	-6.288	-6.283	0.005
	FeCO3	5.991e-009	6.065e-009	-8.223	-8.217	0.005
	FeOH+	1.405e-010	1.152e-010	-9.852	-9.938	-0.086
	FeHSO4+	3.252e-012	2.668e-012	-11.488	-11.574	-0.086
Fe(3)		2.452e-010				
	Fe(OH)2+	2.261e-010	1.854e-010	-9.646	-9.732	-0.086
	Fe(OH)3	1.754e-011	1.775e-011	-10.756	-10.751	0.005
	FeOH+2	1.554e-012	7.038e-013	-11.808	-12.153	-0.344
	Fe(OH)4-	1.528e-014	1.254e-014	-13.816	-13.902	-0.086
	FeSO4+	9.238e-015	7.578e-015	-14.034	-14.120	-0.086
	Fe(SO4)2-	9.869e-016	8.095e-016	-15.006	-15.092	-0.086
	Fe+3	7.359e-016	1.764e-016	-15.133	-15.754	-0.620
	FeHSO4+2	3.656e-020	1.655e-020	-19.437	-19.781	-0.344
	Fe2(OH)2+4	5.222e-022	2.195e-023	-21.282	-22.659	-1.376
	Fe3(OH)4+5	3.664e-028	2.590e-030	-27.436	-29.587	-2.151
H(0)		3.961e-023				
	H2	1.981e-023	2.005e-023	-22.703	-22.698	0.005
Mg		5.775e-003				
	Mg+2	3.925e-003	1.893e-003	-2.406	-2.723	-0.317
	MgSO4	1.644e-003	1.665e-003	-2.784	-2.779	0.005
	MgHCO3+	2.048e-004	1.680e-004	-3.689	-3.775	-0.086
	MgCO3	5.289e-007	5.355e-007	-6.277	-6.271	0.005
	MgOH+	3.544e-009	2.907e-009	-8.450	-8.536	-0.086
Mn(2)		3.286e-004				
	Mn+2	1.860e-004	8.927e-005	-3.730	-4.049	-0.319
	MnHCO3+	7.632e-005	6.261e-005	-4.117	-4.203	-0.086
	MnSO4	6.375e-005	6.455e-005	-4.195	-4.190	0.005
	MnCO3	2.480e-006	2.511e-006	-5.605	-5.600	0.005
	MnOH+	1.315e-009	1.079e-009	-8.881	-8.967	-0.086
Mn(3)		1.411e-026				
	Mn+3	1.411e-026	2.372e-027	-25.851	-26.625	-0.774
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-50.886	-50.880	0.005
S(6)		1.670e-002				
	SO4-2	1.116e-002	5.119e-003	-1.952	-2.291	-0.338
	CaSO4	3.826e-003	3.873e-003	-2.417	-2.412	0.005
	MgSO4	1.644e-003	1.665e-003	-2.784	-2.779	0.005
	MnSO4	6.375e-005	6.455e-005	-4.195	-4.190	0.005
	ZnSO4	5.715e-006	5.786e-006	-5.243	-5.238	0.005
	CuSO4	2.296e-006	2.325e-006	-5.639	-5.634	0.005
	Zn(SO4)2-2	5.834e-007	2.642e-007	-6.234	-6.578	-0.344
	FeSO4	5.148e-007	5.212e-007	-6.288	-6.283	0.005
	HSO4-	3.789e-007	3.108e-007	-6.421	-6.508	-0.086
	CaHSO4+	1.934e-008	1.586e-008	-7.714	-7.800	-0.086
	FeHSO4+	3.252e-012	2.668e-012	-11.488	-11.574	-0.086
	FeSO4+	9.238e-015	7.578e-015	-14.034	-14.120	-0.086
	Fe(SO4)2-	9.869e-016	8.095e-016	-15.006	-15.092	-0.086
	FeHSO4+2	3.656e-020	1.655e-020	-19.437	-19.781	-0.344
Zn		2.454e-005				
	Zn+2	1.148e-005	5.291e-006	-4.940	-5.276	-0.336

ZnHCO3+	6.390e-006	5.242e-006	-5.195	-5.281	-0.086
ZnSO4	5.715e-006	5.786e-006	-5.243	-5.238	0.005
Zn(SO4)2-2	5.834e-007	2.642e-007	-6.234	-6.578	-0.344
ZnCO3	3.693e-007	3.739e-007	-6.433	-6.427	0.005
Zn(CO3)2-2	6.252e-009	2.831e-009	-8.204	-8.548	-0.344
ZnOH+	3.561e-009	2.921e-009	-8.448	-8.534	-0.086
Zn(OH)2	1.041e-010	1.054e-010	-9.983	-9.977	0.005
Zn(OH)3-	5.109e-016	4.191e-016	-15.292	-15.378	-0.086
Zn(OH)4-2	1.845e-022	8.354e-023	-21.734	-22.078	-0.344

----------Saturation indices----------
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Phase	SI	log IAP	log KT	
Anhydrite	-0.33	-4.66	-4.33	CaSO4
Aragonite	-0.55	-8.82	-8.27	CaCO3
Calcite	-0.40	-8.82	-8.42	CaCO3
CO2(g)	-0.45	-18.65	-18.20	CO2
Dolomite	-1.19	-18.00	-16.81	CaMg(CO3)2
Fe(OH)3(a)	-2.35	15.85	18.20	Fe(OH)3
Goethite	3.12	15.85	12.74	FeOOH
Gypsum	-0.08	-4.66	-4.59	CaSO4:2H2O
H2(g)	-19.60	-19.60	0.00	H2
H2O(g)	-1.82	-0.00	1.82	H2O
Hausmannite	-19.97	44.05	64.02	Mn3O4
Hematite	8.18	31.71	23.52	Fe2O3
Manganite	-7.39	17.95	25.34	MnOOH
Melanterite	-6.08	-8.44	-2.36	FeSO4:7H2O
O2(g)	-47.98	39.20	87.17	O2
Pyrochroite	-7.05	8.15	15.20	Mn(OH)2
Pyrolusite	-15.56	27.75	43.31	MnO2
Rhodochrosite	0.59	-10.50	-11.09	MnCO3
Siderite	-1.78	-12.60	-10.82	FeCO3
Smithsonite	-1.86	-11.73	-9.87	ZnCO3
Zn(OH)2(e)	-4.58	6.92	11.50	Zn(OH)2

Initial solution 5. 1014C-October 2001

----------Solution composition----------
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Elements	Molality	Moles
Alkalinity	7.001e-003	7.001e-003
Ca	5.245e-003	5.245e-003
Cu	2.048e-006	2.048e-006
Fe	1.721e-004	1.721e-004
Mg	1.812e-003	1.812e-003
Mn	5.284e-005	5.284e-005
S(6)	4.272e-003	4.272e-003
Zn	1.684e-005	1.684e-005

----------Description of solution----------
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pH = 6.200

pe	= 0.900
Activity of water	= 1.000
Ionic strength	= 2.167e-002
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 1.720e-002
Total CO2 (mol/kg)	= 1.720e-002
Temperature (deg C)	= 12.200
Electrical balance (eq)	= -9.468e-004
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -3.76
Iterations	= 10
Total H	= 1.110194e+002
Total O	= 5.556471e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	7.101e-007	6.310e-007	-6.149	-6.200	-0.051
OH-	6.498e-009	5.622e-009	-8.187	-8.250	-0.063
H2O	5.551e+001	9.995e-001	-0.000	-0.000	0.000
C(4)	1.720e-002				
CO2	1.020e-002	1.025e-002	-1.991	-1.989	0.002
HCO3-	6.702e-003	5.860e-003	-2.174	-2.232	-0.058
CaHCO3+	1.650e-004	1.443e-004	-3.782	-3.841	-0.058
MgHCO3+	6.635e-005	5.769e-005	-4.178	-4.239	-0.061
FeHCO3+	4.414e-005	3.838e-005	-4.355	-4.416	-0.061
MnHCO3+	1.236e-005	1.074e-005	-4.908	-4.969	-0.061
ZnHCO3+	4.706e-006	4.091e-006	-5.327	-5.388	-0.061
CaCO3	1.110e-006	1.115e-006	-5.955	-5.953	0.002
CO3-2	5.500e-007	3.214e-007	-6.260	-6.493	-0.233
MnCO3	5.224e-007	5.250e-007	-6.282	-6.280	0.002
FeCO3	5.024e-007	5.049e-007	-6.299	-6.297	0.002
ZnCO3	3.538e-007	3.556e-007	-6.451	-6.449	0.002
MgCO3	2.193e-007	2.204e-007	-6.659	-6.657	0.002
Zn(CO3)2-2	4.277e-009	2.443e-009	-8.369	-8.612	-0.243
Ca	5.245e-003				
Ca+2	4.275e-003	2.497e-003	-2.369	-2.603	-0.233
CaSO4	8.042e-004	8.083e-004	-3.095	-3.092	0.002
CaHCO3+	1.650e-004	1.443e-004	-3.782	-3.841	-0.058
CaCO3	1.110e-006	1.115e-006	-5.955	-5.953	0.002
CaHSO4+	2.991e-009	2.600e-009	-8.524	-8.585	-0.061
CaOH+	7.552e-010	6.566e-010	-9.122	-9.183	-0.061
Cu(1)	1.986e-006				
Cu+	1.986e-006	1.708e-006	-5.702	-5.768	-0.066
Cu(2)	6.156e-008				
Cu+2	4.953e-008	2.929e-008	-7.305	-7.533	-0.228
CuSO4	9.971e-009	1.002e-008	-8.001	-7.999	0.002
Cu(OH)2	1.528e-009	1.536e-009	-8.816	-8.814	0.002
CuOH+	5.347e-010	4.640e-010	-9.272	-9.334	-0.062
Cu(OH)3-	1.686e-016	1.466e-016	-15.773	-15.834	-0.061
Cu(OH)4-2	8.112e-023	4.633e-023	-22.091	-22.334	-0.243
Fe(2)	1.721e-004				
Fe+2	1.107e-004	6.549e-005	-3.956	-4.184	-0.228
FeHCO3+	4.414e-005	3.838e-005	-4.355	-4.416	-0.061
FeSO4	1.668e-005	1.676e-005	-4.778	-4.776	0.002

	FeCO3	5.024e-007	5.049e-007	-6.299	-6.297	0.002
	FeOH+	1.389e-008	1.208e-008	-7.857	-7.918	-0.061
	FeHSO4+	7.843e-011	6.818e-011	-10.106	-10.166	-0.061
Fe(3)		4.455e-011				
	Fe(OH)2+	4.037e-011	3.509e-011	-10.394	-10.455	-0.061
	Fe(OH)3	3.978e-012	3.998e-012	-11.400	-11.398	0.002
	FeOH+2	1.945e-013	1.111e-013	-12.711	-12.954	-0.243
	Fe(OH)4-	3.882e-015	3.375e-015	-14.411	-14.472	-0.061
	FeSO4+	4.116e-016	3.578e-016	-15.386	-15.446	-0.061
	Fe+3	6.911e-017	2.387e-017	-16.160	-16.622	-0.462
	Fe(SO4)2-	1.571e-017	1.365e-017	-16.804	-16.865	-0.061
	FeHSO4+2	1.093e-021	6.243e-022	-20.961	-21.205	-0.243
	Fe2(OH)2+4	5.424e-024	5.774e-025	-23.266	-24.239	-0.973
	Fe3(OH)4+5	4.817e-031	1.454e-032	-30.317	-31.837	-1.520
H(0)		1.016e-017				
	H2	5.078e-018	5.103e-018	-17.294	-17.292	0.002
Mg		1.812e-003				
	Mg+2	1.479e-003	8.748e-004	-2.830	-3.058	-0.228
	MgSO4	2.658e-004	2.671e-004	-3.576	-3.573	0.002
	MgHCO3+	6.635e-005	5.769e-005	-4.178	-4.239	-0.061
	MgCO3	2.193e-007	2.204e-007	-6.659	-6.657	0.002
	MgOH+	1.730e-009	1.504e-009	-8.762	-8.823	-0.061
Mn(2)		5.284e-005				
	Mn+2	3.478e-005	2.057e-005	-4.459	-4.687	-0.228
	MnHCO3+	1.236e-005	1.074e-005	-4.908	-4.969	-0.061
	MnSO4	5.182e-006	5.208e-006	-5.285	-5.283	0.002
	MnCO3	5.224e-007	5.250e-007	-6.282	-6.280	0.002
	MnOH+	3.238e-010	2.815e-010	-9.490	-9.550	-0.061
Mn(3)		2.524e-030				
	Mn+3	2.524e-030	7.160e-031	-29.598	-30.145	-0.547
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-62.114	-62.112	0.002
S(6)		4.272e-003				
	SO4-2	3.178e-003	1.838e-003	-2.498	-2.736	-0.238
	CaSO4	8.042e-004	8.083e-004	-3.095	-3.092	0.002
	MgSO4	2.658e-004	2.671e-004	-3.576	-3.573	0.002
	FeSO4	1.668e-005	1.676e-005	-4.778	-4.776	0.002
	MnSO4	5.182e-006	5.208e-006	-5.285	-5.283	0.002
	ZnSO4	2.145e-006	2.155e-006	-5.669	-5.666	0.002
	HSO4-	9.961e-008	8.660e-008	-7.002	-7.062	-0.061
	Zn(SO4)2-2	6.248e-008	3.569e-008	-7.204	-7.447	-0.243
	CuSO4	9.971e-009	1.002e-008	-8.001	-7.999	0.002
	CaHSO4+	2.991e-009	2.600e-009	-8.524	-8.585	-0.061
	FeHSO4+	7.843e-011	6.818e-011	-10.106	-10.166	-0.061
	FeSO4+	4.116e-016	3.578e-016	-15.386	-15.446	-0.061
	Fe(SO4)2-	1.571e-017	1.365e-017	-16.804	-16.865	-0.061
	FeHSO4+2	1.093e-021	6.243e-022	-20.961	-21.205	-0.243
Zn		1.684e-005				
	Zn+2	9.570e-006	5.545e-006	-5.019	-5.256	-0.237
	ZnHCO3+	4.706e-006	4.091e-006	-5.327	-5.388	-0.061
	ZnSO4	2.145e-006	2.155e-006	-5.669	-5.666	0.002
	ZnCO3	3.538e-007	3.556e-007	-6.451	-6.449	0.002
	Zn(SO4)2-2	6.248e-008	3.569e-008	-7.204	-7.447	-0.243
	Zn(CO3)2-2	4.277e-009	2.443e-009	-8.369	-8.612	-0.243
	ZnOH+	4.017e-009	3.492e-009	-8.396	-8.457	-0.061
	Zn(OH)2	1.743e-010	1.752e-010	-9.759	-9.756	0.002
	Zn(OH)3-	1.010e-015	8.776e-016	-14.996	-15.057	-0.061

Zn(OH)4-2	3.858e-022	2.203e-022	-21.414	-21.657	-0.243

----------Saturation indices----------

Phase	SI	log IAP	log KT	
Anhydrite	-1.00	-5.34	-4.33	CaSO4
Aragonite	-0.83	-9.10	-8.27	CaCO3
Calcite	-0.68	-9.10	-8.42	CaCO3
CO2(g)	-0.69	-18.89	-18.21	CO2
Dolomite	-1.87	-18.65	-16.78	CaMg(CO3)2
Fe(OH)3(a)	-2.91	15.32	18.23	Fe(OH)3
Goethite	2.50	15.32	12.81	FeOOH
Gypsum	-0.75	-5.34	-4.59	CaSO4:2H2O
H2(g)	-14.20	-14.20	0.00	H2
H2O(g)	-1.86	-0.00	1.86	H2O
Hausmannite	-27.00	37.34	64.34	Mn3O4
Hematite	6.95	30.63	23.68	Fe2O3
Manganite	-10.53	14.81	25.34	MnOOH
Melanterite	-4.54	-6.92	-2.38	FeSO4:7H2O
O2(g)	-59.21	28.40	87.61	O2
Pyrochroite	-7.49	7.71	15.20	Mn(OH)2
Pyrolusite	-21.61	21.91	43.52	MnO2
Rhodochrosite	-0.10	-11.18	-11.08	MnCO3
Siderite	0.13	-10.68	-10.81	FeCO3
Smithsonite	-1.89	-11.75	-9.86	ZnCO3
Zn(OH)2(e)	-4.36	7.14	11.50	Zn(OH)2

Initial solution 6. 1005P - October 2001

----------Solution composition----------

Elements	Molality	Moles
Alkalinity	4.797e-003	4.797e-003
Ca	1.398e-003	1.398e-003
Cu	4.250e-008	4.250e-008
Fe	1.379e-005	1.379e-005
Mg	9.052e-004	9.052e-004
Mn	1.457e-006	1.457e-006
S(6)	5.207e-005	5.207e-005
Zn	1.836e-007	1.836e-007

----------Description of solution----------

pH	=	6.600
pe	=	0.100
Activity of water	=	1.000
Ionic strength	=	6.945e-003
Mass of water (kg)	=	1.000e+000
Total carbon (mol/kg)	=	7.965e-003
Total CO2 (mol/kg)	=	7.965e-003
Temperature (deg C)	=	9.900
Electrical balance (eq)	=	-2.647e-004

Percent error, 100*(Cat-|An|)/(Cat+|An|) = -2.83
Iterations = 10
Total H = 1.110172e+002
Total O = 5.552715e+001

----------Distribution of species----------

	Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
	H+	2.712e-007	2.512e-007	-6.567	-6.600	-0.033
	OH-	1.259e-008	1.154e-008	-7.900	-7.938	-0.038
	H2O	5.551e+001	9.998e-001	-0.000	-0.000	0.000
C(4)		7.965e-003				
	HCO3-	4.714e-003	4.338e-003	-2.327	-2.363	-0.036
	CO2	3.169e-003	3.174e-003	-2.499	-2.498	0.001
	CaHCO3+	4.223e-005	3.885e-005	-4.374	-4.411	-0.036
	MgHCO3+	3.315e-005	3.043e-005	-4.480	-4.517	-0.037
	FeHCO3+	3.469e-006	3.184e-006	-5.460	-5.497	-0.037
	CO3-2	7.812e-007	5.599e-007	-6.107	-6.252	-0.145
	CaCO3	7.381e-007	7.393e-007	-6.132	-6.131	0.001
	MnHCO3+	3.302e-007	3.030e-007	-6.481	-6.519	-0.037
	MgCO3	2.645e-007	2.649e-007	-6.578	-6.577	0.001
	FeCO3	9.842e-008	9.858e-008	-7.007	-7.006	0.001
	ZnHCO3+	5.163e-008	4.739e-008	-7.287	-7.324	-0.037
	MnCO3	3.481e-008	3.486e-008	-7.458	-7.458	0.001
	ZnCO3	9.679e-009	9.695e-009	-8.014	-8.013	0.001
	Zn(CO3)2-2	1.635e-010	1.161e-010	-9.786	-9.935	-0.149
Ca		1.398e-003				
	Ca+2	1.350e-003	9.668e-004	-2.870	-3.015	-0.145
	CaHCO3+	4.223e-005	3.885e-005	-4.374	-4.411	-0.036
	CaSO4	5.192e-006	5.200e-006	-5.285	-5.284	0.001
	CaCO3	7.381e-007	7.393e-007	-6.132	-6.131	0.001
	CaOH+	6.958e-010	6.386e-010	-9.158	-9.195	-0.037
	CaHSO4+	7.110e-012	6.526e-012	-11.148	-11.185	-0.037
Cu(1)		4.231e-008				
	Cu+	4.231e-008	3.869e-008	-7.374	-7.412	-0.039
Cu(2)		1.904e-010				
	Cu+2	1.495e-010	1.077e-010	-9.825	-9.968	-0.143
	Cu(OH)2	3.559e-011	3.565e-011	-10.449	-10.448	0.001
	CuOH+	4.672e-012	4.286e-012	-11.331	-11.368	-0.037
	CuSO4	6.151e-013	6.161e-013	-12.211	-12.210	0.001
	Cu(OH)3-	9.315e-018	8.549e-018	-17.031	-17.068	-0.037
	Cu(OH)4-2	9.567e-024	6.790e-024	-23.019	-23.168	-0.149
Fe(2)		1.379e-005				
	Fe+2	1.019e-005	7.339e-006	-4.992	-5.134	-0.143
	FeHCO3+	3.469e-006	3.184e-006	-5.460	-5.497	-0.037
	FeCO3	9.842e-008	9.858e-008	-7.007	-7.006	0.001
	FeSO4	3.047e-008	3.052e-008	-7.516	-7.515	0.001
	FeOH+	3.067e-009	2.815e-009	-8.513	-8.551	-0.037
	FeHSO4+	5.398e-014	4.954e-014	-13.268	-13.305	-0.037
Fe(3)		3.614e-012				
	Fe(OH)2+	2.921e-012	2.681e-012	-11.534	-11.572	-0.037
	Fe(OH)3	6.862e-013	6.873e-013	-12.164	-12.163	0.001
	FeOH+2	5.240e-015	3.719e-015	-14.281	-14.430	-0.149
	Fe(OH)4-	1.434e-015	1.317e-015	-14.843	-14.881	-0.037

	Fe+3	7.361e-019	3.691e-019	-18.133	-18.433	-0.300
	FeSO4+	9.698e-020	8.901e-020	-19.013	-19.051	-0.037
	Fe(SO4)2-	6.236e-023	5.724e-023	-22.205	-22.242	-0.037
	FeHSO4+2	8.819e-026	6.258e-026	-25.055	-25.204	-0.149
	Fe2(OH)2+4	2.831e-027	7.182e-028	-26.548	-27.144	-0.596
	Fe3(OH)4+5	1.489e-035	1.746e-036	-34.827	-35.758	-0.931
H(0)		6.594e-017				
	H2	3.297e-017	3.302e-017	-16.482	-16.481	0.001
Mg		9.052e-004				
	Mg+2	8.687e-004	6.252e-004	-3.061	-3.204	-0.143
	MgHCO3+	3.315e-005	3.043e-005	-4.480	-4.517	-0.037
	MgSO4	3.038e-006	3.043e-006	-5.517	-5.517	0.001
	MgCO3	2.645e-007	2.649e-007	-6.578	-6.577	0.001
	MgOH+	2.341e-009	2.149e-009	-8.631	-8.668	-0.037
Mn(2)		1.457e-006				
	Mn+2	1.088e-006	7.838e-007	-5.963	-6.106	-0.143
	MnHCO3+	3.302e-007	3.030e-007	-6.481	-6.519	-0.037
	MnCO3	3.481e-008	3.486e-008	-7.458	-7.458	0.001
	MnSO4	3.213e-009	3.218e-009	-8.493	-8.492	0.001
	MnOH+	2.389e-011	2.193e-011	-10.622	-10.659	-0.037
Mn(3)		6.463e-033				
	Mn+3	6.463e-033	2.988e-033	-32.190	-32.525	-0.335
O(0)		0.000e+000				
	O2	0.000e+000	0.000e+000	-64.552	-64.551	0.001
S(6)		5.207e-005				
	SO4-2	4.380e-005	3.128e-005	-4.359	-4.505	-0.146
	CaSO4	5.192e-006	5.200e-006	-5.285	-5.284	0.001
	MgSO4	3.038e-006	3.043e-006	-5.517	-5.517	0.001
	FeSO4	3.047e-008	3.052e-008	-7.516	-7.515	0.001
	MnSO4	3.213e-009	3.218e-009	-8.493	-8.492	0.001
	HSO4-	6.117e-010	5.615e-010	-9.213	-9.251	-0.037
	ZnSO4	5.620e-010	5.629e-010	-9.250	-9.250	0.001
	CaHSO4+	7.110e-012	6.526e-012	-11.148	-11.185	-0.037
	CuSO4	6.151e-013	6.161e-013	-12.211	-12.210	0.001
	Zn(SO4)2-2	2.279e-013	1.617e-013	-12.642	-12.791	-0.149
	FeHSO4+	5.398e-014	4.954e-014	-13.268	-13.305	-0.037
	FeSO4+	9.698e-020	8.901e-020	-19.013	-19.051	-0.037
	Fe(SO4)2-	6.236e-023	5.724e-023	-22.205	-22.242	-0.037
	FeHSO4+2	8.819e-026	6.258e-026	-25.055	-25.204	-0.149
Zn		1.836e-007				
	Zn+2	1.215e-007	8.678e-008	-6.916	-7.062	-0.146
	ZnHCO3+	5.163e-008	4.739e-008	-7.287	-7.324	-0.037
	ZnCO3	9.679e-009	9.695e-009	-8.014	-8.013	0.001
	ZnSO4	5.620e-010	5.629e-010	-9.250	-9.250	0.001
	Zn(CO3)2-2	1.635e-010	1.161e-010	-9.786	-9.935	-0.149
	ZnOH+	1.235e-010	1.133e-010	-9.908	-9.946	-0.037
	Zn(OH)2	1.728e-011	1.731e-011	-10.762	-10.762	0.001
	Zn(SO4)2-2	2.279e-013	1.617e-013	-12.642	-12.791	-0.149
	Zn(OH)3-	2.374e-016	2.179e-016	-15.625	-15.662	-0.037
	Zn(OH)4-2	1.937e-022	1.374e-022	-21.713	-21.862	-0.149

----------Saturation indices----------
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Phase	SI	log IAP	log KT	
Anhydrite	-3.18	-7.52	-4.34	CaSO4

Aragonite	-1.01	-9.27	-8.25	CaCO3
Calcite	-0.86	-9.27	-8.41	CaCO3
CO2(g)	-1.23	-19.45	-18.22	CO2
Dolomite	-2.00	-18.72	-16.72	CaMg(CO3)2
Fe(OH)3(a)	-3.52	-14.77	18.29	Fe(OH)3
Goethite	1.80	14.77	12.96	FeOOH
Gypsum	-2.93	-7.52	-4.59	CaSO4:2H2O
H2(g)	-13.40	-13.40	0.00	H2
H2O(g)	-1.92	-0.00	1.92	H2O
Hausmannite	-30.28	34.68	64.97	Mn3O4
Hematite	5.54	29.53	24.00	Fe2O3
Manganite	-11.55	13.79	25.34	MnOOH
Melanterite	-7.23	-9.64	-2.41	FeSO4:7H2O
O2(g)	-61.66	26.80	88.46	O2
Pyrochroite	-8.11	7.09	15.20	Mn(OH)2
Pyrolusite	-23.43	20.49	43.93	MnO2
Rhodochrosite	-1.28	-12.36	-11.07	MnCO3
Siderite	-0.59	-11.39	-10.79	FeCO3
Smithsonite	-3.48	-13.31	-9.83	ZnCO3
Zn(OH)2(e)	-5.36	6.14	11.50	Zn(OH)2

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End of simulation.
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Reading input data for simulation 2.
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End of run.
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Appendix B

Groundwater Quality & Elevation

Surface Water Quality

Trends

Foth & Van Dyke
Memorandum

January 25, 2002

TO: Jana Murphy, Flambeau Mining Co.

CC: Jim Hutchison, Foth & Van Dyke
Jerry Sevick, Foth & Van Dyke

FR: Steve Lehrke, Foth & Van Dyke SL

RE: Flambeau Mining Company - 2001 Annual Report Groundwater and Surface Water Trends

Background

The groundwater and surface water sample results collected between July of 1991 and November of 2001 for the monitoring program have been graphically displayed and tested statistically to determine whether any significant increasing or decreasing trends are occurring in groundwater or surface water chemistry. Groundwater quality results during this time period are listed in Table 1A, and surface water quality results during this time period are listed in Table 2A. Trend graphs of the groundwater (compliance boundary) and surface water quality results are presented in Attachments 1 and 2, respectively. Trend graphs of groundwater elevations are presented in Attachment 3.

It should be noted that MW-1000P was damaged in the first quarter in 1996 and was replaced with MW-1000P-R at the exact same location and the same specifications. This monitoring point will be referred to as MW-1000P-R in this report.

Groundwater concentration trends of the in-pit wells and wells MW-1015A and MW-1015B were also statistically analyzed. The statistical trend results, along with tabulated data and historical trend graphs, are included as Attachment 4. The in-pit wells are MW-1013, MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B, MW-1014C. Wells MW-1015A and MW-1015B were constructed in January 2001 approximately 1000 ft. northwest of the backfilled pit and adjacent to the compliance boundary. Baseline data for these two wells has been collected on a monthly basis since April, 2001.

Statistical Methods

Since the data sets are becoming large, and there is a significant amount of data available following mining production, October of 1997 was selected as the start date for the trend tests. October of 1997 is the beginning of the "post-mining" period.

The non-parametric Mann-Kendall test for trend was used to statistically determine existing trends in the post-mining data. This test indicates whether any general increasing or decreasing trends have occurred during this time frame. The results of the trend tests are best used in conjunction with the trend graphs of Attachments 1, 2, 3 and 4 to properly evaluate trend conditions. It should be noted that a statistically increasing or decreasing trend does not necessarily indicate a substantial increase or decrease in parameter concentrations.

The procedure for the Mann-Kendall test is given in Gilbert (1987)1[1]. The Type I error for each test was set to 0.01.

As can be seen in the groundwater and surface water trend graphs (Attachments 1 and 2), several parameters had initially high detection limits which were later reduced. This resulted in detections at lower levels than the initial detection limits. Since the non-detected values with high detection limits cause increased uncertainty in the trend tests, all non-detects which were greater than two times the historically minimum detected value were omitted from the trend analysis.

Summary statistics for each parameter and well, along with the trend analysis results are given in Table 1B for groundwater and Table 2B for surface water. In the trend test results, a "+" indicates a statistically increasing trend and a "-" indicates a statistically decreasing trend. If neither a "+" or "-" is given, no statistically significant trend is present.

Trend Results

The main conclusions which may be reached from the trend graphs and statistical trend tests are as follows:

- MW-1000P-R: Several parameters exhibited an increase in concentrations at the beginning of the post-mining period. These are conductivity, alkalinity, hardness, iron, manganese, sulfate and TDS. Of these parameters, only alkalinity continues to be statistically increasing.

- MW-1002: During the post-mining period, alkalinity and hardness have statistically increasing trends. However, concentration levels are very similar to those observed during the pre-mining period (prior to January of 1993). The currently increasing trend of these two parameters reflects an increase to pre-mining levels after a decrease during the production period. A decreasing trend of copper was also indicated by the statistical test for MW-1002.

- MW-1002G: A statistically increasing trend of alkalinity was observed during the post-mining period, however actual concentrations are increasing by only a very small amount, and are within ranges observed prior to this time period.

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[1]Gilbert, R.O., 1987. "Statistical Methods for Environmental Pollution Monitoring", Van Nostrand Reinhold, New York.

- MW-1004P: A statistically increasing trend of iron was observed for the post-mining period, however current concentrations are well below those observed during the pre-mining period. A decreasing trend of TDS is observed in this well.

- MW-1004S: Statistically decreasing trends of conductivity and alkalinity were observed, along with an increasing trend of sulfate. The current conductivity and alkalinity concentrations are similar to those of the pre-mining period. Sulfate concentrations are increasing above historical levels by about 10-15 mg/L.

- MW-1005: Statistically decreasing trends of conductivity, alkalinity, hardness, iron and manganese were observed for the post-mining period. Levels of all of these parameters have generally decreased below pre-mining and production levels.

- MW-1005P: A statistically decreasing trend of sulfate is occurring. Sulfate has not been detected in this well over the last nine sampling events.

- MW-1005S: A statistically increasing trend of manganese occurred for MW-1005S during the post-mining period, but actual change in concentration was very slight. A statistically decreasing trend of sulfate is also occurring during this time period.

- MW-1010P: A statistically decreasing trend of conductivity and increasing trend of iron are occurring during the post-mining period for this well. Iron increased significantly during October of 2000, but since then has actually returned to levels seen historically, hence the trend noted by the statistical test is most likely reversed.

Several trends were noted for the in-pit wells and the new MW-1015 well nest. These are as follows:

- MW-1013B: An increasing trend of manganese is occurring in this well, however, the latest result revealed a decrease in concentration.

- MW-1013C: Iron and manganese have statistically increasing trends. Similar to MW-1013B, the latest result was a decrease in concentration.

- MW-1014B: Cadmium and manganese have statistically decreasing trends.

- MW-1014C: Statistically decreasing trends were noted for hardness, iron, manganese, zinc and conductivity.

- MW-1015A: A statistically decreasing trend of barium and increasing trend of manganese was observed, but actual changes in concentration are slight.

- MW-1015B: A decreasing trend of manganese was observed.

No significant trends were noted for the surface water results.

Recovery of groundwater elevations in MW-1000PR seem to have stabilized during the end of 1998 and remain so. Overall, the groundwater elevation data continued to show that the groundwater system is recovering.

Conclusions

Parameter concentrations of conductivity, hardness, iron, manganese, sulfate and TDS in MW-1000P-R seem to have stabilized correspondingly with the stabilization of groundwater elevations. Alkalinity in MW-1000P-R and sulfate in MW-1004S have currently increasing trends and need continued evaluation. MW-1005 has decreasing trends of conductivity, alkalinity, hardness, iron and manganese. The increase of iron in MW-1010P during October of 2000 reversed and returned levels seen historically.

Of the in-pit wells, an increasing trend of iron was noted for MW-1013B and MW-1013C. However, iron, along with zinc and conductivity were decreasing in MW-14C

No trends were noted for the surface water samples.

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-91	Oct-91	Jan-92	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93
MW-1000P-R									
Conductivity(Field)	umhos	225	327	190	183.2	194	201	203	198
pH(Field)	S.U.	8.39	7.41	5.75	6.91	6.64	6.9	6.22	6.24
Alkalinity	mg/l	65	90	88	84	81	95	84	82
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	0.014	< 0.014	< 0.014	0.02
Hardness	mg/l	84	110	110	88	120	100	88	90
Iron	mg/l	0.65	0.84	1.7	1.3	0.47	0.8	0.15	0.27
Manganese	mg/l	0.85	0.88	0.82	0.83	0.73	0.78	0.71	0.94
Sulfate	mg/l	< 10	< 10	11	14	12	12	< 10	12
TDS	mg/l	190	160	120	120	140	160	100	130
Zinc	mg/l								
MW-1002									
Conductivity(Field)	umhos	157	189	138	145	118	181	127	136
pH(Field)	S.U.	8.33	6.78	6.88	6.05	5.61	6.94	6.96	6.33
Alkalinity	mg/l	50	49	47	49	41	53	53	66
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	60	60	67	48	120	82	66	90
Iron	mg/l	0.99	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	0.059	< 0.01
Manganese	mg/l	0.0051	< 0.004	< 0.004	< 0.004	< 0.004	0.015	0.0047	< 0.004
Sulfate	mg/l	< 10	< 10	< 10	11	< 10	11	< 10	9
TDS	mg/l	160	170	100	85	87	130	90	120
Zinc	mg/l								
MW-1002G									
Conductivity(Field)	umhos	277	272	221	199	198	254	197	239
pH(Field)	S.U.	7.56	6.98	6.93	6.25	6.02	6.94	7.14	6.13
Alkalinity	mg/l	86	88	80	84	79	85	75	44
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	100	120	110	110	160	130	94	76
Iron	mg/l	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.01
Manganese	mg/l	0.0054	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Sulfate	mg/l	< 10	10	11	14	11	11	12	8
TDS	mg/l	240	280	140	150	150	180	98	74
Zinc	mg/l								
MW-1004P									
Conductivity(Field)	umhos	175	352	302	282	295	342	291	329
pH(Field)	S.U.	8.15	7.15	6.8	6.88	6.74	7.46	6.24	7.74
Alkalinity	mg/l	160	170	160	170	160	190	170	170
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	150	170	150	160	170	180	160	160
Iron	mg/l	0.33	0.22	0.32	0.37	0.38	0.32	0.39	< 0.01
Manganese	mg/l	0.13	0.13	0.12	0.14	0.13	0.13	0.14	< 0.004
Sulfate	mg/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10	3
TDS	mg/l	210	310	160	180	180	260	160	160
Zinc	mg/l								
MW-1004S									
Conductivity(Field)	umhos	161	135	146	153	175	258	174	168
pH(Field)	S.U.	8.64	7.25	7.03	6.7	6.5	6.96	6.37	7.77
Alkalinity	mg/l	50	49	27	60	74	100	73	51
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	60	60	62	72	150	110	92	70
Iron	mg/l	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.055	< 0.01
Manganese	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Sulfate	mg/l	< 10	10	11	12	< 10	< 10	< 10	11
TDS	mg/l	160	170	95	100	110	220	95	120
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-93	Oct-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95	Apr-95
MW-1000P-R									
Conductivity(Field)	umhos	217	233	135	124	133	116	116	106
pH(Field)	S.U.	6.6	7.03	6.9	7.7	7.5	7.2	7.1	7.4
Alkalinity	mg/l	82	62	43	44	39	34	30	38
Copper	mg/l	0.016	0.013	0.022	0.023	0.017	0.058	0.052	0.058
Hardness	mg/l	86	120	54	54	49	36	36	35
Iron	mg/l	0.061	0.032	< 0.015	0.021	0.026	0.047	0.12	0.026
Manganese	mg/l	0.73	0.91	0.34	0.5	0.42	0.36	0.29	0.32
Sulfate	mg/l	15	12	12	12	11	17	9.0	14.0
TDS	mg/l	140	110	70	95	90	120	88	90
Zinc	mg/l								
MW-1002									
Conductivity(Field)	umhos	273	138	151	105	109.4	122	143.2	106
pH(Field)	S.U.	6.83	7.52	7.5	7.5	7	7	6.7	7.4
Alkalinity	mg/l	42	42	39	35	31	38	38	42
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.0016	< 0.0005	0.002
Hardness	mg/l	52	52	50	45	44	46	47	42
Iron	mg/l	0.034	< 0.015	< 0.015	< 0.015	< 0.015	0.0056	0.0073	0.0039
Manganese	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.0005	0.0027	0.0003
Sulfate	mg/l	10	6	7	7	6.6	6.1	6.2	7.3
TDS	mg/l	100	78	82	86	94	87	120	170
Zinc	mg/l								
MW-1002G									
Conductivity(Field)	umhos	480	262	278	267	238	269	301	255
pH(Field)	S.U.	6.72	7.38	7	7.4	6.7	6.8	6.7	6.9
Alkalinity	mg/l	64	82	94	92	92	88	90	93
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.0016	< 0.0005	0.0014
Hardness	mg/l	80	110	120	120	120	110	110	100
Iron	mg/l	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.0054	0.0072	0.0044
Manganese	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.0005	0.0021	< 8.6E-05
Sulfate	mg/l	11	11	14	12	12	14	12	15
TDS	mg/l	140	190	180	170	170	200	240	170
Zinc	mg/l								
MW-1004P									
Conductivity(Field)	umhos	347	329	371	287	317	303	315	292
pH(Field)	S.U.	7.4	7.61	7.3	7.4	7.1	7.1	6.7	7.4
Alkalinity	mg/l	170	170	140	160	160	170	170	170
Copper	mg/l	< 0.012	< 0.012	< 0.012	0.015	< 0.012	< 0.0016	0.0033	0.011
Hardness	mg/l	150	160	150	150	150	160	150	130
Iron	mg/l	0.042	0.048	< 0.015	0.033	0.024	0.035	0.014	0.025
Manganese	mg/l	0.022	0.04	0.02	0.045	0.028	0.029	0.029	0.031
Sulfate	mg/l	5	3	2	3	2.5	3.9	1.7	4.7
TDS	mg/l	180	230	160	180	190	200	190	250
Zinc	mg/l								
MW-1004S									
Conductivity(Field)	umhos	178	186	123	109	200	124	142.4	131
pH(Field)	S.U.	7	7.41	7	7.8	6.8	6.7	6.2	6.7
Alkalinity	mg/l	24	32	42	38	140	44	100	55
Copper	mg/l	< 0.012	< 0.012	0.016	< 0.012	< 0.012	< 0.0016	0.0011	0.007
Hardness	mg/l	56	46	44	51	52	54	57	45
Iron	mg/l	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.0064	0.0049	0.0087
Manganese	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.0005	0.0034	0.0009
Sulfate	mg/l	11	9	10	8	8	8.6	7.1	7.8
TDS	mg/l	110	98	74	100	100	150	140	150
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-95	Oct-95	Jan-96	Apr-96	Jul-96	Oct-96	Jan-97	Apr-97
MW-1000P-R									
Conductivity(Field)	umhos	116	119	112.4	149.4	113.5	109	112.4	132.9
pH(Field)	S.U.	8.1	7.3	6.86	7.07	7.26	7.4	7.22	7.46
Alkalinity	mg/l	34	36	27	53	35	38	27	36
Copper	mg/l	0.043	0.061	0.049	0.031	0.033	0.057	0.033	0.032
Hardness	mg/l	36	39	33	40	38	36	33	43
Iron	mg/l	0.0096	0.027	0.011	0.018	0.0066	0.01	0.0093	0.043
Manganese	mg/l	0.24	0.11	0.054	0.064	0.12	0.14	0.15	0.19
Sulfate	mg/l	10	11	8.5	16	9.3	7.1	9.8	9.9
TDS	mg/l	99	75	87	130	140	76	160	160
Zinc	mg/l								
MW-1002									
Conductivity(Field)	umhos	99	120	153.7	142.2	119.6	155.1	123.8	140
pH(Field)	S.U.	7.2	6.6	6.98	6.75	6.78	6.9	7.47	7.4
Alkalinity	mg/l	33	30	35	32	34	41	42	41
Copper	mg/l	0.001	0.0016	< 0.0007	0.0017	0.0016	0.0035	0.00099	0.00079
Hardness	mg/l	35	38	41	36	97	42	46	46
Iron	mg/l	< 0.0017	0.0040	0.0031	0.017	0.021	0.0063	0.011	0.007
Manganese	mg/l	0.0004	0.0014	0.0001	0.001	0.0005	0.0002	0.00018	0.00087
Sulfate	mg/l	5.3	7.9	5.4	5.9	5.9	6.9	6.3	7
TDS	mg/l	76	86	65	120	94	85	110	110
Zinc	mg/l								
MW-1002G									
Conductivity(Field)	umhos	275	239	232	264	221	226	245	260
pH(Field)	S.U.	6.9	6.9	6.79	6.55	6.71	6.8	7.15	7
Alkalinity	mg/l	90	100	85	110	79	86	80	81
Copper	mg/l	< 0.0007	< 0.0007	< 0.0007	< 0.0007	< 0.0005	< 0.0005	0.0019	0.00054
Hardness	mg/l	100	110	100	100	93	93	96	100
Iron	mg/l	0.0019	< 0.0017	< 0.0017	0.0039	0.0038	0.0039	0.0024	0.0029
Manganese	mg/l	< 8.6E-05	< 8.6E-05	< 8.6E-05	0.0001	< 0.0002	< 0.0002	0.00018	0.00018
Sulfate	mg/l	11	14	11	11	11	11	9.6	10
TDS	mg/l	190	160	150	220	200	120	180	200
Zinc	mg/l								
MW-1004P									
Conductivity(Field)	umhos	317	308	295	258	287	340	238	311
pH(Field)	S.U.	7.2	7.0	7.3	6.93	7.21	7.2	7.42	7.25
Alkalinity	mg/l	170	170	150	150	150	160	160	140
Copper	mg/l	0.02	0.0043	0.0033	0.0073	0.0033	0.0059	0.0062	0.016
Hardness	mg/l	130	150	130	130	130	120	120	130
Iron	mg/l	0.044	0.0086	0.0094	0.011	0.0047	0.0042	0.015	0.008
Manganese	mg/l	0.077	0.028	0.027	0.022	0.017	0.014	0.034	0.017
Sulfate	mg/l	1.8	8.1	2.3	4.2	4.3	4.2	5.5	6.9
TDS	mg/l	190	170	150	210	200	160	220	210
Zinc	mg/l								
MW-1004S									
Conductivity(Field)	umhos	126.3	144.9	144.9	168.2	153.5	159.5	163.7	165.8
pH(Field)	S.U.	6.9	6.3	6.61	5.84	6.31	6.3	7.03	6.51
Alkalinity	mg/l	50	79	50	61	55	66	61	60
Copper	mg/l	0.0066	0.0076	0.0034	0.0026	0.0039	0.0018	0.0051	0.0018
Hardness	mg/l	50	59	54	52	46	59	62	59
Iron	mg/l	0.0031	0.0040	0.0038	0.0048	0.0023	0.0049	0.0061	0.0049
Manganese	mg/l	0.0005	0.0013	0.0011	0.0003	0.0007	0.0003	0.00025	0.00072
Sulfate	mg/l	6.2	9.4	5.8	6.2	6.9	6.5	6.6	8.2
TDS	mg/l	110	110	120	130	130	100	150	110
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-97	Oct-97	Jan-98	Apr-98	Jul-98	Oct-98	Jan-99	Apr-99
MW-1000P-R									
Conductivity(Field)	umhos	107.1	132	576	888	1097	1338	1293	1319
pH(Field)	S.U.	6.72	6.55	6.47	6.69	6.28	6.24	6.15	6.2
Alkalinity	mg/l	33	40	54	93	71	100	120	120
Copper	mg/l	0.029	0.034	0.04	0.098	0.066	0.053	0.037	0.054
Hardness	mg/l	39	45	110	470	480	570	760	740
Iron	mg/l	0.0079	0.0044	0.0061	0.044	0.076	0.012	1.2	1.2
Manganese	mg/l	0.061	0.11	0.49	3	1.8	2	4.8	5.3
Sulfate	mg/l	7.8	5.9	180	310	350	480	560	440
TDS	mg/l	110	82	96	770	250	960	1200	1300
Zinc	mg/l								
MW-1002									
Conductivity(Field)	umhos	118.4	114	109.8	131.7	124.8	158	142.9	160
pH(Field)	S.U.	6.38	6.02	7.15	7.32	6.55	7.13	7.29	6.6
Alkalinity	mg/l	30	40	40	30	44	52	54	52
Copper	mg/l	0.0013	0.00086	0.0014	0.00086	0.0009	0.00056 <	0.00054	0.00051
Hardness	mg/l	45	46	47	37	50	57	60	59
Iron	mg/l	0.0087	0.003	0.034	0.05	0.0077	0.0096	0.012	0.0018
Manganese	mg/l	0.0008	0.00052	0.00026	0.0017	0.00092	0.0004	0.00071 <	0.00041
Sulfate	mg/l	6.6	6	7.6 <	5	8.2	6.9	8.3	7.3
TDS	mg/l	88	76	82	89	100	120	92	72
Zinc	mg/l								
MW-1002G									
Conductivity(Field)	umhos	271	228	218	245	215	194	215	248
pH(Field)	S.U.	6.51	6.35	6.85	6.97	6.81	7	6.54	6.5
Alkalinity	mg/l	78	88	82	75	82	76	85	85
Copper	mg/l	0.00054	0.00054 <	0.00054 <	0.00054	0.00069 <	0.00054 <	0.00054 <	0.00047
Hardness	mg/l	100	98	100	98	93	97	97	95
Iron	mg/l	0.0051	0.001	0.0034	0.0047	0.0038 <	0.001	0.0035 <	0.001
Manganese	mg/l	0.00018	0.00018 <	0.00018	0.00021 <	0.00018 <	0.00018	0.00024 <	0.00041
Sulfate	mg/l	9.3	7.8	12	11	13	13	11	9.8
TDS	mg/l	200	160	150	180	180	120	160	100
Zinc	mg/l								
MW-1004P									
Conductivity(Field)	umhos	277	349	271	303	292	327	267	294
pH(Field)	S.U.	6.94	6.91	7.13	7.41	7.08	7.06	7.47	6.7
Alkalinity	mg/l	140	150	150	96	160	140	160	160
Copper	mg/l	0.014	0.04	0.027	0.02	0.01	0.005	0.0026	0.0032
Hardness	mg/l	140	140	140	130	130	140	140	130
Iron	mg/l	0.0035	0.0047	0.012	0.0064	0.0077	0.0094	0.007	0.0066
Manganese	mg/l	0.012	0.01	0.012	0.0099	0.032	0.012	0.012	0.009
Sulfate	mg/l	6.5	5.3	8.8	8.5	9.2	8.6	7.6	6.6
TDS	mg/l	200	120	140	170	220	150	140	140
Zinc	mg/l								
MW-1004S									
Conductivity(Field)	umhos	202	201	140.1	164.6	162.3	324	141.8	157
pH(Field)	S.U.	6.36	6.13	6.6	7.97	6.5	6.29	6.59	6.1
Alkalinity	mg/l	55	58	48	47	40	48	44	46
Copper	mg/l	0.002	0.0016	0.0016	0.00092	0.0014	0.0011	0.0006	0.0017
Hardness	mg/l	64	75	58	60	60	60	59	60
Iron	mg/l	0.0091	0.0057	0.0027	0.0049	0.0054	0.0029	0.005	0.0037
Manganese	mg/l	0.00038	0.00093	0.0003	0.00052	0.00029	0.00045	0.00062	0.00087
Sulfate	mg/l	8	15	11	10	13	14	11	10
TDS	mg/l	130	100	120	140	140	98	120	82
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-99	Oct-99	Jan-00	Apr-00	Jul-00	Oct-00	Jan-01	Apr-01
MW-1000P-R									
Conductivity(Field)	umhos	1310	1400	1300	1274	1200	1189	1192	1200
pH(Field)	S.U.	6.1	6.7	6.3	6.9	6.3	6.2	6.13	5.9
Alkalinity	mg/l	130	130	140	140	140	170	180	170
Copper	mg/l	0.13	0.017	0.0019	0.019	0.0073 <	0.0026 <	0.0026	0.014
Hardness	mg/l	770	760	670	720	710	680	610	650
Iron	mg/l	3.3	3.6	4.4	3.4	2.3	6.6	6.8	1.3
Manganese	mg/l	5.4	5.2	4.1	3.8	5	4.2	3.7	2.9
Sulfate	mg/l	380	680	610	560	550	460	440	480
TDS	mg/l	1300	1100	1000	920	930	1100	1000	910
Zinc	mg/l	0.89	0.73			0.62	0.9	0.81	0.6
MW-1002									
Conductivity(Field)	umhos	149	140	170	166	160	125	156.3	130
pH(Field)	S.U.	6.7	7	6.9	6.8	6.7	6.4	6.55	6.5
Alkalinity	mg/l	50	46	57	55	52	47	58	60
Copper	mg/l	< 0.0047 <	0.00047 <	0.00047	0.00091 <	0.00053 <	0.0005 <	0.0005 <	0.0027
Hardness	mg/l	58	51	65	67	66	58	66	72
Iron	mg/l	0.0027	0.029 <	0.001	0.0039 <	0.005 <	0.005 <	0.005	0.012
Manganese	mg/l	< 0.00041 <	0.00041 <	0.00041 <	0.00041 <	0.002 <	0.002 <	0.002 <	0.002
Sulfate	mg/l	5.9	6.9	5.6	5.2	5.7	5.7	6.7	6.4
TDS	mg/l	110	91	110	98	110	120	120	99
Zinc	mg/l	< 0.012			<	0.012 <	0.012 <	0.012 <	0.012
MW-1002G									
Conductivity(Field)	umhos	227	240	240	239	220	223	253	200
pH(Field)	S.U.	7	7.2	7.1	6.8	6.6	6.6	6.48	6.3
Alkalinity	mg/l	84	87	87	89	90	89	90	89
Copper	mg/l	< 0.0047 <	0.00047 <	0.00047 <	0.0006 <	0.00053 <	0.0005 <	0.0005 <	0.0027
Hardness	mg/l	100	100	98	100	110	110	99	110
Iron	mg/l	0.0022	0.0061	0.0031	0.0027 <	0.005 <	0.005 <	0.005 <	0.005
Manganese	mg/l	< 0.00041 <	0.00041 <	0.00041 <	0.00041 <	0.002 <	0.002 <	0.002 <	0.002
Sulfate	mg/l	11	12	12	11	12	12	12	12
TDS	mg/l	180	150	120	140	160	150	150	170
Zinc	mg/l	< 0.012			<	0.012 <	0.012 <	0.012 <	0.012
MW-1004P									
Conductivity(Field)	umhos	308	320	310	293	300	284	293	260
pH(Field)	S.U.	7.1	7.4	6.7	6.9	6.3	7.2	7.25	7
Alkalinity	mg/l	160	160	160	160	160	160	160	160
Copper	mg/l	< 0.0069	0.0019 <	0.00047	0.0017	0.00065	0.0008 <	0.0005 <	0.0027
Hardness	mg/l	140	140	130	140	150	140	130	140
Iron	mg/l	0.014	0.014	0.085	0.012	0.0086	0.008	0.085	0.055
Manganese	mg/l	0.01	0.0081	0.056	0.0079	0.022	0.016	0.052	0.054
Sulfate	mg/l	3	2.8 <	5 <	5 <	5 <	5 <	5 <	5
TDS	mg/l	180	180	150	170	160	200	130	160
Zinc	mg/l	< 0.012 <	0.012		<	0.012 <	0.012 <	0.012 <	0.012
MW-1004S									
Conductivity(Field)	umhos	158	160	160	156	150	134	139.3	130
pH(Field)	S.U.	5.9	6.5	6.7	6.9	6.6	6	5.9	5.5
Alkalinity	mg/l	40	41	43	42	41	35	39	35
Copper	mg/l	< 0.0069	0.00083 <	0.00047	0.0013	0.0012	0.001 <	0.0005 <	0.0027
Hardness	mg/l	59	57	59	56	61	58	56	60
Iron	mg/l	0.0068	0.0089	0.0051	0.0027 <	0.005 <	0.005 <	0.005 <	0.005
Manganese	mg/l	0.0023	0.00063	0.00065 <	0.00041 <	0.002 <	0.002 <	0.002 <	0.002
Sulfate	mg/l	10	15	16	15	16	18	19	19
TDS	mg/l	100	84	110	98	100	130	100	73
Zinc	mg/l	< 0.012 <	0.012		<	0.012 <	0.012 <	0.012 <	0.012

Prepared By: SGL Checked By: JBH1

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units		Jul-01		Oct-01
MW-1000P-R					
Conductivity(Field)	umhos		1130		1109
pH(Field)	S.U.		5.99		5.97
Alkalinity	mg/l		180		190
Copper	mg/l	<	0.013	<	0.013
Hardness	mg/l		660		560
Iron	mg/l		7.1		2.8
Manganese	mg/l		3.9		3.3
Sulfate	mg/l		450		450
TDS	mg/l		950		940
Zinc	mg/l		0.86		0.44
MW-1002					
Conductivity(Field)	umhos		123		123.3
pH(Field)	S.U.		6.12		6.03
Alkalinity	mg/l		54		53
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		67		57
Iron	mg/l	<	0.005	<	0.005
Manganese	mg/l	<	0.002	<	0.002
Sulfate	mg/l		7.6		7.1
TDS	mg/l		79		140
Zinc	mg/l	<	0.012	<	0.012
MW-1002G					
Conductivity(Field)	umhos		202		203
pH(Field)	S.U.		6.63		6.1
Alkalinity	mg/l		89		89
Copper	mg/l		0.0036	<	0.0027
Hardness	mg/l		110		94
Iron	mg/l	<	0.005	<	0.005
Manganese	mg/l	<	0.002	<	0.002
Sulfate	mg/l		11		11
TDS	mg/l		120		140
Zinc	mg/l		0.019	<	0.012
MW-1004P					
Conductivity(Field)	umhos		260		260
pH(Field)	S.U.		6.9		6.81
Alkalinity	mg/l		150		160
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		150		130
Iron	mg/l		0.015		0.1
Manganese	mg/l		0.014		0.065
Sulfate	mg/l	<	5	<	5
TDS	mg/l		160		130
Zinc	mg/l	<	0.012	<	0.012
MW-1004S					
Conductivity(Field)	umhos		122		121.3
pH(Field)	S.U.		5.6		5.73
Alkalinity	mg/l		34		34
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		60		51
Iron	mg/l	<	0.005	<	0.005
Manganese	mg/l	<	0.002	<	0.002
Sulfate	mg/l		22		23
TDS	mg/l		96		110
Zinc	mg/l	<	0.012	<	0.012

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-91	Oct-91	Jan-92	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93
MW-1005									
Conductivity(Field)	umhos	1028	981	870	905	912	1013	945	971
pH(Field)	S.U.	7.73	7.34	6.12	6.32	6.01	6.13	6.21	6.11
Alkalinity	mg/l	84	92	86	90	90	110	94	78
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	380	360	1000	520	440	420	400	500
Iron	mg/l	17	20	18	17	19	22	24	24
Manganese	mg/l	0.51	0.49	0.46	0.38	0.44	0.47	0.52	0.54
Sulfate	mg/l	15	12	14	16	15	15	23	15
TDS	mg/l	570	770	530	680	640	600	140	630
Zinc	mg/l								
MW-1005P									
Conductivity(Field)	umhos	512	479	391	417	426	501	440	458
pH(Field)	S.U.	8.49	7.66	6.85	6.97	6.81	7.26	6.39	6.52
Alkalinity	mg/l	260	260	260	260	270	270	260	250
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	230	230	240	240	260	260	240	250
Iron	mg/l	1.2	1	0.75	1	0.95	1.2	1.1	0.46
Manganese	mg/l	0.22	0.15	0.16	0.13	0.15	0.1	0.11	0.15
Sulfate	mg/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10	2
TDS	mg/l	290	440	280	350	270	320	220	240
Zinc	mg/l								
MW-1005S									
Conductivity(Field)	umhos	377	351	303	324	331	391	418	360
pH(Field)	S.U.	7.68	7.37	6.88	7.48	6.68	7.38	6.99	6.38
Alkalinity	mg/l	170	170	170	180	170	190	180	81
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.01
Hardness	mg/l	170	170	250	290	220	270	180	210
Iron	mg/l	3	3.8	3.6	3.7	4.1	3.9	4.1	4.4
Manganese	mg/l	0.21	0.22	0.21	0.2	0.21	0.2	0.21	0.23
Sulfate	mg/l	< 10	< 10	< 10	< 10	< 10	< 10	10	8
TDS	mg/l	220	370	< 20	210	220	260	160	200
Zinc	mg/l								
MW-1010P									
Conductivity(Field)	umhos	337	326	292	314	285	389	357	357
pH(Field)	S.U.	8.47	8.26	6.87	7.62	6.86	7.49	7.21	6.62
Alkalinity	mg/l	140	160	150	160	160	180	190	170
Copper	mg/l	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014	< 0.014
Hardness	mg/l	140	130	130	140	180	160	130	130
Iron	mg/l	< 0.055	< 0.055	0.15	< 0.055	< 0.055	< 0.055	< 0.055	0.055
Manganese	mg/l	0.26	0.28	0.25	0.2	0.086	0.14	0.031	0.14
Sulfate	mg/l	< 10	10	16	14	< 10	< 10	32	28
TDS	mg/l	180	250	200	340	180	280	210	270
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-93	Oct-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95	Apr-95
MW-1005									
Conductivity(Field)	umhos	110	1005	1072	1082	1093	1028	1035	1014
pH(Field)	S.U.	6.12	6.68	6.3	7.6	6.2	6.1	6.2	6.2
Alkalinity	mg/l	74	84	81	88	75	78	84	79
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.0016	< 0.0005	0.0013
Hardness	mg/l	410	390	440	450	450	420	370	320
Iron	mg/l	18	25	24	24	31	28	29	28
Manganese	mg/l	0.42	0.61	0.53	0.54	0.69	0.63	0.65	0.6
Sulfate	mg/l	18	17	18	13	14	20	14	18
TDS	mg/l	590	680	560	620	600	820	660	770
Zinc	mg/l								
MW-1005P									
Conductivity(Field)	umhos	519	462	487	487	456	452	511	420
pH(Field)	S.U.	7.59	7.53	7.3	7.2	6.9	7.2	7.1	7.5
Alkalinity	mg/l	250	250	250	250	240	250	270	270
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.0016	0.0044	0.0037
Hardness	mg/l	230	220	230	230	230	250	230	200
Iron	mg/l	0.61	0.17	0.19	0.2	0.22	0.24	0.04	0.08
Manganese	mg/l	0.14	0.069	0.035	0.16	0.1	0.062	0.041	0.041
Sulfate	mg/l	3	< 2	< 2	< 2	< 2	2.5	< 0.56	< 0.56
TDS	mg/l	260	300	260	270	270	280	340	300
Zinc	mg/l								
MW-1005S									
Conductivity(Field)	umhos	372	321	357	344	322	320	425	315
pH(Field)	S.U.	7.28	7.28	7.2	7.5	6.9	7.3	6.7	7.0
Alkalinity	mg/l	170	170	160	160	160	160	160	160
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.0016	< 0.0005	< 0.0007
Hardness	mg/l	160	160	160	160	160	160	150	130
Iron	mg/l	4.2	4.2	4	4.1	4.1	3.7	4.2	4.0
Manganese	mg/l	0.22	0.24	0.2	0.2	0.2	0.19	0.22	0.2
Sulfate	mg/l	9	6	9	8	7.2	13	8.9	9.3
TDS	mg/l	200	220	190	200	210	240	240	190
Zinc	mg/l								
MW-1010P									
Conductivity(Field)	umhos	313	294	283	276	322	309	337	311
pH(Field)	S.U.	7.21	7.51	7.3	7.4	7.2	7.5	7.6	7.4
Alkalinity	mg/l	150	160	160	160	160	160	160	170
Copper	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.0032	0.0067	0.0097
Hardness	mg/l	130	130	150	150	150	150	160	130
Iron	mg/l	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.0046	0.0040	0.0050
Manganese	mg/l	0.035	0.018	0.17	0.014	0.01	0.014	0.06	0.051
Sulfate	mg/l	11	5	3	3	3.4	4.5	3.3	5.0
TDS	mg/l	180	230	170	180	190	200	250	240
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-95	Oct-95	Jan-96	Apr-96	Jul-96	Oct-96	Jan-97	Apr-97
MW-1005									
Conductivity(Field)	umhos	1049	976	963	967	858	948	921	812
pH(Field)	S.U.	6.3	6.2	6.17	5.97	6.07	6.2	5.91	6.34
Alkalinity	mg/l	75	55	78	73	68	64	79	66
Copper	mg/l	< 0.0007	< 0.0007	< 0.0007	< 0.0007	< 0.0005	0.005	0.015	0.0045
Hardness	mg/l	320	360	330	300	300	320	300	280
Iron	mg/l	28	32	28	23	19	17	23	21
Manganese	mg/l	0.64	0.7	0.6	0.55	0.47	0.43	0.54	0.51
Sulfate	mg/l	14	21	14	14	14	14	13	12
TDS	mg/l	730	740	560	530	650	550	600	620
Zinc	mg/l								
MW-1005P									
Conductivity(Field)	umhos	454	470	464	486	441	471	462	480
pH(Field)	S.U.	7.2	7.2	7.31	6.85	6.9	7.2	7.04	7
Alkalinity	mg/l	280	260	240	250	240	260	260	250
Copper	mg/l	0.0018	0.0021	< 0.0007	< 0.0007	0.0039	0.0082	0.0027	0.0016
Hardness	mg/l	200	230	210	210	210	200	210	220
Iron	mg/l	0.07	0.17	0.28	0.049	0.064	0.37	0.073	0.41
Manganese	mg/l	0.09	0.072	0.097	0.035	0.14	0.067	0.024	0.077
Sulfate	mg/l	< 0.56	5.3	0.93	2.2	2.6	3.6	5.4	5.8
TDS	mg/l	290	260	270	300	300	280	280	320
Zinc	mg/l								
MW-1005S									
Conductivity(Field)	umhos	358	354	360	329	323	329	321	344
pH(Field)	S.U.	6.9	7.1	7.27	6.8	6.8	7.1	6.8	6.8
Alkalinity	mg/l	170	170	160	160	150	160	160	160
Copper	mg/l	< 0.0007	< 0.0007	< 0.0007	< 0.0007	< 0.0005	0.0006	0.004	0.0016
Hardness	mg/l	140	160	140	140	140	130	140	150
Iron	mg/l	3.8	4.3	3.7	3.9	3.6	3.6	3.8	4.1
Manganese	mg/l	0.2	0.22	0.2	0.2	0.19	0.2	0.2	0.21
Sulfate	mg/l	6.9	14	7	7.6	8.8	8	7.4	9.5
TDS	mg/l	220	220	190	240	230	220	250	250
Zinc	mg/l								
MW-1010P									
Conductivity(Field)	umhos	315	291	313	309	285	302	282	346
pH(Field)	S.U.	7.6	7.4	7.01	7.16	7.42	7.6	7.23	7.43
Alkalinity	mg/l	160	140	140	160	140	150	140	150
Copper	mg/l	0.021	0.063	0.045	0.016	0.074	0.039	0.056	0.015
Hardness	mg/l	130	140	130	140	130	130	130	150
Iron	mg/l	0.0017	0.037	0.0023	0.0036	< 0.001	0.0026	0.0018	0.008
Manganese	mg/l	0.011	0.021	0.013	0.1	0.12	0.021	0.028	0.12
Sulfate	mg/l	2.4	9.6	3.4	3.8	5.9	5.8	5.8	6.7
TDS	mg/l	200	200	180	200	200	170	180	170
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-97	Oct-97	Jan-98	Apr-98	Jul-98	Oct-98	Jan-99	Apr-99
MW-1005									
Conductivity(Field)	umhos	755	804	782	725	644	724	598	596
pH(Field)	S.U.	6.22	6	6.1	6.06	6.16	6.12	6.21	6.3
Alkalinity	mg/l	63	77	71	69	130	65	74	69
Copper	mg/l	0.0059	0.00054 <	0.00054 <	0.00054 <	0.00054 <	0.00054 <	0.00054 <	0.00047
Hardness	mg/l	300	280	260	250	240	250	230	200
Iron	mg/l	29	23	21	21	17	19	20	20
Manganese	mg/l	0.8	0.59	0.49	0.5	0.4	0.46	0.47	0.48
Sulfate	mg/l	12	10	14	13	16	17	12	11
TDS	mg/l	220	510	490	440	440	430	370	430
Zinc	mg/l								
MW-1005P									
Conductivity(Field)	umhos	448	505	456	461	458	477	449	464
pH(Field)	S.U.	7.03	6.9	7.06	7.36	7.01	6.96	7.6	7
Alkalinity	mg/l	240	240	250	240	260	230	250	250
Copper	mg/l	0.002	0.00054	0.00073	0.0011 <	0.00054	0.0019 <	0.00054	0.0011
Hardness	mg/l	230	230	220	210	220	220	220	210
Iron	mg/l	0.087	0.17	0.41	0.077	0.34	0.17	0.066	0.049
Manganese	mg/l	0.066	0.062	0.072	0.029	0.1	0.063	0.027	0.023
Sulfate	mg/l	6.7	5	11	9.6	12	9.4	7.8	7.8
TDS	mg/l	280	260	270	280	270	250	250	230
Zinc	mg/l								
MW-1005S									
Conductivity(Field)	umhos	689	351	313	332	305	327	319	297
pH(Field)	S.U.	6.83	6.77	7.09	7.19	6.7	6.82	6.87	7
Alkalinity	mg/l	140	150	170	140	160	150	170	160
Copper	mg/l	0.00071	0.00054 <	0.00054 <	0.00054	0.011 <	0.00054 <	0.00054 <	0.00047
Hardness	mg/l	150	150	120	140	150	150	150	140
Iron	mg/l	4	4.2	3.3	4.2	3.9	3.9	4	4.1
Manganese	mg/l	0.2	0.21	0.17	0.2	0.2	0.21	0.2	0.21
Sulfate	mg/l	9.8	6.2	11	11	15	13	8.9	8.6
TDS	mg/l	260	190	200	250	230	180	180	210
Zinc	mg/l								
MW-1010P									
Conductivity(Field)	umhos	295	303	284	294	284	309	288	284
pH(Field)	S.U.	7.25	7.03	7.4	7.64	7.24	7.53	7.01	7.1
Alkalinity	mg/l	130	140	140	130	150	130	140	160
Copper	mg/l	0.048	0.03	0.026	0.019	0.027	0.02	0.024	0.012
Hardness	mg/l	140	140	130	130	130	130	130	140
Iron	mg/l	0.001	0.001 <	0.001	0.0034	0.0034 <	0.001	0.0046	0.019
Manganese	mg/l	0.026	0.029	0.029	0.043	0.029	0.022	0.02	0.067
Sulfate	mg/l	7	5.1	9.2	5.6	11	8.6	8.3	7.6
TDS	mg/l	170	170	190	170	160	190	170	140
Zinc	mg/l								

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units	Jul-99	Oct-99	Jan-00	Apr-00	Jul-00	Oct-00	Jan-01	Apr-01
MW-1005									
Conductivity(Field)	umhos	603	570	600	598	520	530	520	460
pH(Field)	S.U.	6.2	6.5	6.8	6.8	6.6	6.2	6.18	5.6
Alkalinity	mg/l	65	65	85	66	64	58	58	61
Copper	mg/l	< 0.0047	< 0.00047	< 0.00047	0.00067	0.0007	0.0006 <	0.0005 <	0.0027
Hardness	mg/l	200	190	200	190	210	190	160	170
Iron	mg/l	19	18	16	18	20	17	16	15
Manganese	mg/l	0.46	0.41	0.53	0.41	0.6	0.39	0.37	0.35
Sulfate	mg/l	12	17	16	13	15	15	15	14
TDS	mg/l	530	400	300	400	470	430	300	370
Zinc	mg/l	< 0.012			<	0.012 <	0.012 <	0.012 <	0.012
MW-1005P									
Conductivity(Field)	umhos	501	460	480	483	460	448	454	430
pH(Field)	S.U.	6.9	7.3	6.7	7.3	6.5	7.3	7.17	6.7
Alkalinity	mg/l	240	240	250	250	250	240	250	240
Copper	mg/l	< 0.0047	< 0.00047	< 0.00047	0.0006 <	0.00053	0.0007 <	0.0005 <	0.0027
Hardness	mg/l	220	220	200	220	230	220	210	220
Iron	mg/l	0.054	0.97	0.14	0.37	0.058	0.13	0.058	0.055
Manganese	mg/l	0.051	0.088	0.047	0.08	0.075	0.038	0.024	0.027
Sulfate	mg/l	7.3 <	1.5 <	5 <	5 <	5 <	5 <	5 <	5
TDS	mg/l	250	260	280	220	290	260	260	290
Zinc	mg/l	< 0.012			<	0.012 <	0.012 <	0.012 <	0.012
MW-1005S									
Conductivity(Field)	umhos	331	320	380	354	330	330	335	310
pH(Field)	S.U.	6.7	7	6.7	7	6.5	7.3	6.95	6.7
Alkalinity	mg/l	160	160	170	170	170	170	170	170
Copper	mg/l	< 0.0047	< 0.00047	< 0.00047	0.0006 <	0.00053 <	0.0005 <	0.0005 <	0.0027
Hardness	mg/l	150	150	150	150	170	160	150	160
Iron	mg/l	4.3	4.1	3.9	4.2	4.6	4.3	4.1	4.4
Manganese	mg/l	0.22	0.21	0.21	0.22	0.24	0.22	0.21	0.23
Sulfate	mg/l	9.5	5.6 <	5 <	5 <	5 <	5 <	5 <	5
TDS	mg/l	240	210	210	230	200	210	200	210
Zinc	mg/l	< 0.012			<	0.012 <	0.012 <	0.012 <	0.012
MW-1010P									
Conductivity(Field)	umhos	296	300	280	283	290	268	270	250
pH(Field)	S.U.	7.2	7.6	6.8	7.1	6.5	7.5	7.57	7.1
Alkalinity	mg/l	150	150	140	140	140	150	160	150
Copper	mg/l	0.012	0.0035	0.0022	0.0099	0.014	0.0043 <	0.0005	0.0055
Hardness	mg/l	140	140	130	150	140	140	140	140
Iron	mg/l	0.0074	0.0096	0.017	0.0066 <	0.025	0.41	0.17	0.066
Manganese	mg/l	0.059	0.065	0.039	0.024	0.026	0.25	0.18	0.064
Sulfate	mg/l	5.5	5.3 <	5 <	5 <	5 <	5 <	5 <	5
TDS	mg/l	200	170	130	140	190	220	170	130
Zinc	mg/l	< 0.012 <	0.012		<	0.06 <	0.012 <	0.012 <	0.012

Table 1A

Groundwater Quality Results
July 1991 Through October 2001

Well/Parameter	Units		Jul-01		Oct-01
MW-1005					
Conductivity(Field)	umhos		493		530
pH(Field)	S.U.		5.87		5.72
Alkalinity	mg/l		53		49
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		190		170
Iron	mg/l		15		12
Manganese	mg/l		0.42		0.34
Sulfate	mg/l		14		15
TDS	mg/l		330		450
Zinc	mg/l	<	0.012	<	0.012
MW-1005P					
Conductivity(Field)	umhos		428		424
pH(Field)	S.U.		7.13		6.63
Alkalinity	mg/l		230		240
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		230		200
Iron	mg/l		0.087		0.2
Manganese	mg/l		0.049		0.068
Sulfate	mg/l	<	5	<	5
TDS	mg/l		250		270
Zinc	mg/l	<	0.012	<	0.012
MW-1005S					
Conductivity(Field)	umhos		308		306
pH(Field)	S.U.		6.91		6.45
Alkalinity	mg/l		170		170
Copper	mg/l	<	0.0027	<	0.0027
Hardness	mg/l		170		140
Iron	mg/l		4.4		3.9
Manganese	mg/l		0.23		0.21
Sulfate	mg/l	<	5	<	5
TDS	mg/l		190		230
Zinc	mg/l	<	0.012	<	0.012
MW-1010P					
Conductivity(Field)	umhos		250		246
pH(Field)	S.U.		7.08		6.63
Alkalinity	mg/l		140		150
Copper	mg/l	<	0.0027		0.0053
Hardness	mg/l		150		120
Iron	mg/l		0.16		0.0097
Manganese	mg/l		0.15		0.018
Sulfate	mg/l		6		5.4
TDS	mg/l		140		180
Zinc	mg/l	<	0.012	<	0.012

.000116

Table 1B

Groundwater Quality Results, Summary Statistics and Trend Analysis
October 1997 Through October 2001

Well/Parameter	Total Samples	Total Detections	# Of Samples Included In Trend Test(*)	Mann-Kendall S	p-Level	
MW-1000P-R						
Conductivity(Field)	17	17	17	1	0.984	
pH(Field)	17	17	17	-62	0.01	
Alkalinity	17	17	17	125	0	+
Copper	17	13	15	-50	0.014	
Hardness	17	17	17	21	0.416	
Iron	17	17	17	91	0.99	
Manganese	17	17	17	24	0.348	
Sulfate	17	17	17	40	0.108	
TDS	17	17	17	23	0.37	
Zinc	8	8	8	-10	0.276	
MW-1002						
Conductivity(Field)	17	17	17	11	0.686	
pH(Field)	17	17	17	-60	0.014	
Alkalinity	17	17	17	69	0.004	+
Copper	17	7	13	-32	0.007	-
Hardness	17	17	17	78	0	+
Iron	17	11	12	-11	0.503	
Manganese	17	6	11	-24	0.073	
Sulfate	17	16	17	-7	0.808	
TDS	17	17	17	52	0.034	
Zinc	7	0	7	0	1	
MW-1002G						
Conductivity(Field)	17	17	17	-16	0.542	
pH(Field)	17	17	17	-36	0.152	
Alkalinity	17	17	17	80	0	+
Copper	17	3	14	-23	0.064	
Hardness	17	17	17	42	0.092	
Iron	17	9	11	2	0.32	
Manganese	17	3	6	5	0.47	
Sulfate	17	17	17	5	0.872	
TDS	17	17	17	-26	0.308	
Zinc	7	1	7	4	0.667	
MW-1004P						
Conductivity(Field)	17	17	17	-54	0.028	
pH(Field)	17	17	17	-30	0.236	
Alkalinity	17	17	17	35	0.164	
Copper	17	11	13	-67	0.06	
Hardness	17	17	17	12	0.656	
Iron	17	17	17	71	0.002	+
Manganese	17	17	17	42	0.092	
Sulfate	17	9	17	-82	0	-
TDS	17	17	17	4	0.904	
Zinc	8	0	8	0	1	
MW-1004S						
Conductivity(Field)	17	17	17	-85	0	-
pH(Field)	17	17	17	-53	0.031	
Alkalinity	17	17	17	-99	0	-
Copper	17	11	13	-30	0.076	
Hardness	17	17	17	-42	0.092	
Iron	17	11	17	-50	0.85	
Manganese	17	10	11	6	0.676	
Sulfate	17	17	17	89	0	+
TDS	17	17	17	-30	0.236	
Zinc	8	0	8	0	1	

Table 1B

Groundwater Quality Results, Summary Statistics and Trend Analysis
October 1997 Through October 2001

Well/Parameter	Total Samples	Total Detections	# Of Samples Included In Trend Test(*)	Mann-Kendall S	p-Level	
MW-1005						
Conductivity(Field)	17	17	17	-105	0	-
pH(Field)	17	17	17	8	0.776	
Alkalinity	17	17	17	-91	0	-
Copper	17	3	13	-5	0.566	
Hardness	17	17	17	-103	0	-
Iron	17	17	17	-95	0	-
Manganese	17	17	17	-64	0.008	-
Sulfate	17	17	17	21	0.416	
TDS	17	17	17	-51	0.038	
Zinc	7	0	7	0	1	
MW-1005P						
Conductivity(Field)	17	17	17	-59	0.016	
pH(Field)	17	17	17	-27	0.289	
Alkalinity	17	17	17	-19	0.465	
Copper	17	6	13	-23	0.184	
Hardness	17	17	17	-11	0.686	
Iron	17	17	17	-24	0.348	
Manganese	17	17	17	-17	0.516	
Sulfate	17	8	17	-65	0.007	-
TDS	17	17	17	7	0.808	
Zinc	7	0	7	0	1	
MW-1005S						
Conductivity(Field)	17	17	17	-15	0.57	
pH(Field)	17	17	17	-25	0.328	
Alkalinity	17	17	17	62	0.01	
Copper	17	2	13	-36	0.18	
Hardness	17	17	17	49	0.047	
Iron	17	17	17	42	0.092	
Manganese	17	17	17	68	0.004	+
Sulfate	17	9	17	-81	0	-
TDS	17	17	17	4	0.904	
Zinc	7	0	7	0	1	
MW-1010P						
Conductivity(Field)	17	17	17	-80	0	-
pH(Field)	17	17	17	-31	0.22	
Alkalinity	17	17	17	34	0.176	
Copper	17	15	17	-86	0.06	
Hardness	17	17	17	34	0.176	
Iron	17	14	16	76	0	+
Manganese	17	17	17	23	0.37	
Sulfate	17	11	17	-59	0.016	
TDS	17	17	17	-15	0.57	
Zinc	8	0	8	0	1	

+ : Implies Statistically Increasing Trend
- : Implies Statistically Decreasing Trend

(*) If the value of a sample is below the detection limit, three situations apply:
1) If the detection limit is equal to or less than the minimum detected value, the result is replaced with zero.
2) If the detection limit is greater than the minimum detected value, but less than or equal to two times the minimum detected value, the result is replaced with the minimum detected value.
3) If the detection limit is greater than two times the minimum detected value the result is omitted from the trend analysis.

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Jul-91	Oct-91	Jan-92	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93
SW-1									
Conductivity(Field)	umhos	112	102	84	74	86	134	136	84
pH(Field)	S.U.	7.43	7.92	6.95	6.71	6.75	7.23	6.71	7.07
Alkalinity	mg/l								
Aluminum	mg/l	< 0.4	0.08	0.7	0.75	0.14	0.42	0.11	0.13
Arsenic	mg/l	< 0.001	< 0.002	≤ 0.002	< 0.002	< 0.002	≤ 0.002	≤ 0.002	≤ 0.002
Beryllium	mg/l	< 0.2	< 0.2	< 0.2	< 0.001	< 0.001	< 0.001	≤ 0.001	≤ 0.001
Cadmium	mg/l	< 0.0002	0.001	< 0.0002	< 0.0002	0.0006	< 0.0002	0.0007	< 0.0002
Chromium	mg/l	0.0027	< 0.002	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chromium IV	mg/l	0.01	< 0.02	0.009	< 0.02	< 0.018	< 0.02	< 0.005	< 0.005
Copper	mg/l	< 0.003	0.004	0.003	0.005	0.002	0.004	< 0.002	< 0.002
Diss O2	mg/l	6.2	11	12	11.2	7.4	9.9	11	6.8
Hardness	mg/l	100	46	50	34	23	52	52	40
Iron	mg/l								
Lead	mg/l	0.0012	< 0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Manganese	mg/l								
Mercury	mg/l	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	mg/l	< 0.05	< 0.016	< 0.05	< 0.02	< 0.018	< 0.02	< 0.02	< 0.02
Selenium	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Silver	mg/l	< 0.0005	< 0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Sulfate	mg/l								
Sulfide	mg/l								
TDS	mg/l	140	98	90	86	90	90	100	66
TSS	mg/l	< 1	14	4	< 1	9	4	< 1	2
Zinc	mg/l	0.02	24	0.008	0.011	0.006	< 0.003	0.007	< 0.003
SW-2									
Conductivity(Field)	umhos	120	104	144	69	85	117	158	85
pH(Field)	S.U.	7.92	8.01	7.09	6.19	7.1	7.11	7.05	7.25
Alkalinity	mg/l								
Aluminum	mg/l	< 0.4	0.06	0.42	0.72	0.14	0.54	0.07	0.11
Arsenic	mg/l	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Beryllium	mg/l	< 0.2	< 0.2	< 0.2	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	mg/l	< 0.0002	0.0005	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium	mg/l	0.0012	< 0.002	0.002	< 0.001	0.001	< 0.001	< 0.001	< 0.001
Chromium IV	mg/l	0.009	< 0.02	0.007	< 0.02	< 0.013	< 0.02	< 0.005	< 0.005
Copper	mg/l	0.0042	< 0.002	0.004	< 0.002	< 0.002	0.004	0.004	0.002
Diss O2	mg/l	6.5	10	12	11.5	7.6	10	12	11
Hardness	mg/l	48	47	50	34	28	68	52	40
Iron	mg/l								
Lead	mg/l	0.0012	< 0.003	0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001
Manganese	mg/l								
Mercury	mg/l	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	mg/l	< 0.05	< 0.016	< 0.05	< 0.02	< 0.018	< 0.02	< 0.02	< 0.02
Selenium	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Silver	mg/l	< 0.0005	< 0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Sulfate	mg/l								
Sulfide	mg/l								
TDS	mg/l	140	85	87	120	120	96	110	74
TSS	mg/l	< 1	4	< 1	< 1	7	5	< 1	1
Zinc	mg/l	0.02	< 3	0.004	0.009	0.008	< 0.003	0.008	< 0.003

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Jul-93	Nov-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95	Apr-95
SW-1									
Conductivity(Field)	umhos	87	118.9	203	118	117	78	128.5	78.1
pH(Field)	S.U.	7.29	8.59	7.8	8	7.4	7.2	8.14	7.7
Alkalinity	mg/l								
Aluminum	mg/l	0.18	0.047	0.12	0.29	0.07	0.2	0.059	0.093
Arsenic	mg/l	0.0028	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.0014	< 0.0014
Beryllium	mg/l	< 0.0004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0003	< 0.0003
Cadmium	mg/l	< 0.0008	< 0.0006	< 0.0002	0.0004	< 0.0002	< 0.0008	< 0.0005	0.0002
Chromium	mg/l	< 0.002	0.004	< 0.001	0.0018	0.0018	0.0025	< 0.0006	0.0043
Chromium IV	mg/l	< 0.005		< 0.005	< 0.005	< 0.005	< 0.0015	< 0.0015	< 0.0015
Copper	mg/l	< 0.012	< 0.002	0.0044	< 0.002	0.0027	0.002	0.0078	< 0.0038
Diss O2	mg/l	10	9	11.9	5.8	8.5	10.1	9	9.3
Hardness	mg/l	44	56	64	43	48	36	48	36
Iron	mg/l								
Lead	mg/l	< 0.005	< 0.001	< 0.001	0.01	0.0025	0.0011	< 0.0008	0.0045
Manganese	mg/l								
Mercury	mg/l	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 9.5E-05	< 9.5E-05
Nickel	mg/l	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.0059	< 0.0059
Selenium	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.0015	< 0.0015
Silver	mg/l	< 0.002	< 0.0015	< 0.0005	< 0.0005	< 0.0005	< 0.0025	0.0016	0.0013
Sulfate	mg/l								
Sulfide	mg/l		< 2			< 2	< 2	< 2	< 2
TDS	mg/l	66	91	93	84	96	100	120	100
TSS	mg/l	5	< 1	1	3	< 1	8	8	10
Zinc	mg/l	< 0.003	< 0.003	0.007	0.009	0.011	0.017	0.016	< 0.012
SW-2									
Conductivity(Field)	umhos	100	132.6	151	124	119	82	158	86
pH(Field)	S.U.	7.14	7.93	8.1	8	7.6	7.1	8.19	7.7
Alkalinity	mg/l								
Aluminum	mg/l	0.36	0.072	0.036	0.31	0.14	0.22	0.26	0.12
Arsenic	mg/l	0.0027	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.0014	< 0.0014
Beryllium	mg/l	< 0.0004	< 0.001	< 0.001	< 0.001	0.0012	0.0012	0.0012	0.0006
Cadmium	mg/l	< 0.0008	< 0.0006	< 0.0002	< 0.0002	0.0002	< 0.0008	< 0.0005	< 0.0016
Chromium	mg/l	0.0021	0.004	< 0.001	0.0019	0.0023	0.0037	< 0.0006	0.0044
Chromium IV	mg/l	< 0.005		< 0.005	< 0.005	< 0.005	< 0.0015	< 0.0015	< 0.0015
Copper	mg/l	< 0.012	0.0032	< 0.002	0.0051	0.0036	0.0057	0.011	< 0.0038
Diss O2	mg/l	9.7	8.5	11.6	6.6	8.8	9.3	8.6	10.8
Hardness	mg/l	76	60	60	40	48	38	55	36
Iron	mg/l								
Lead	mg/l	< 0.005	< 0.001	< 0.001	< 0.001	0.0014	0.0015	0.0097	0.0061
Manganese	mg/l								
Mercury	mg/l	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 9.5E-05	< 9.5E-05
Nickel	mg/l	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.0059	< 0.0059
Selenium	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.0015	< 0.0015
Silver	mg/l	< 0.002	< 0.0015	< 0.0005	< 0.0005	< 0.0005	< 0.0025	< 0.0009	0.0018
Sulfate	mg/l								
Sulfide	mg/l		< 2			< 2	< 2	< 2	< 2
TDS	mg/l	100	88	83	82	100	92	150	81
TSS	mg/l	11	< 1	< 1	13	10	8	6	< 1
Zinc	mg/l	0.009	0.04	0.05	0.007	0.009	0.023	0.021	< 0.012

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Jul-95	Oct-95	Jan-96	Apr-96	Jul-96	Oct-96	Jan-97	Apr-97
SW-1									
Conductivity(Field)	umhos	105.5	112.5	150.5	124	94.5	153.5	113.3	58.9
pH(Field)	S.U.	7.18	7.74	7.15	6.5	7.53	7.95	7.57	6.82
Alkalinity	mg/l								
Aluminum	mg/l	0.06	0.096	< 0.025	0.037	0.14	0.046	0.064	0.26
Arsenic	mg/l	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018
Beryllium	mg/l	< 8.3E-05	0.0001	< 8.3E-05	< 8.3E-05	0.0002	< 8.3E-05	< 8.3E-05	< 8.3E-05
Cadmium	mg/l	< 0.0002	0.0002	0.0004	< 0.0002	0.0002	0.0003	< 0.00016	< 0.00016
Chromium	mg/l	< 0.0006	0.0014	0.0013	< 9.3E-06	0.0014	< 0.0006	0.0025	0.00082
Chromium IV	mg/l	< 0.0015	< 0.006	0.003	< 0.0015	< 0.029	0.004	< 0.0036	< 0.018
Copper	mg/l	< 0.0017	0.0037	< 0.0017	0.0033	0.0021	0.0019	< 0.0017	0.0018
Diss O2	mg/l	9.1	8.2	10.7	9.1	5.3	8.5	9.6	12.1
Hardness	mg/l	43	40	46	44	34	40	44	20
Iron	mg/l								
Lead	mg/l	< 0.002	0.0082	0.01	< 0.002	0.0027	< 0.002	0.0023	< 0.002
Manganese	mg/l								
Mercury	mg/l	< 9.5E-05	< 9.5E-05	< 9.5E-05	< 9.5E-05	0.0007	< 6.7E-05	< 6.7E-05	< 6.7E-05
Nickel	mg/l	< 0.0008	0.0026	< 0.0008	< 0.0008	0.0008	< 0.0008	< 0.00075	0.00076
Selenium	mg/l	< 0.0015	< 0.0015	< 0.0015	< 0.0015	0.0017	0.0025	0.0018	< 0.0015
Silver	mg/l	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.0015	< 0.0011	< 0.0011
Sulfate	mg/l								
Sulfide	mg/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
TDS	mg/l	80	120	86	120	120	16	100	98
TSS	mg/l	7	< 1	4	< 1	< 1	< 1	< 1	8
Zinc	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.021	0.013
SW-2									
Conductivity(Field)	umhos	170	126	120.2	153.1	106.8	274	132	89.6
pH(Field)	S.U.	7.38	7.95	7.01	6.76	7.41	7.86	7.61	6.51
Alkalinity	mg/l								
Aluminum	mg/l	0.043	0.12	< 0.025	0.071	0.091	0.047	0.058	0.24
Arsenic	mg/l	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	0.002	< 0.0018	< 0.0018
Beryllium	mg/l	< 8.3E-05	0.0001	< 8.3E-05	< 8.3E-05	0.0001	< 8.3E-05	< 8.3E-05	< 8.3E-05
Cadmium	mg/l	< 0.0002	0.0003	< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.00016	0.00016
Chromium	mg/l	< 0.0006	0.002	0.0014	< 9.3E-06	0.0012	< 0.0006	0.0021	< 0.0012
Chromium IV	mg/l	< 0.0015	< 0.006	0.003	< 0.0015	< 0.029	< 0.0036	< 0.0036	< 0.018
Copper	mg/l	< 0.0017	0.0043	< 0.0017	< 0.0017	0.0017	0.0043	< 0.0017	0.0026
Diss O2	mg/l	10.2	8.5	10.7	11.7	7.5	8.7	11.1	12.9
Hardness	mg/l	46	46	45	53	36	69	52	21
Iron	mg/l								
Lead	mg/l	< 0.002	0.0083	0.0096	< 0.002	0.0026	0.0022	0.0021	< 0.002
Manganese	mg/l								
Mercury	mg/l	< 9.5E-05	< 9.5E-05	< 9.5E-05	< 9.5E-05	< 9.5E-05	< 6.7E-05	< 6.7E-05	< 6.7E-05
Nickel	mg/l	< 0.0008	0.0008	< 0.0008	< 0.0008	< 0.0008	< 0.0008	< 0.00075	< 0.00075
Selenium	mg/l	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015
Silver	mg/l	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	0.0013	< 0.0011	0.0016
Sulfate	mg/l								
Sulfide	mg/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
TDS	mg/l	63	110	95	110	120	98	84	100
TSS	mg/l	6	3	< 1	< 1	< 1	< 1	3	4
Zinc	mg/l	< 0.012	0.013	< 0.012	< 0.012	< 0.012	0.023	< 0.012	0.017

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Jul-97	Oct-97	Jan-98	Apr-98	Jul-98	Oct-98	Jan-99	Mar-99
SW-1									
Conductivity(Field)	umhos	96.1	107.6	136.3	110	130			166.7
pH(Field)	S.U.	7.25	7.27	7.63	7	8.7			7.3
Alkalinity	mg/l								
Aluminum	mg/l	0.085	0.11	0.036	0.065	< 0.025			0.085
Arsenic	mg/l	< 0.0014	< 0.0014	< 0.0018	< 0.0018	< 0.0018		<	0.003
Beryllium	mg/l	0.00011	< 8.3E-05	< 8.3E-05	< 8.3E-05	< 8.3E-05		<	0.00015
Cadmium	mg/l	< 0.00016	< 0.00016	0.0002	< 0.00016	< 0.00016		<	0.00031
Chromium	mg/l	0.0011	< 0.00061	< 0.00061	< 0.00061	0.0011			0.00078
Chromium IV	mg/l	< 0.0036	< 0.0036	0.006	< 0.0036	< 0.0036		<	0.0036
Copper	mg/l	< 0.0017	0.0022	0.0076	< 0.0017	< 0.0017			0.00074
Diss O2	mg/l	6	6.9	8.7	8.5	8.2			9.3
Hardness	mg/l	35	39	46	29	41			58
Iron	mg/l								
Lead	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002		<	0.0024
Manganese	mg/l								
Mercury	mg/l	< 5E-05	< 5E-05	< 5E-05	0.00033	< 5E-05		<	5E-05
Nickel	mg/l	< 0.00075	< 0.00075	0.0019	0.001	< 0.00075		<	0.001
Selenium	mg/l	< 0.0016	< 0.0016	< 0.0016	< 0.0016	< 0.0016		<	0.0016
Silver	mg/l	< 0.0011	0.0011	< 0.0011	< 0.0011	< 0.0011		<	0.00047
Sulfate	mg/l								
Sulfide	mg/l	< 2	< 2	< 2	< 2	< 2		<	2
TDS	mg/l	94	72	84	71	70			110
TSS	mg/l	4	5	< 1	6	6			8
Zinc	mg/l	< 0.012	< 0.012	0.043	< 0.012	< 0.012		<	0.012
SW-2									
Conductivity(Field)	umhos	106.8	113.8	167.9	97	160			159.6
pH(Field)	S.U.	7.25	7.44	7.32	7	8.3			7.7
Alkalinity	mg/l								
Aluminum	mg/l	0.08	0.072	0.074	0.057	0.12			0.094
Arsenic	mg/l	< 0.0014	< 0.0014	< 0.0018	0.0043	< 0.0018		<	0.003
Beryllium	mg/l	0.00023	< 8.3E-05	< 8.3E-05	< 8.3E-05	0.00021		<	0.00015
Cadmium	mg/l	< 0.00016	< 0.00016	0.00023	< 0.00016	< 0.00016		<	0.00031
Chromium	mg/l	0.0012	0.0014	0.0032	< 0.00061	0.0016		<	0.00062
Chromium IV	mg/l	< 0.0036	< 0.0036	0.005	< 0.0036	< 0.0036			0.005
Copper	mg/l	< 0.0017	< 0.0017	0.012	< 0.0017	< 0.0017		<	0.0006
Diss O2	mg/l	6.1	8.1	8.5	8.7	8.6			9.7
Hardness	mg/l	37	40	49	28	52			57
Iron	mg/l								
Lead	mg/l	< 0.002	< 0.002	0.0021	< 0.002	0.002		<	0.0024
Manganese	mg/l								
Mercury	mg/l	< 5E-05	< 5E-05	6E-05	0.00013	< 5E-05		<	5E-05
Nickel	mg/l	0.0011	< 0.00075	0.0037	0.0013	< 0.00075		<	0.001
Selenium	mg/l	< 0.0016	< 0.0016	0.0026	0.004	< 0.0016		<	0.0016
Silver	mg/l	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011		<	0.00047
Sulfate	mg/l								
Sulfide	mg/l	< 2	< 2	< 2	< 2	< 2		<	2
TDS	mg/l	99	80	92	88	70			110
TSS	mg/l	3	< 1	3	5	12			11
Zinc	mg/l	< 0.012	< 0.012	0.089	< 0.012	< 0.012		<	0.012

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Apr-99	Nov-99	Jun-00	Nov-00	Jun-01
SW-1						
Conductivity(Field)	umhos	119.3	144	120	126	45
pH(Field)	S.U.	7.63	8.4	6.5	8	6.6
Alkalinity	mg/l			39		
Aluminum	mg/l	0.075		0.042		
Arsenic	mg/l	< 0.003		< 0.003		
Beryllium	mg/l	< 0.00015		< 0.00015		
Cadmium	mg/l	< 0.00031		< 0.00031		
Chromium	mg/l	< 0.00062		0.00092		
Chromium IV	mg/l	< 0.0036		< 0.018		
Copper	mg/l	< 0.0006	< 0.0006	0.00094	< 0.0012	< 0.0013
Diss O2	mg/l	7.8	7.5	6.3	11.5	
Hardness	mg/l	43	50	38	50	
Iron	mg/l		0.34	0.36	0.48	0.65
Lead	mg/l	< 0.0024		< 0.0024		
Manganese	mg/l		0.042	0.06	0.056	0.068
Mercury	mg/l	< 5E-05		< 5E-05		
Nickel	mg/l	< 0.001		< 0.001		
Selenium	mg/l	< 0.0016		< 0.0017		
Silver	mg/l	< 0.00047		< 0.00047		
Sulfate	mg/l		7.7	5.2	8.6	< 5
Sulfide	mg/l	< 2				
TDS	mg/l	78	38	180		
TSS	mg/l	5	3	< 1		
Zinc	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
SW-2						
Conductivity(Field)	umhos	124.7	139	120	125	44
pH(Field)	S.U.	7	8.3	5.5	7.6	6.8
Alkalinity	mg/l			39		
Aluminum	mg/l	0.077		0.16		
Arsenic	mg/l	< 0.003		< 0.003		
Beryllium	mg/l	< 0.00015		< 0.00015		
Cadmium	mg/l	< 0.00031		< 0.00031		
Chromium	mg/l	< 0.00062		0.0013		
Chromium IV	mg/l	< 0.0036		< 0.018		
Copper	mg/l	< 0.0006	< 0.0006	0.0013	< 0.0012	< 0.0013
Diss O2	mg/l	7.5	7.3	7.5	11.5	
Hardness	mg/l	44	48	40	49	
Iron	mg/l		0.34	0.54	0.46	0.66
Lead	mg/l	< 0.0024		< 0.0024		
Manganese	mg/l		0.038	0.089	0.053	0.066
Mercury	mg/l	< 5E-05		< 5E-05		
Nickel	mg/l	< 0.001		0.0016		
Selenium	mg/l	< 0.0016		< 0.0017		
Silver	mg/l	< 0.00047		< 0.00047		
Sulfate	mg/l		7.9	5.2	8.4	< 5
Sulfide	mg/l	< 2				
TDS	mg/l	79	28	85		
TSS	mg/l	4	4	10		
Zinc	mg/l	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012

Table 2A

Surface Water Quality Results
July 1991 Through November 2001

Station/Parameter	Units	Oct-01
SW-1		
Conductivity(Field)	umhos	140
pH(Field)	S.U.	7.1
Alkalinity	mg/l	
Aluminum	mg/l	
Arsenic	mg/l	
Beryllium	mg/l	
Cadmium	mg/l	
Chromium	mg/l	
Chromium IV	mg/l	
Copper	mg/l	< 0.0013
Diss O2	mg/l	
Hardness	mg/l	
Iron	mg/l	0.36
Lead	mg/l	
Manganese	mg/l	0.083
Mercury	mg/l	
Nickel	mg/l	
Selenium	mg/l	
Silver	mg/l	
Sulfate	mg/l	8.8
Sulfide	mg/l	
TDS	mg/l	
TSS	mg/l	
Zinc	mg/l	< 0.012
SW-2		
Conductivity(Field)	umhos	110
pH(Field)	S.U.	7.1
Alkalinity	mg/l	
Aluminum	mg/l	
Arsenic	mg/l	
Beryllium	mg/l	
Cadmium	mg/l	
Chromium	mg/l	
Chromium IV	mg/l	
Copper	mg/l	< 0.0013
Diss O2	mg/l	
Hardness	mg/l	
Iron	mg/l	0.39
Lead	mg/l	
Manganese	mg/l	0.095
Mercury	mg/l	
Nickel	mg/l	
Selenium	mg/l	
Silver	mg/l	
Sulfate	mg/l	8.9
Sulfide	mg/l	
TDS	mg/l	
TSS	mg/l	
Zinc	mg/l	< 0.012

Table 2B

Surface Water Summary Statistics and Trend Analysis
October 1997 Through October 2001

Station/Parameter	Total Samples	Total Detections	# Of Samples Included In Trend Test(*)	Mann-Kendall S	p-Level
SW-1					
Conductivity(Field)	11	11	11	5	0.762
pH(Field)	11	11	11	-6	0.705
Alkalinity	1	1	Not Currently Sampled		
Aluminum	7	6	Not Currently Sampled		
Arsenic	7	0	Not Currently Sampled		
Beryllium	7	0	Not Currently Sampled		
Cadmium	7	1	Not Currently Sampled		
Chromium	7	3	Not Currently Sampled		
Chromium IV	7	1	Not Currently Sampled		
Copper	11	4	9	-9	0.417
Diss O2	9	9	Not Currently Sampled		
Hardness	9	9	Not Currently Sampled		
Iron	5	5	5	5	0.359
Lead	7	0	Not Currently Sampled		
Manganese	5	5	5	8	0.084
Mercury	7	1	Not Currently Sampled		
Nickel	7	2	Not Currently Sampled		
Selenium	7	0	Not Currently Sampled		
Silver	7	1	Not Currently Sampled		
Sulfate	5	5	5	2	0.816
Sulfide	6	0	Not Currently Sampled		
TDS	8	8	Not Currently Sampled		
TSS	8	6	Not Currently Sampled		
Zinc	11	1	11	-8	0.595
SW-2					
Conductivity(Field)	11	11	11	-19	0.164
pH(Field)	11	11	11	-11	0.446
Alkalinity	1	1	Not Currently Sampled		
Aluminum	7	7	Not Currently Sampled		
Arsenic	7	1	Not Currently Sampled		
Beryllium	7	1	Not Currently Sampled		
Cadmium	7	1	Not Currently Sampled		
Chromium	7	4	Not Currently Sampled		
Chromium IV	7	2	Not Currently Sampled		
Copper	11	2	11	-10	0.494
Diss O2	9	9	Not Currently Sampled		
Hardness	9	9	Not Currently Sampled		
Iron	5	5	5	2	0.816
Lead	7	2	Not Currently Sampled		
Manganese	5	5	5	6	0.234
Mercury	7	2	Not Currently Sampled		
Nickel	7	3	Not Currently Sampled		
Selenium	7	2	Not Currently Sampled		
Silver	7	0	Not Currently Sampled		
Sulfate	5	5	5	2	0.816
Sulfide	6	0	Not Currently Sampled		
TDS	8	8	Not Currently Sampled		
TSS	8	7	Not Currently Sampled		
Zinc	11	1	11	-8	0.595

+ : Implies Statistically Increasing Trend
- : Implies Statistically Decreasing Trend

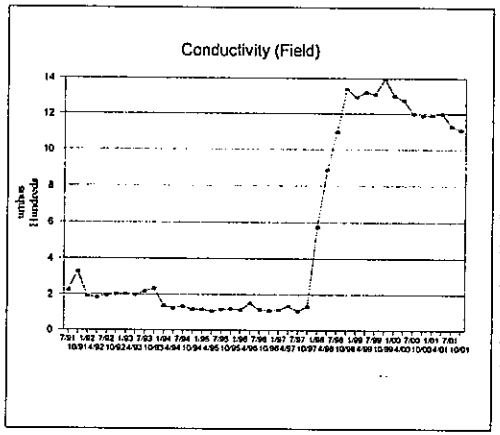
(*) If the value of a sample is below the detection limit, three situations apply:
1) If the detection limit is equal to or less than the minimum detected value, the result is replaced with zero.
2) If the detection limit is greater than the minimum detected value, but less than or equal to two times the minimum detected value, the result is replaced with the minimum detected value.
3) If the detection limit is greater than two times the minimum detected value the result is omitted from the trend analysis.

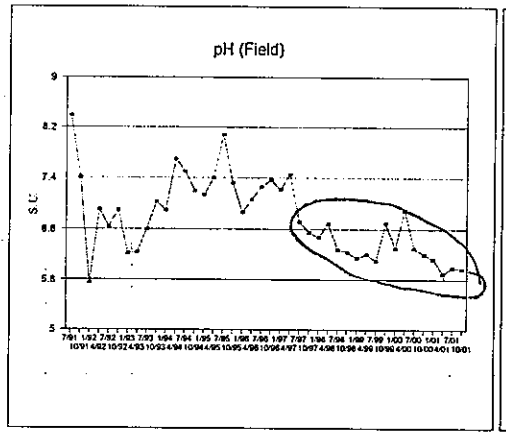
Attachment 1

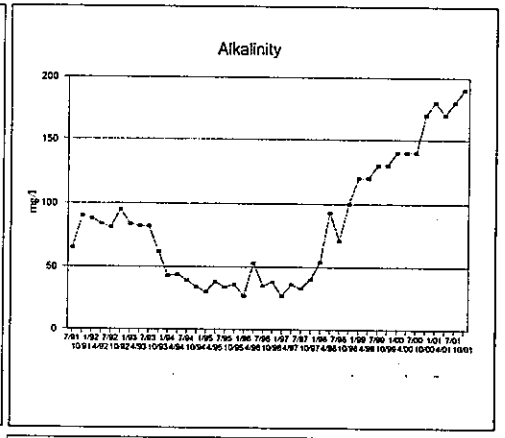
Trend Graphs (Groundwater)

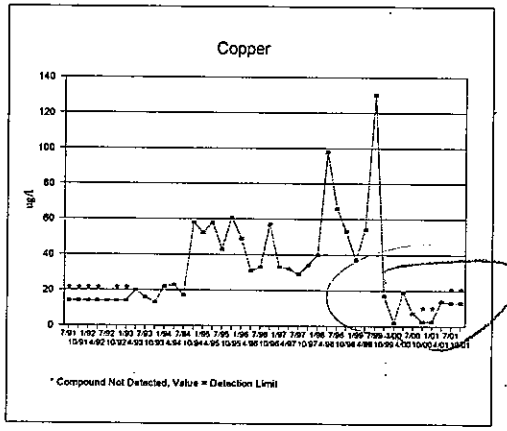
Flambeau Mining Company
Groundwater Quality Results

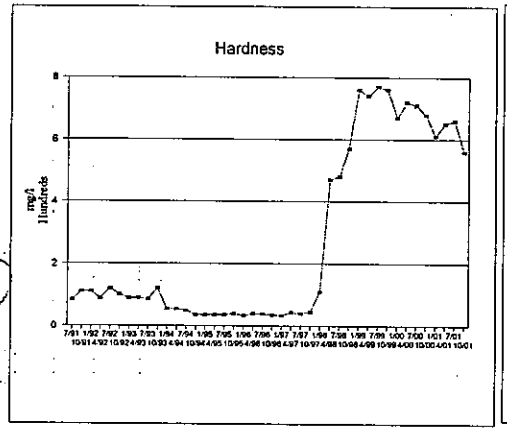
MW-1000P-R

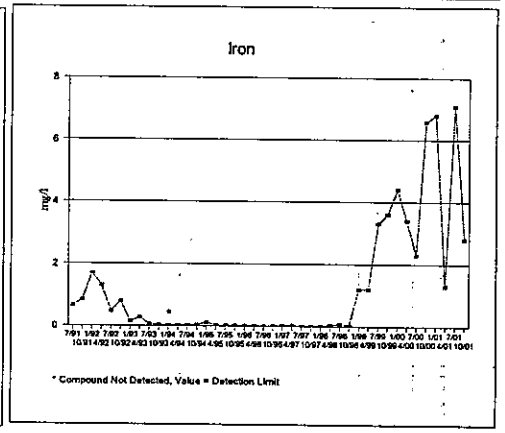


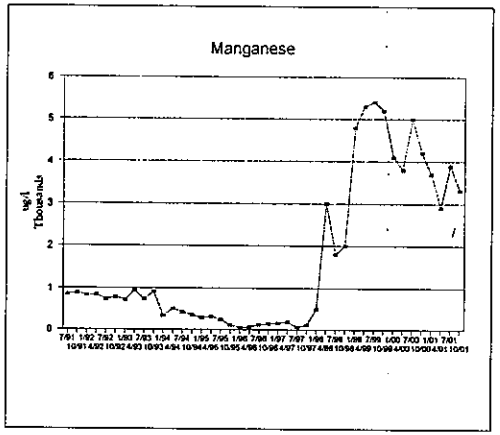


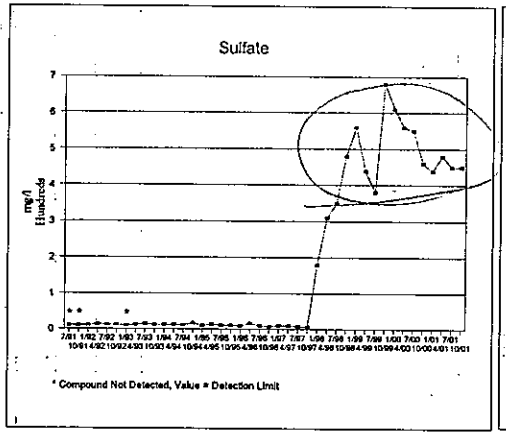


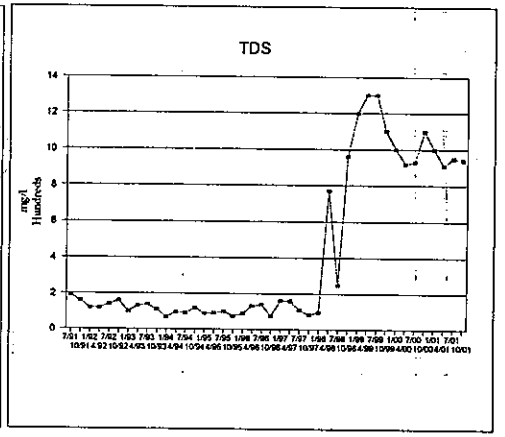








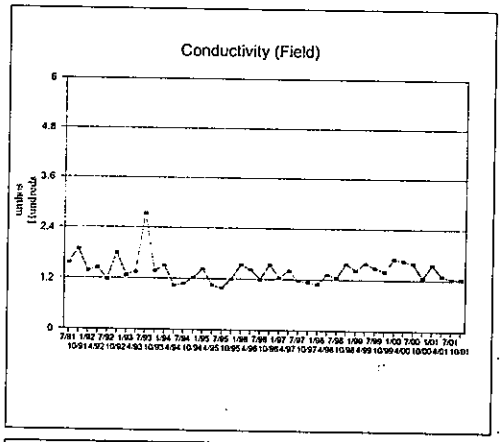


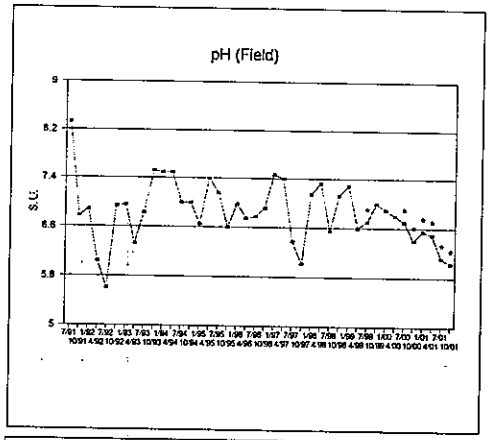


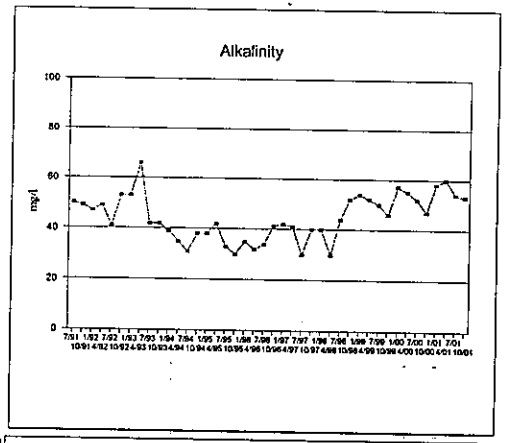
Prepared By: SGL Checked By: JBHT

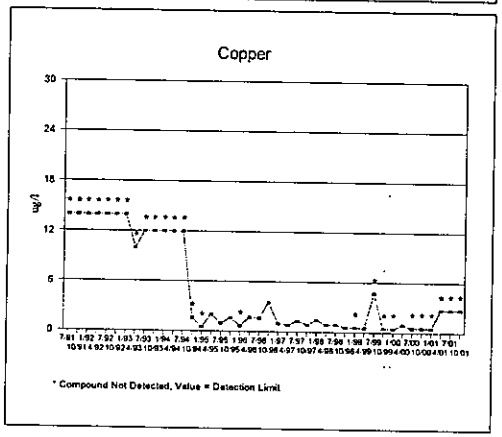
Flambeau Mining Company
Groundwater Quality Results

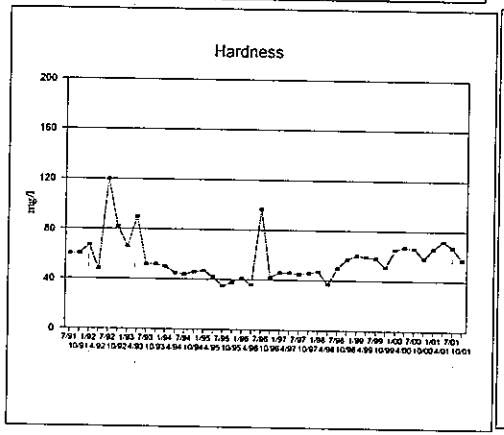
MW-1002

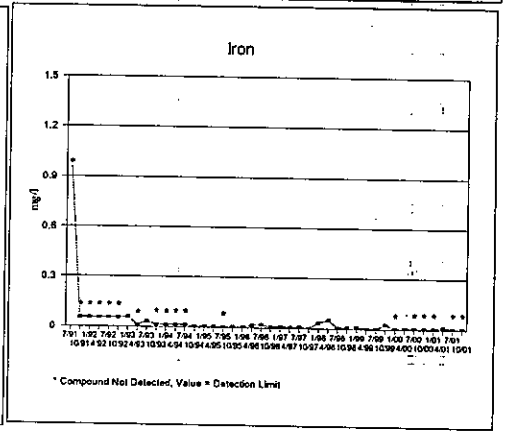


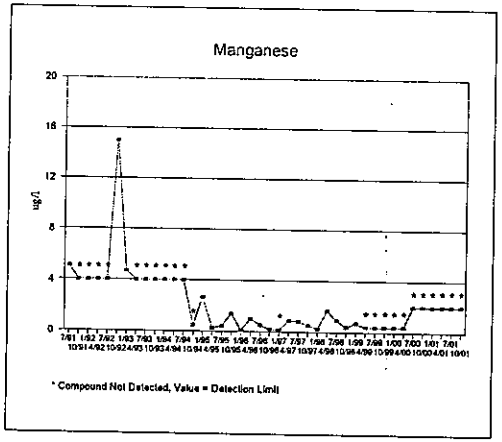


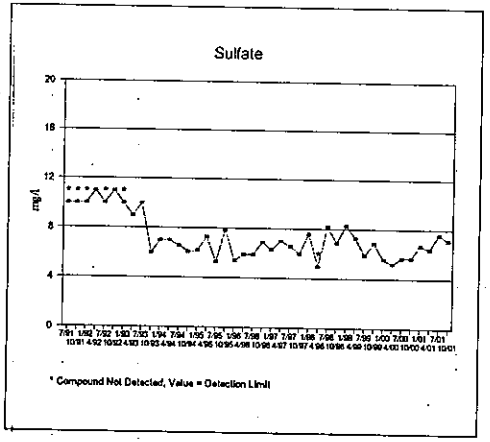


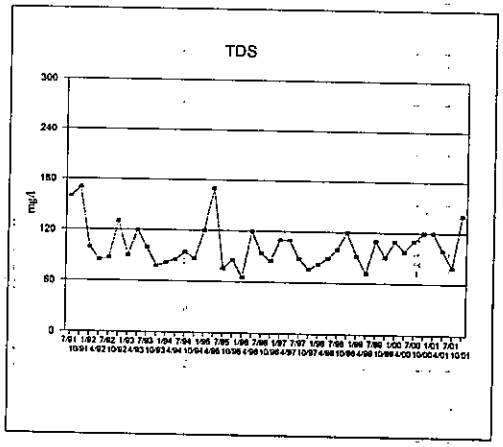












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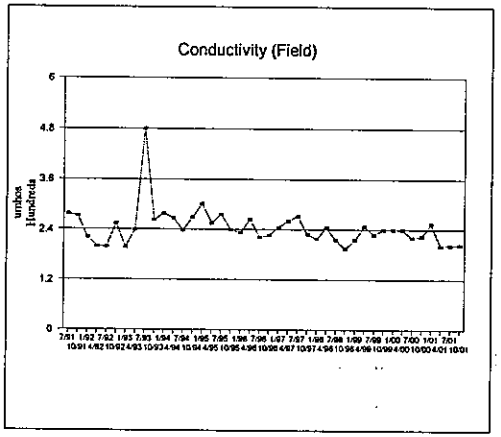
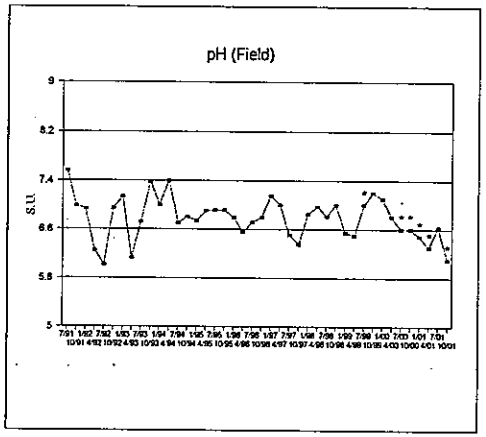
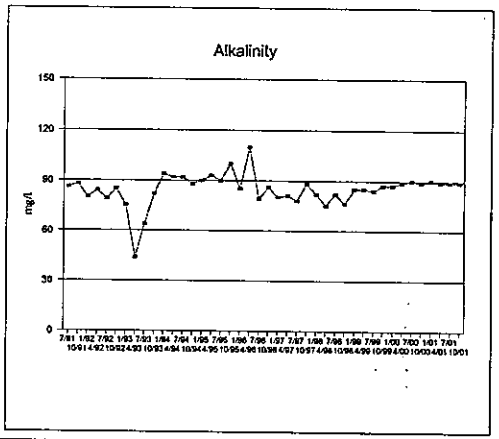
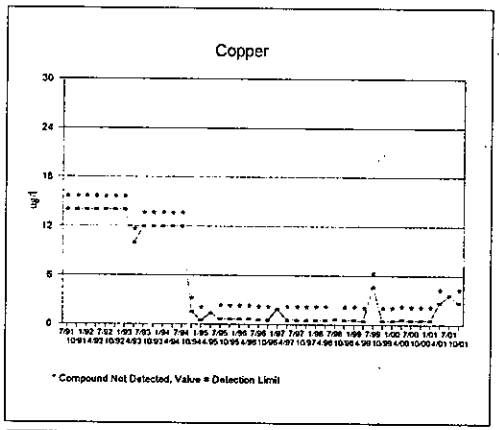
Groundwater Quality Results

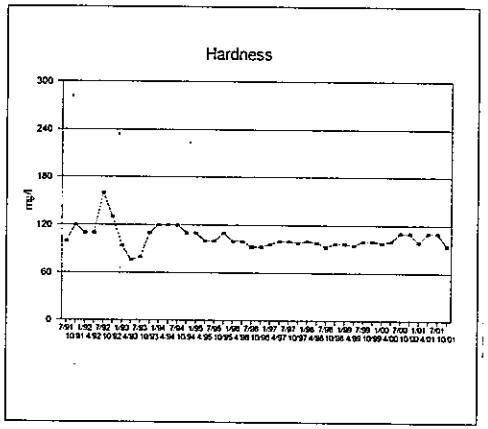
MW-1002G

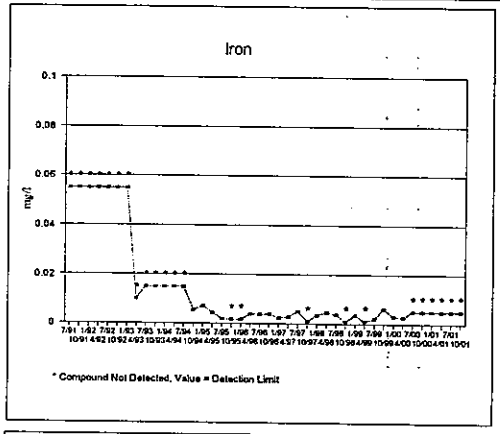


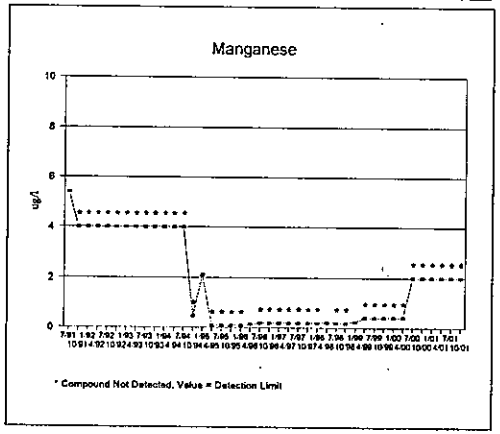


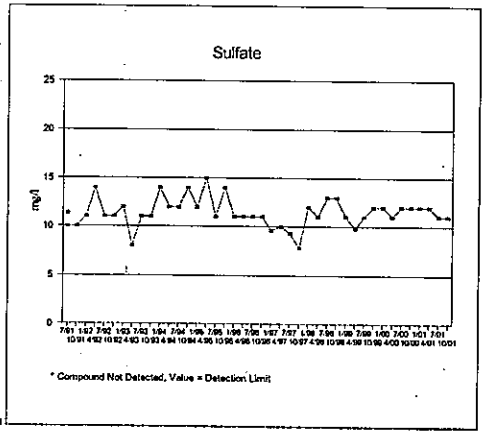


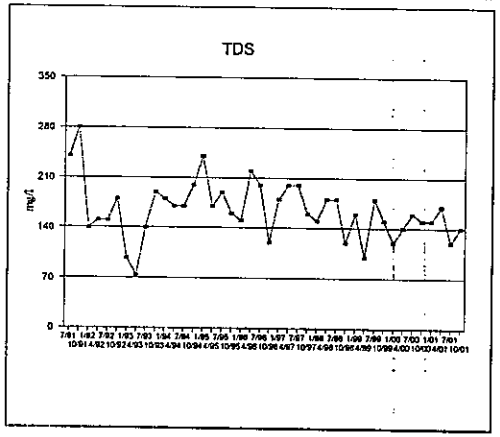












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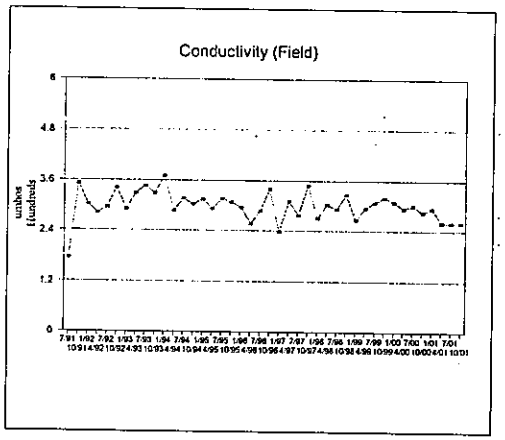
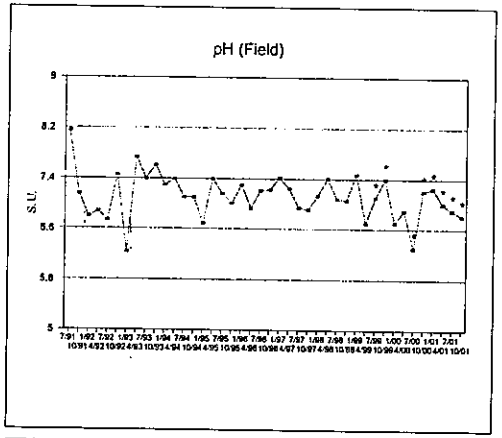
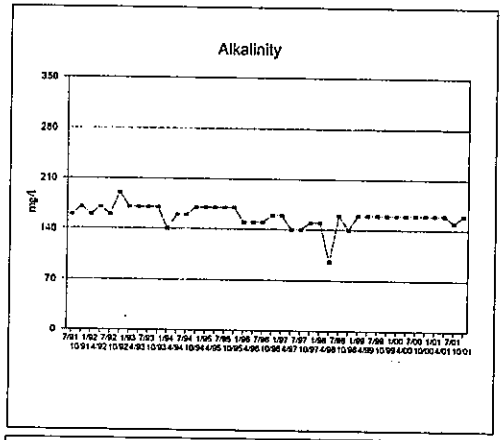
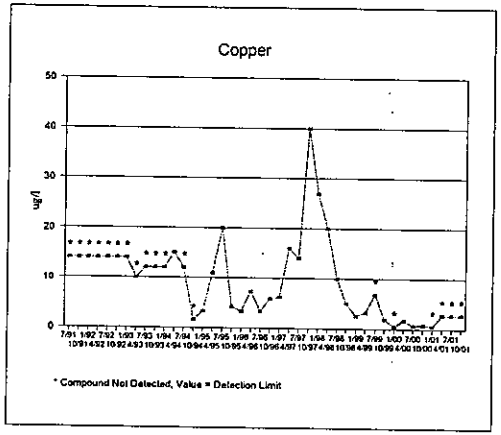
Flambeau Mining Company
Groundwater Quality Results

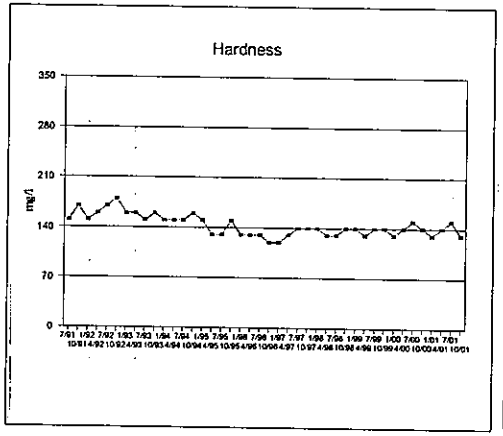
MW-1004P

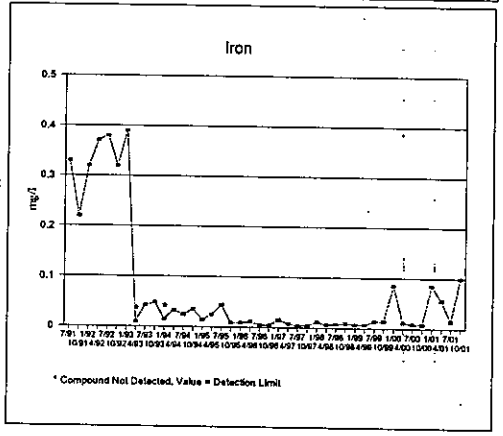


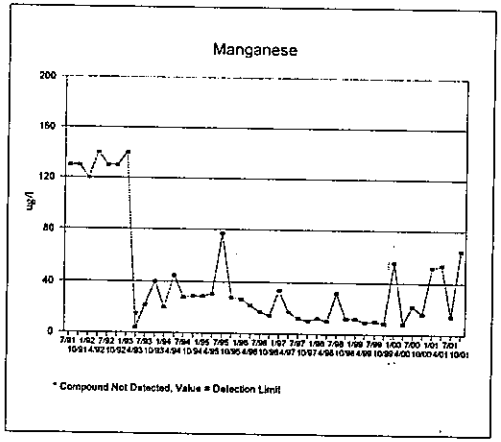


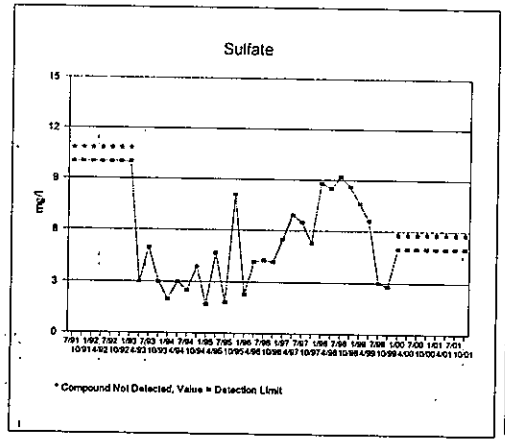


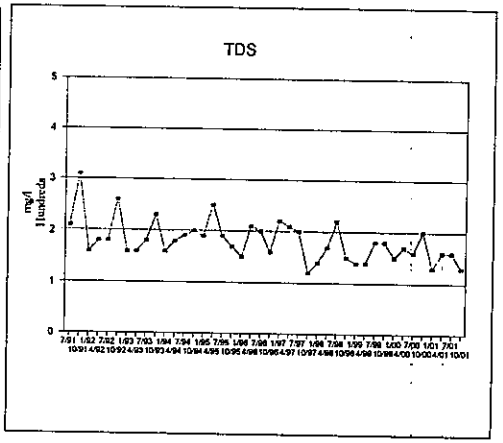












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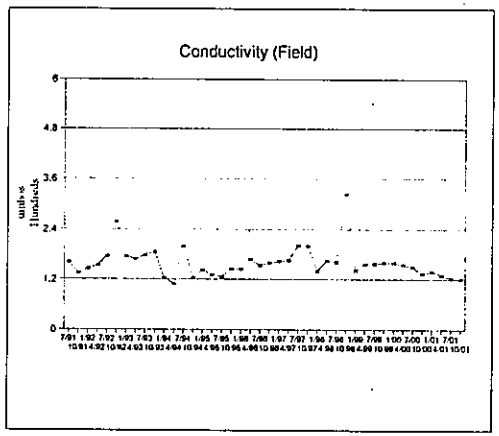
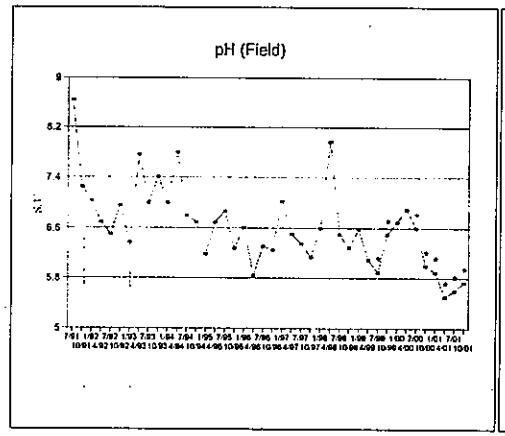
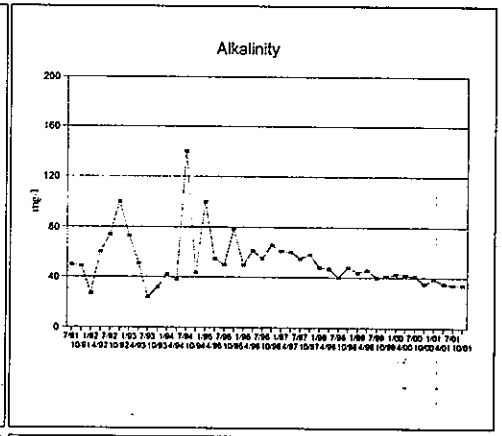
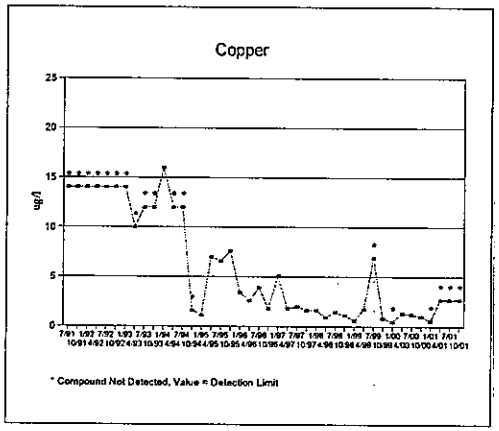
Groundwater Quality Results

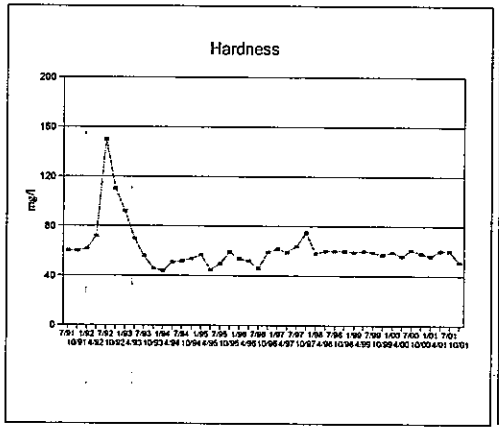
MW-1004S

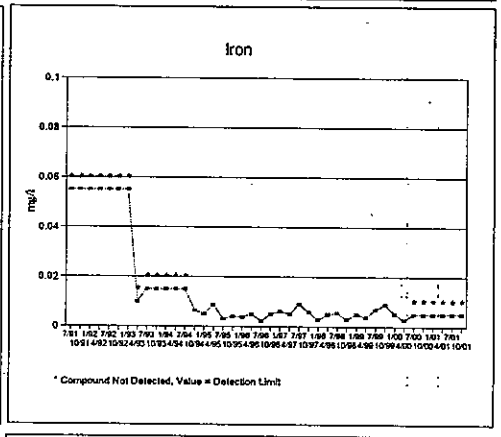


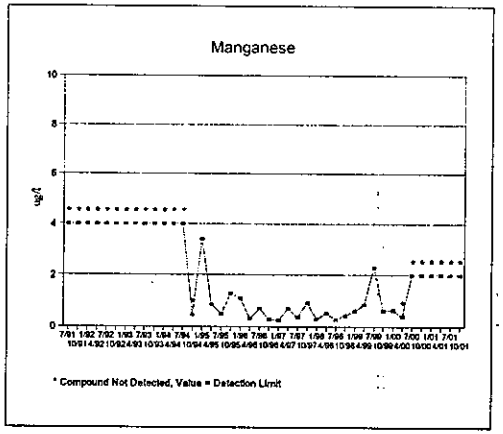


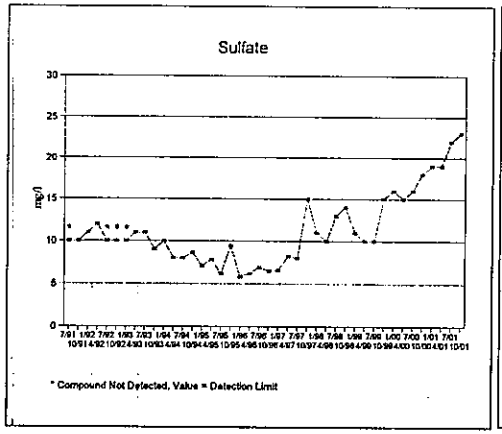


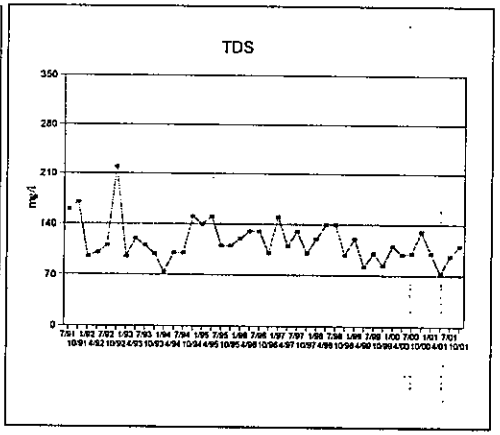












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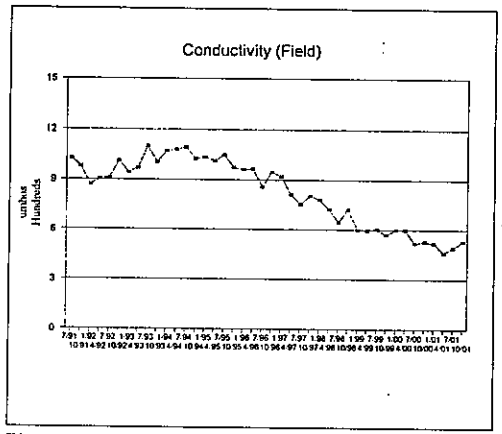

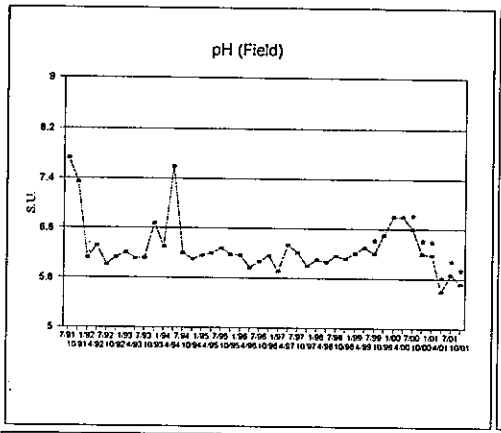

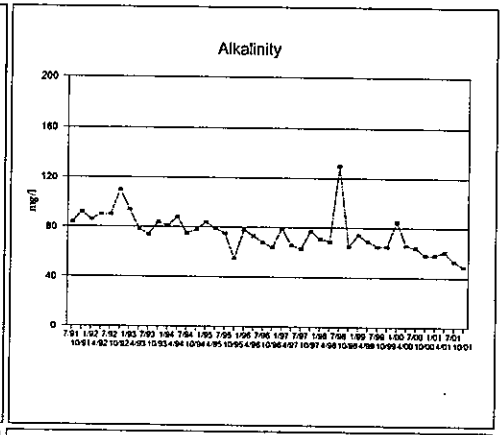

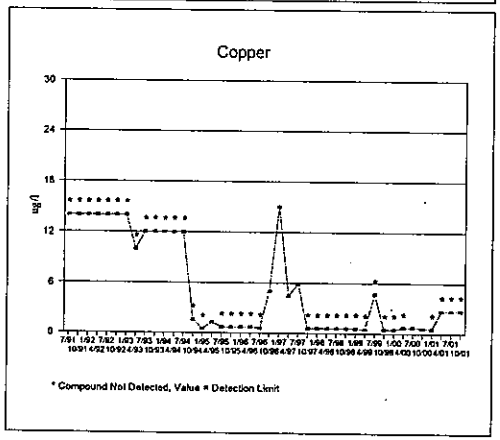

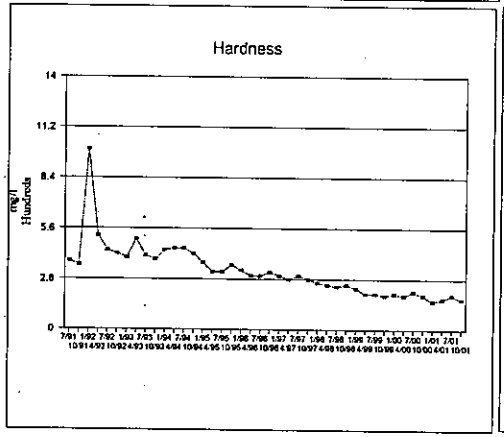

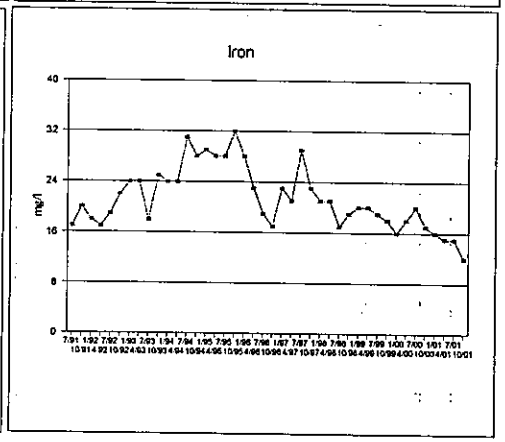

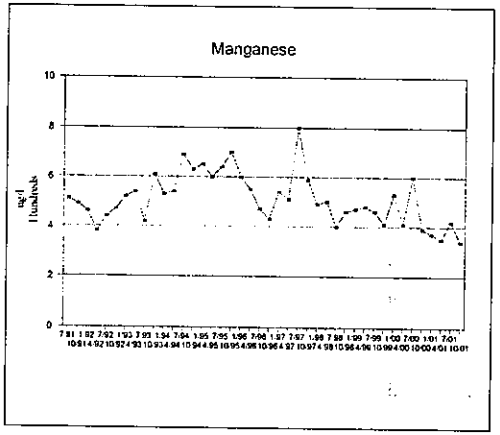

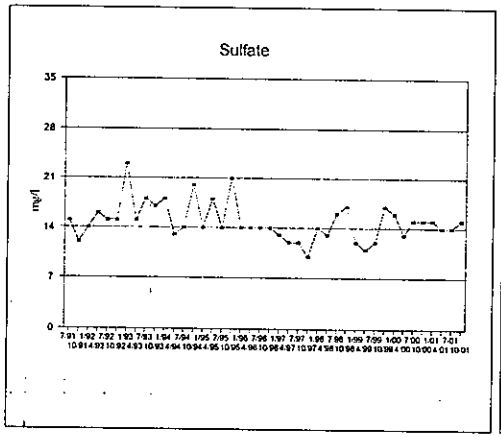

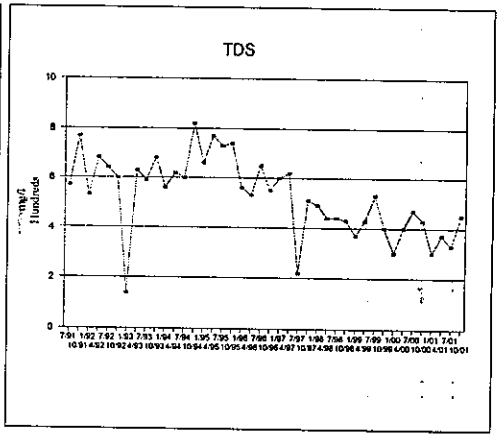

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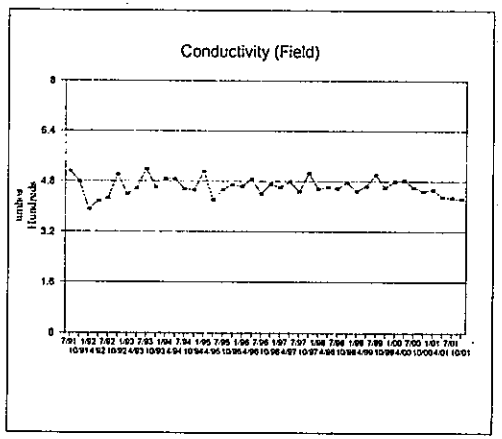
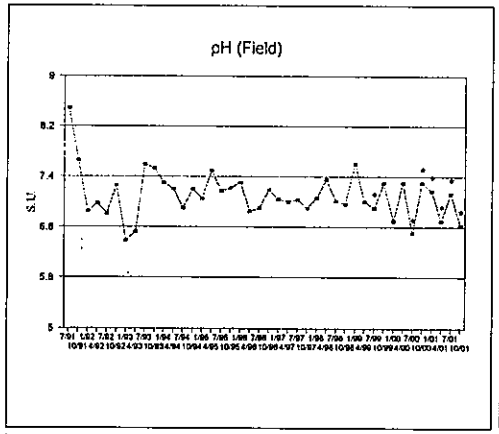
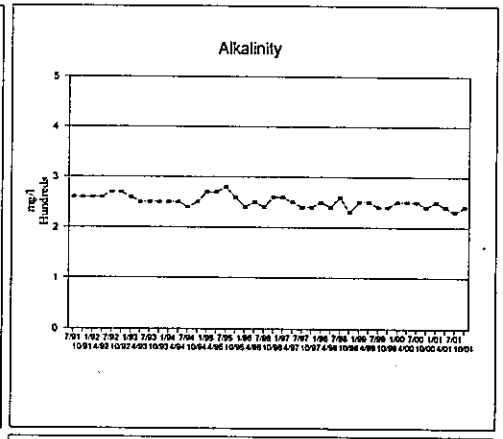
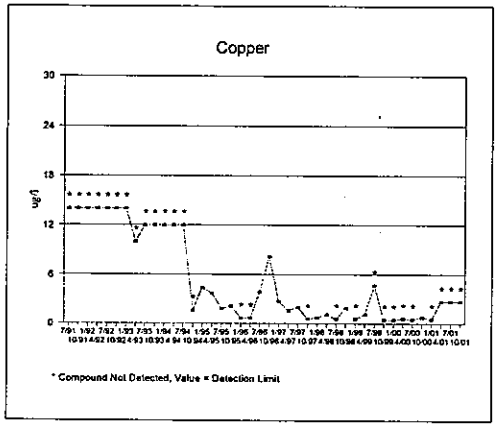
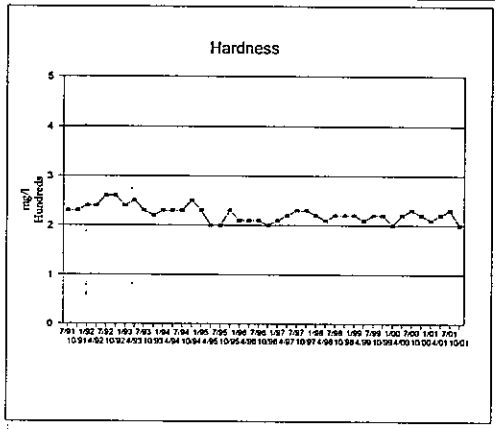
MW-1005P

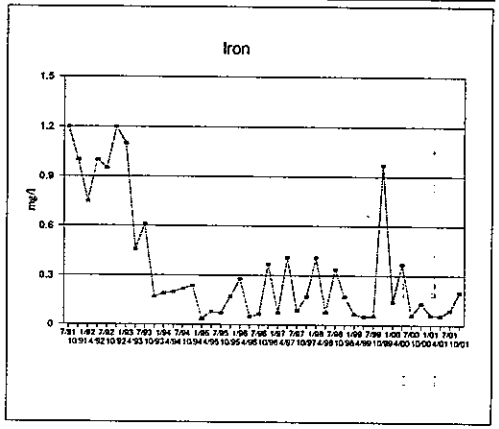


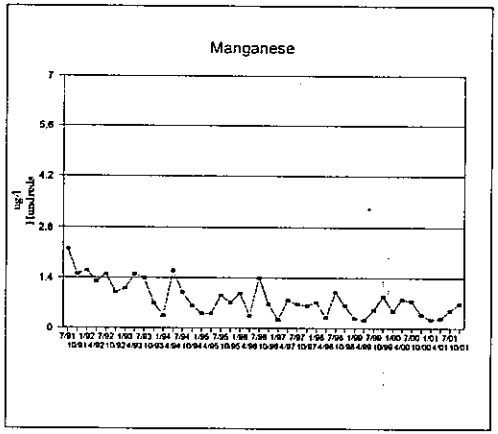


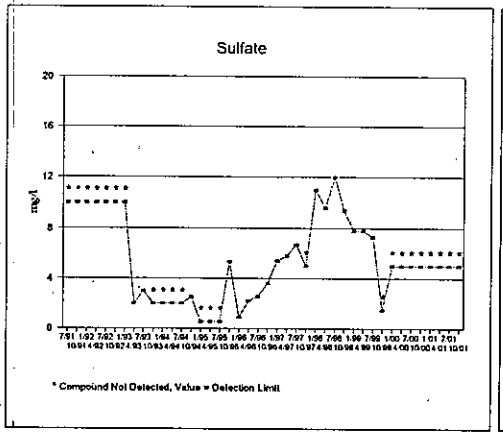


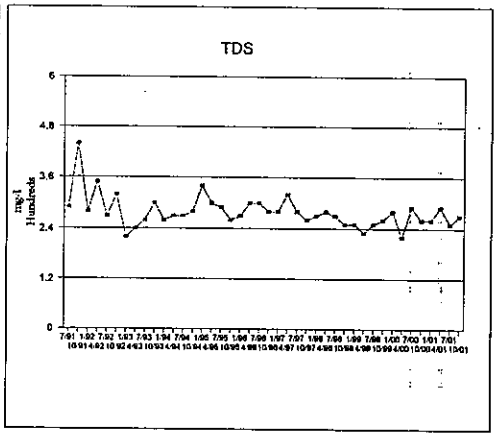












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Groundwater Quality Results

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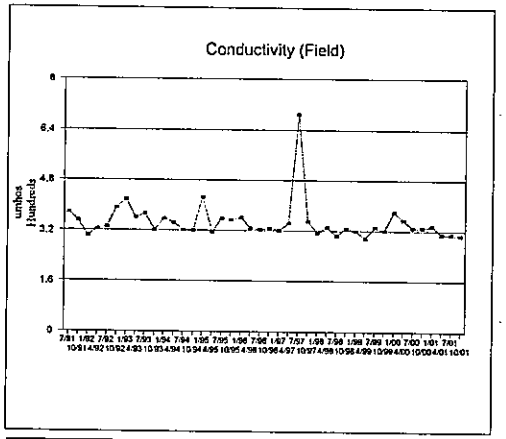

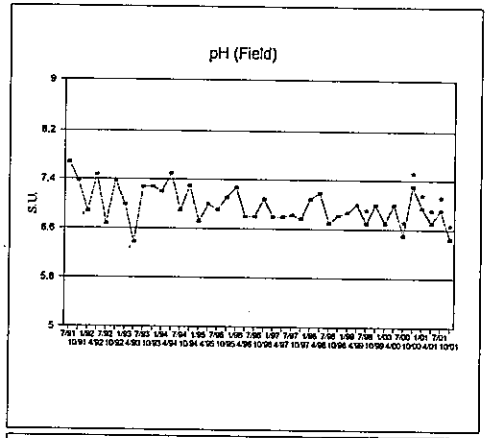

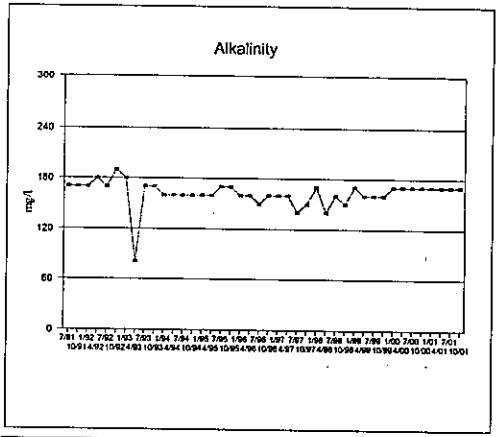

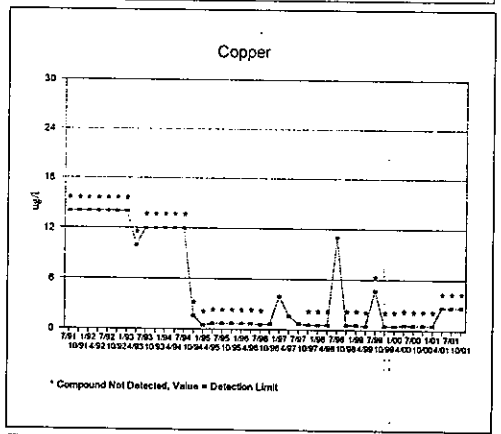

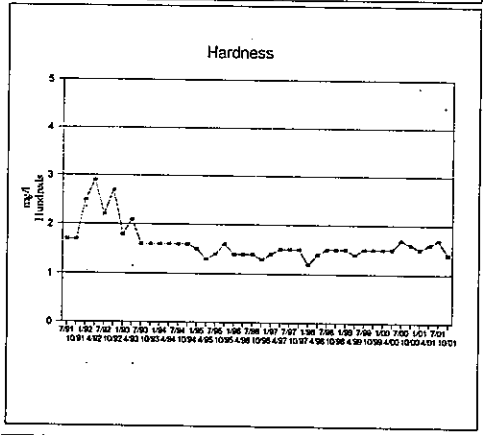

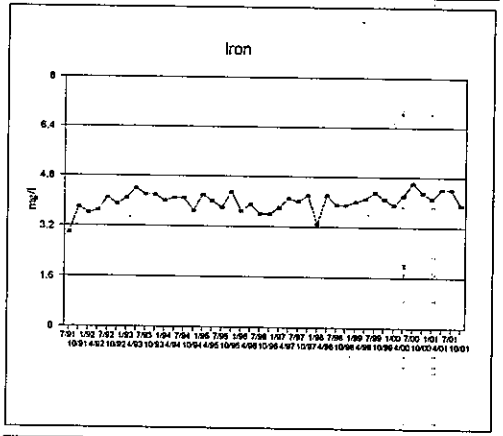

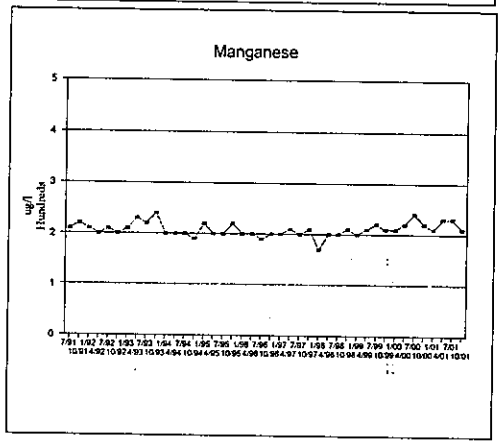

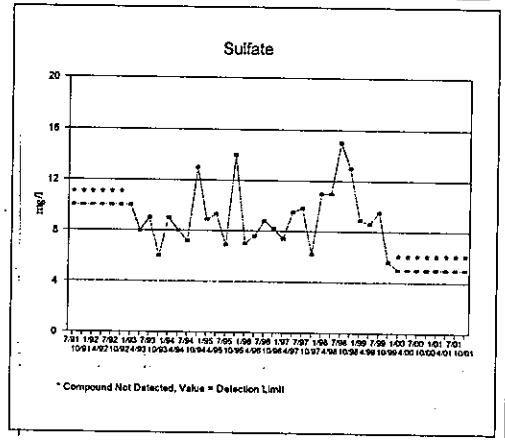

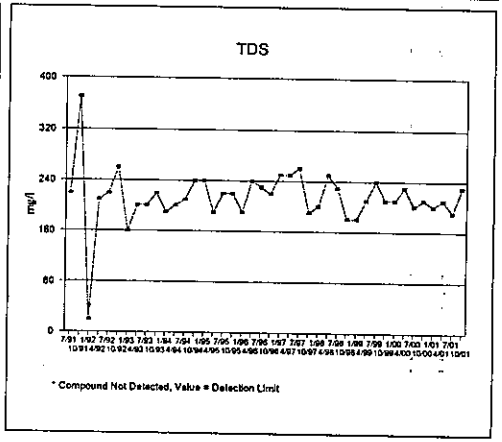

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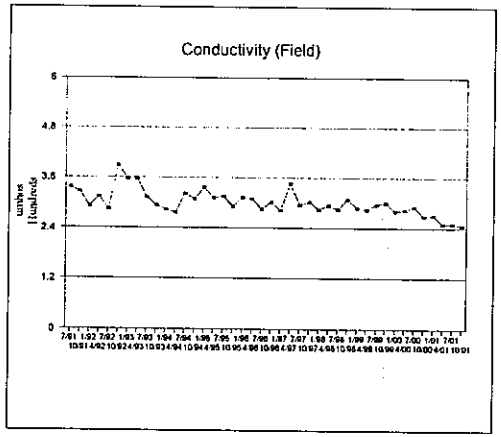
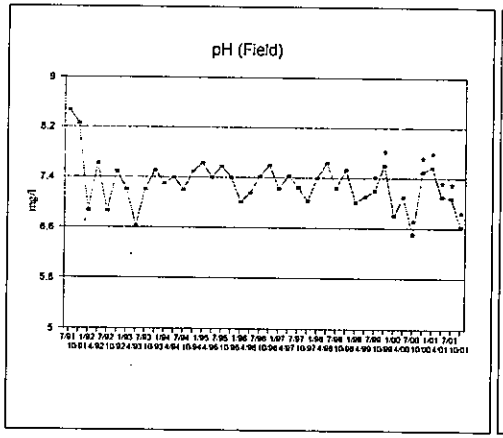
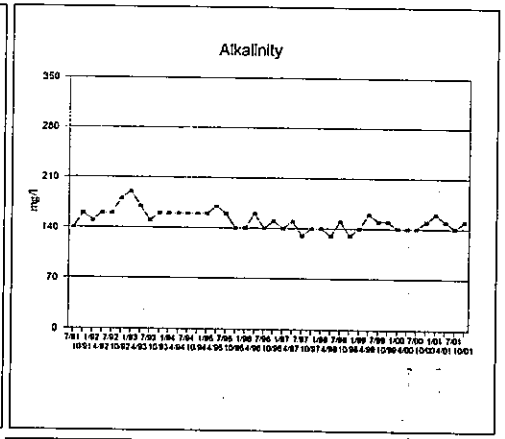
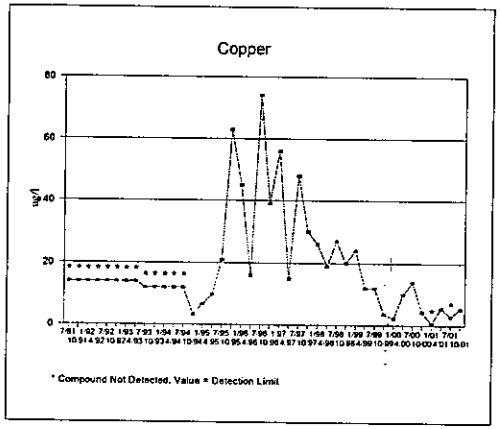
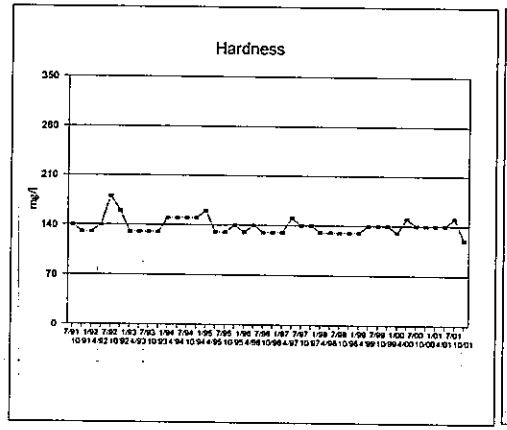
MW-1010P

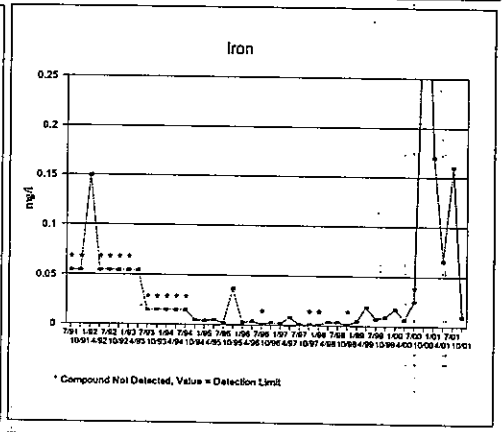


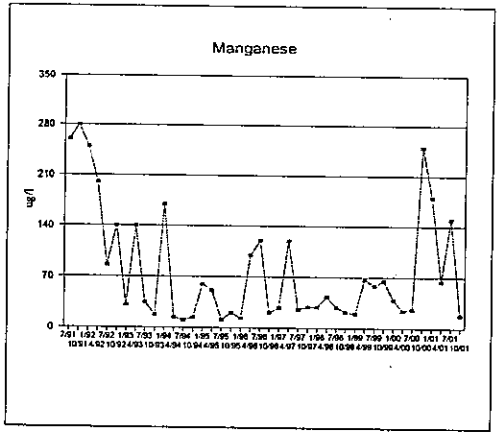


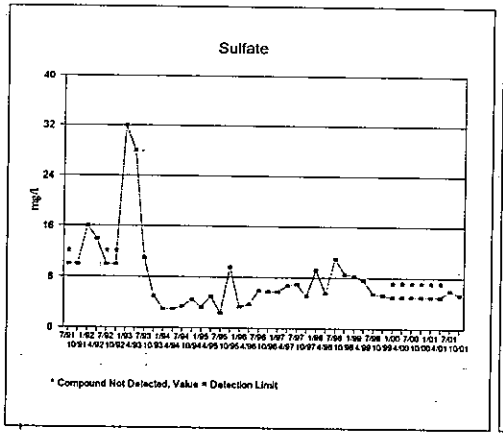


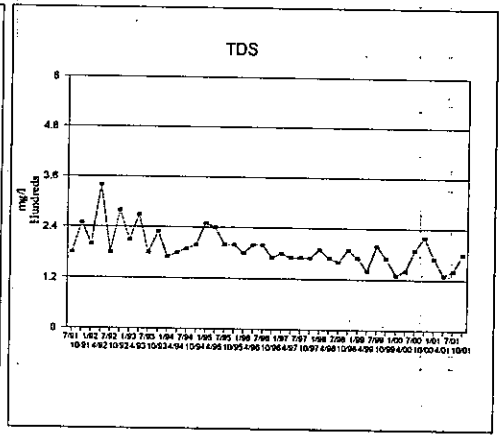












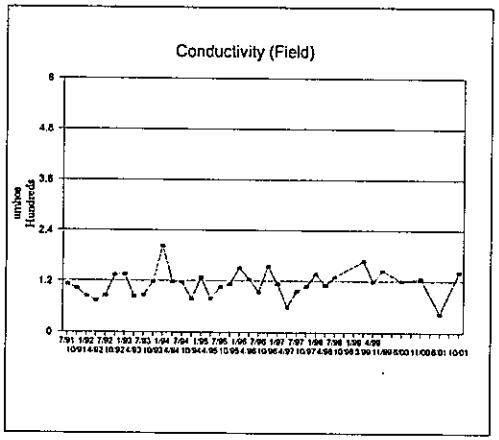
Prepared By: SGL Checked By: JBHT

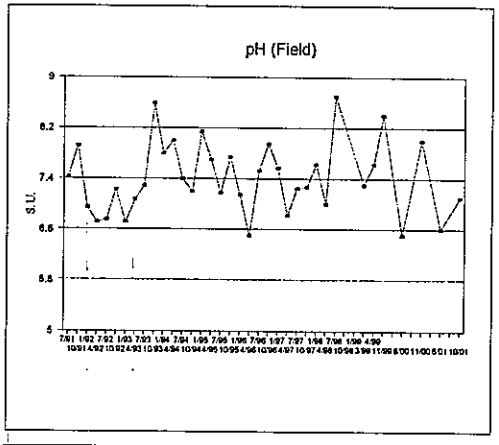
Attachment 2

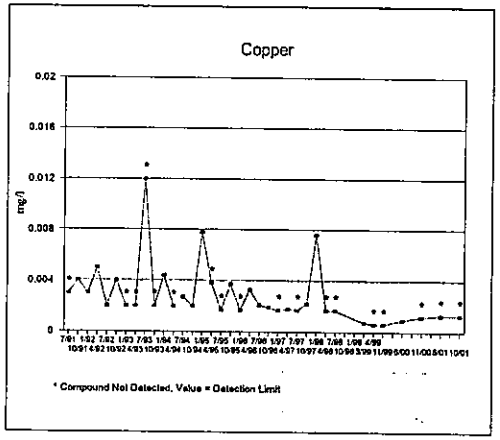
Surface Water Trend Plots

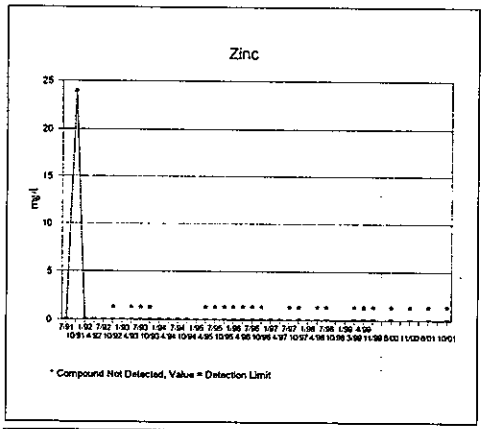
Flambeau Mining Company
Surface Water Quality Results

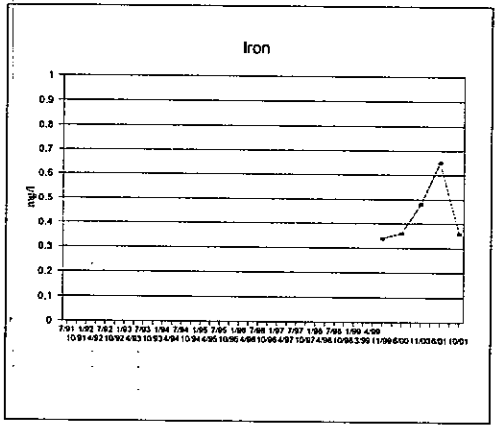
SW-1 (Upstream)

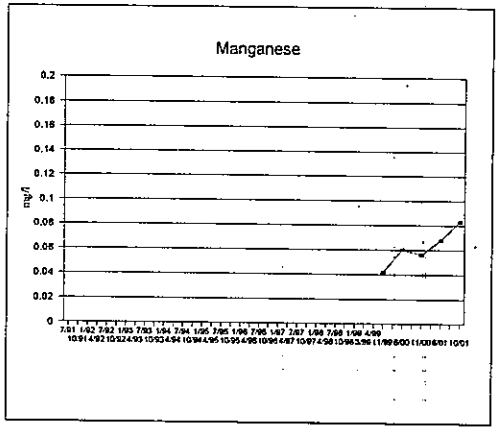


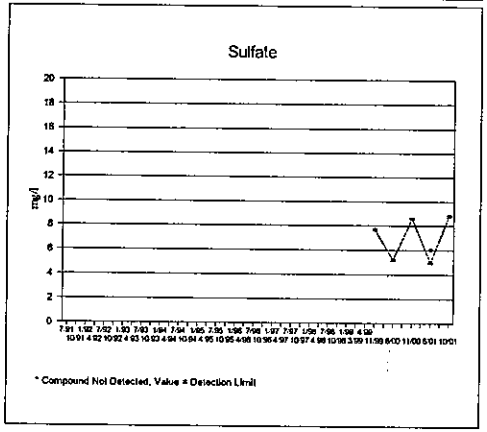








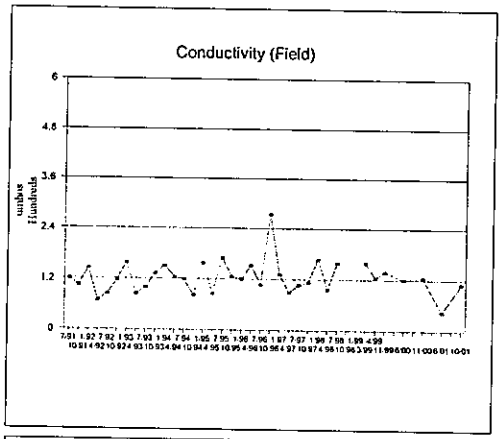


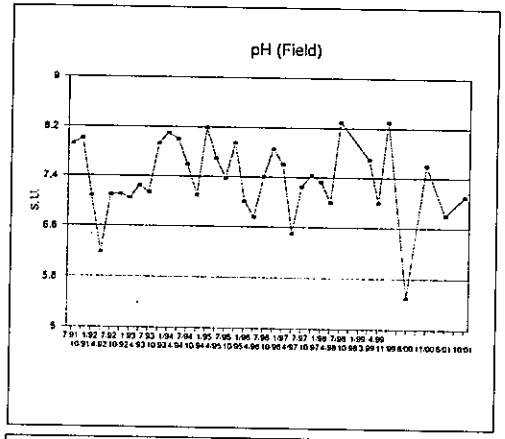


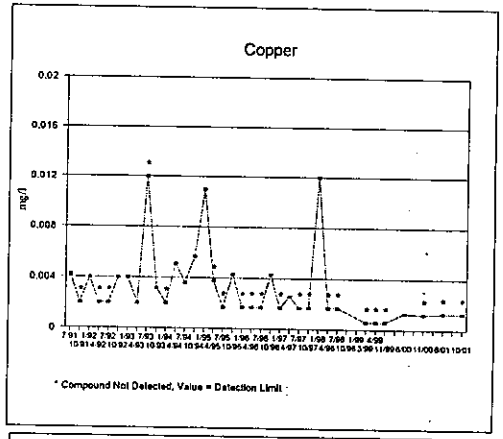
Prepared By: SGL Checked By: JBM

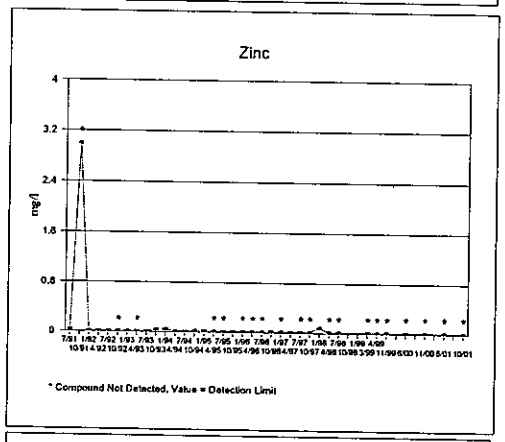
Flambeau Mining Company
Surface Water Quality Results

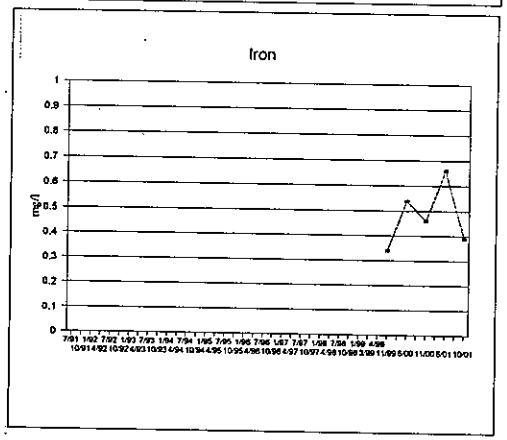
SW-2 (Downstream)

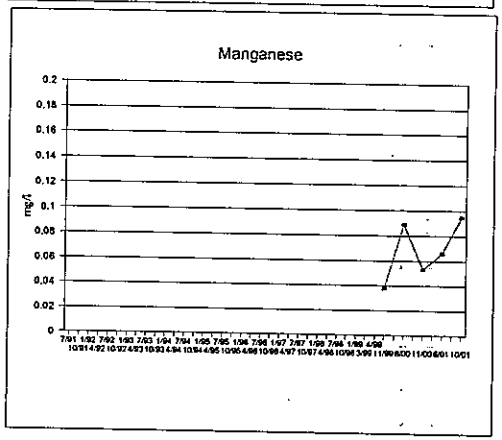


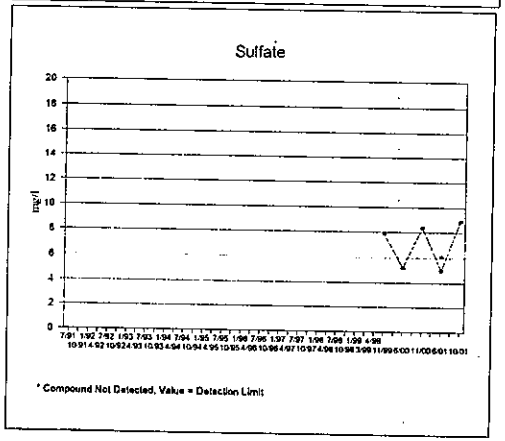












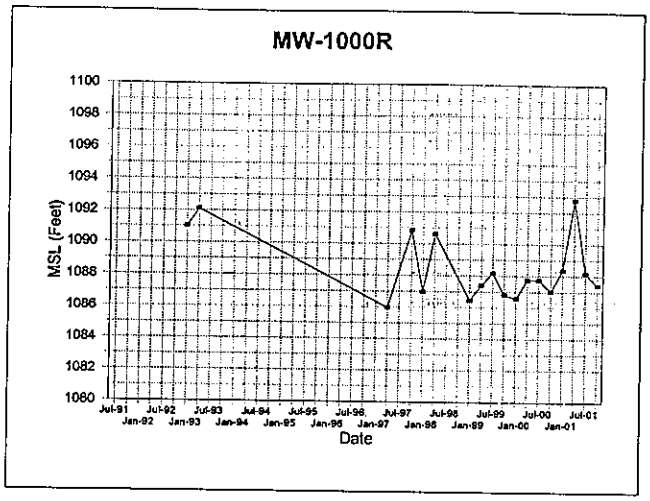
Prepared By: SGL Checked By: JBH1

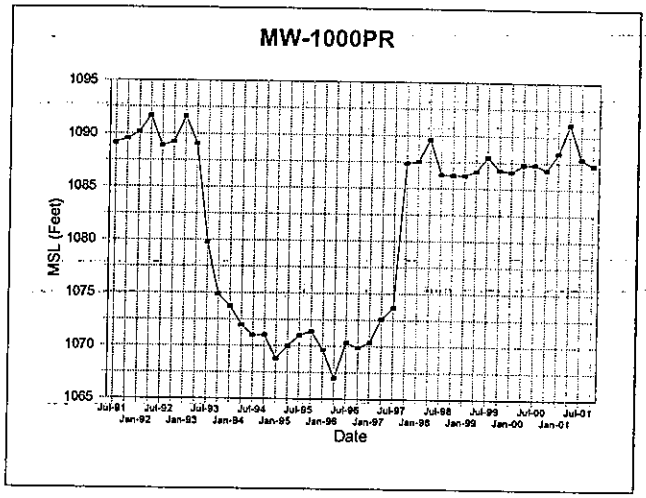
Attachment 3

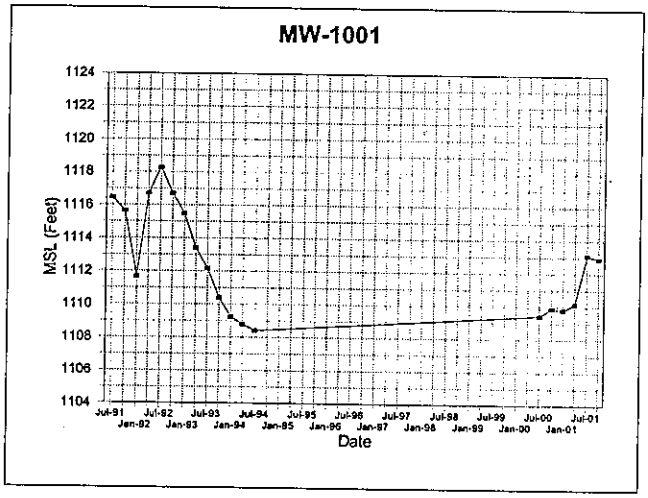
Hydrographs

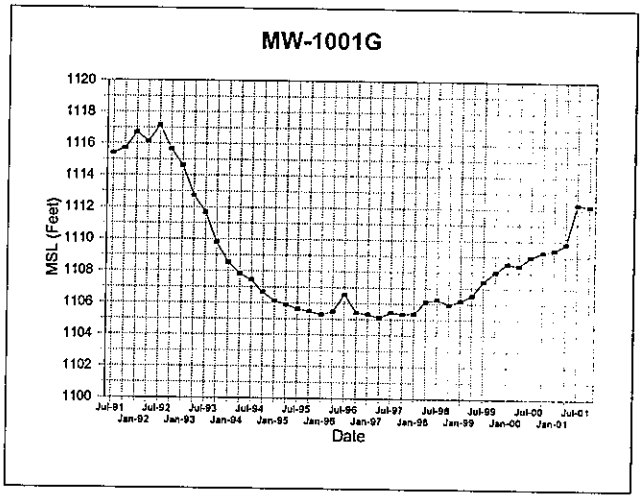
Flambeau Mining Company

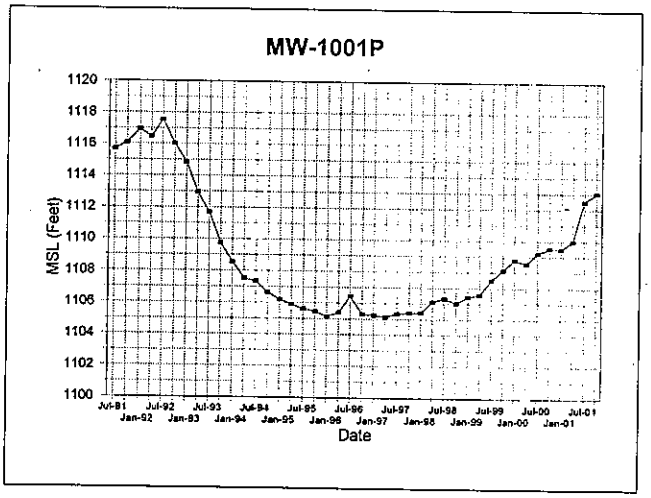
Groundwater Elevation Results

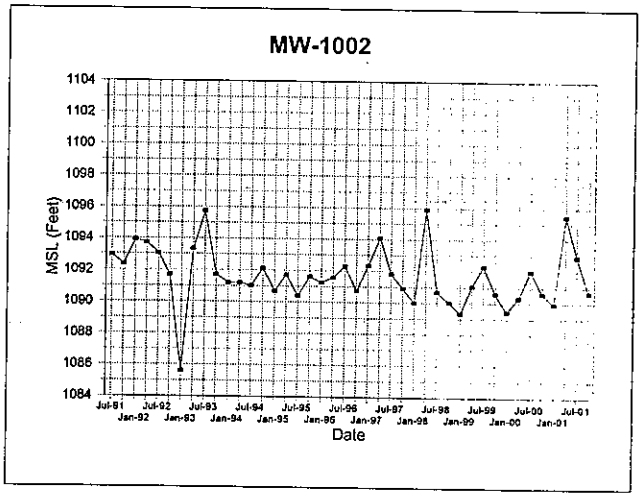






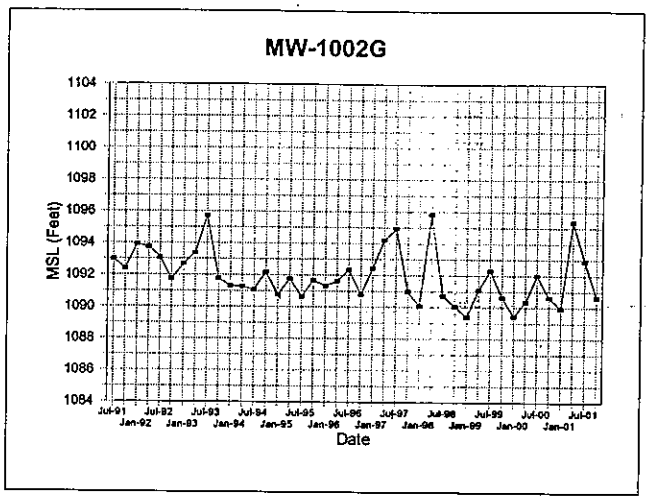


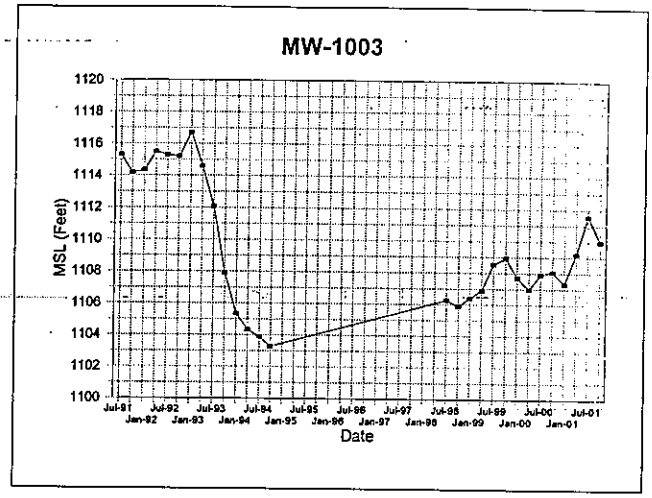


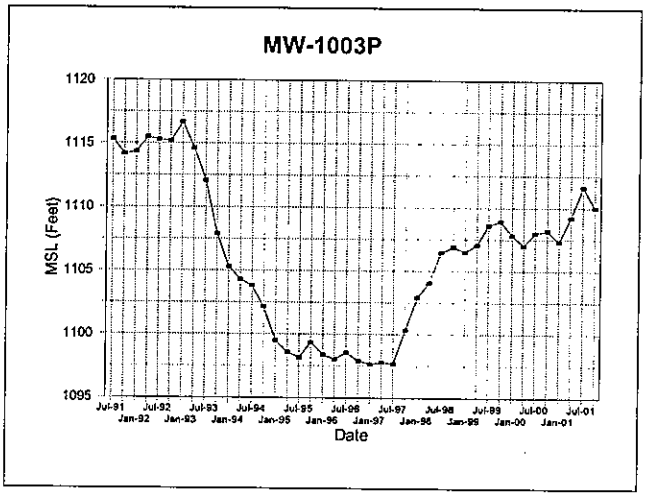


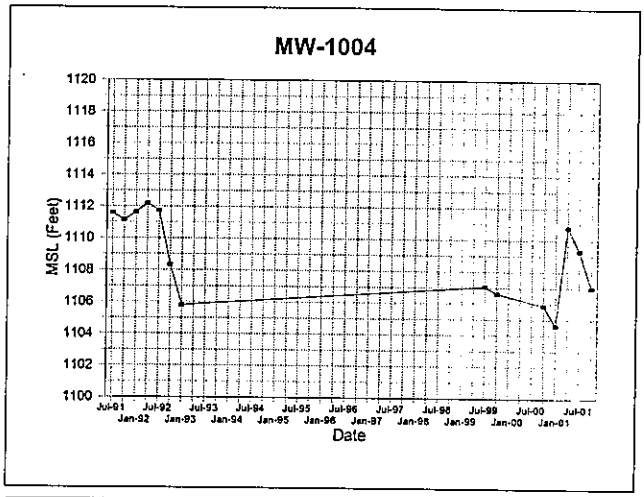
Flambeau Mining Company

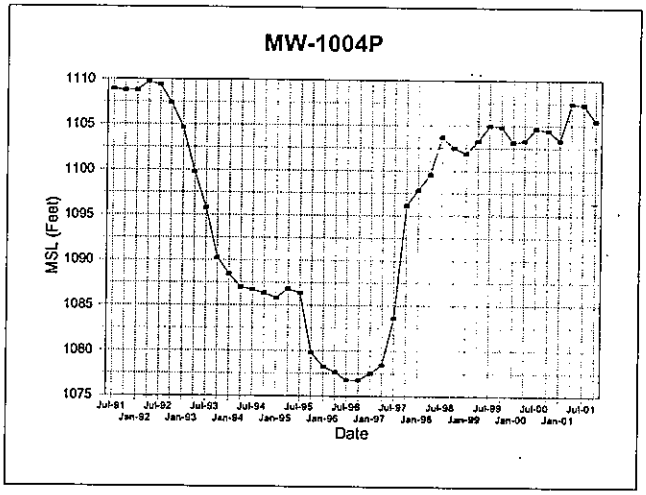
Groundwater Elevation Results

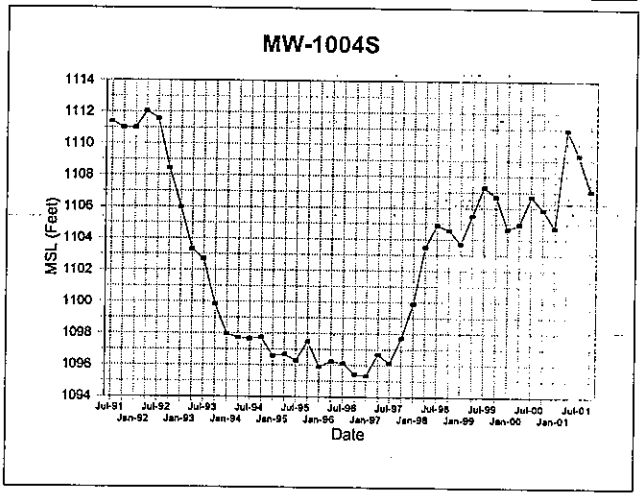






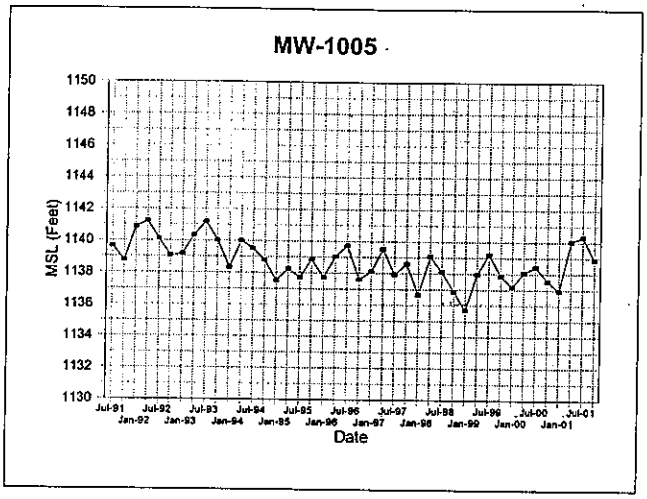


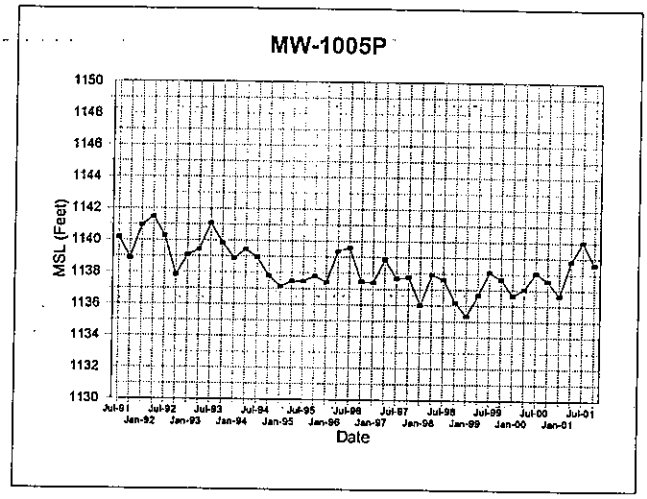


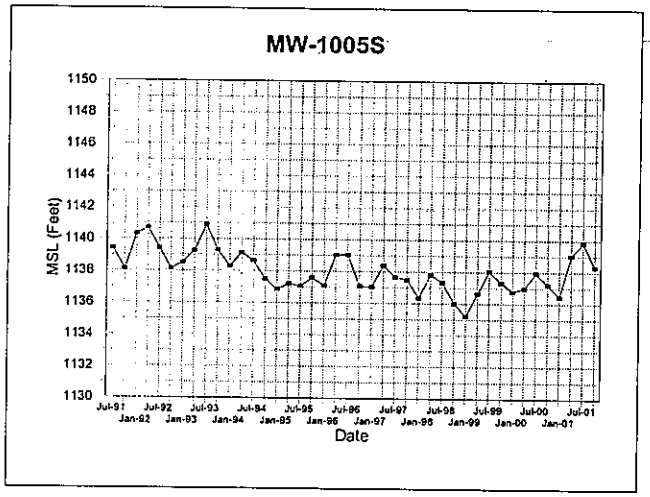


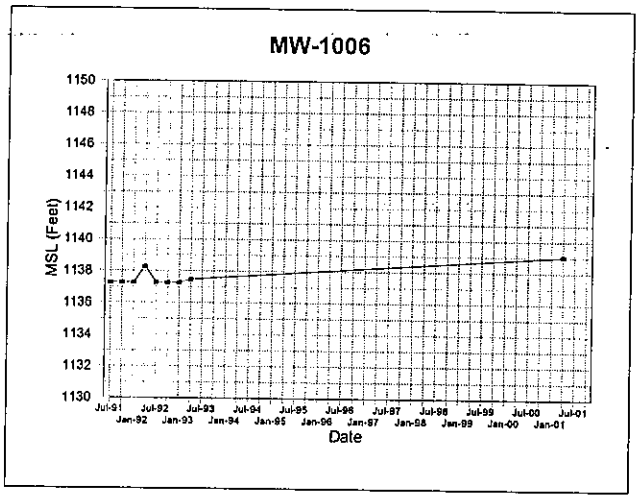
Flambeau Mining Company

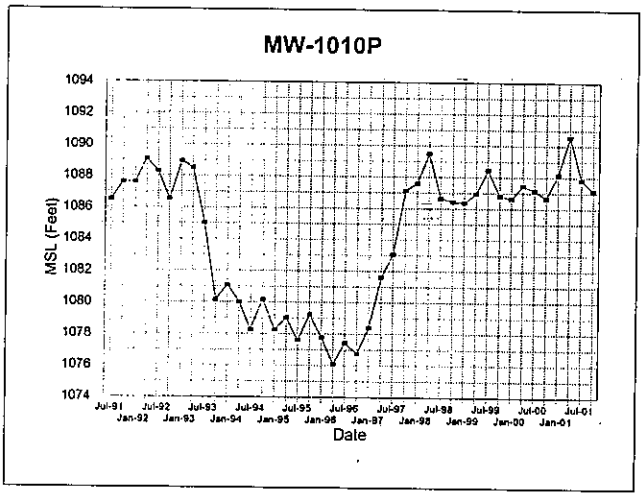
Groundwater Elevation Results

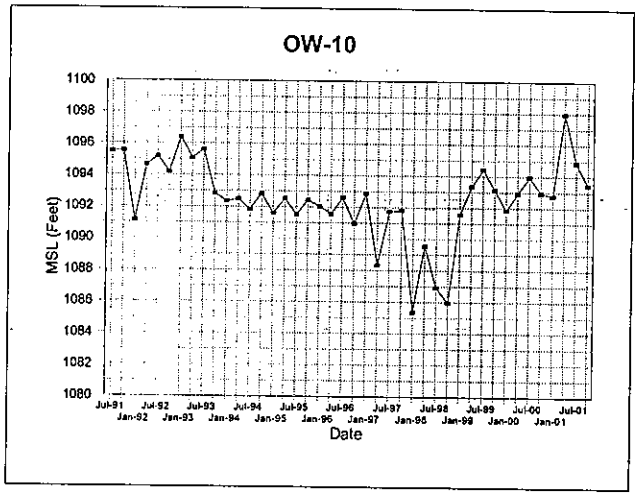








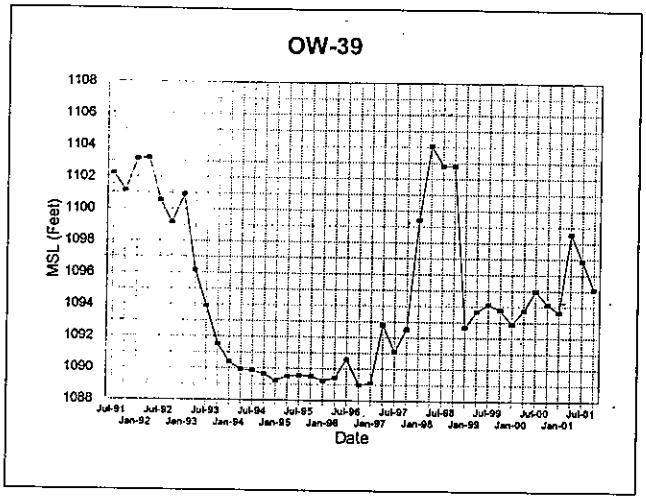


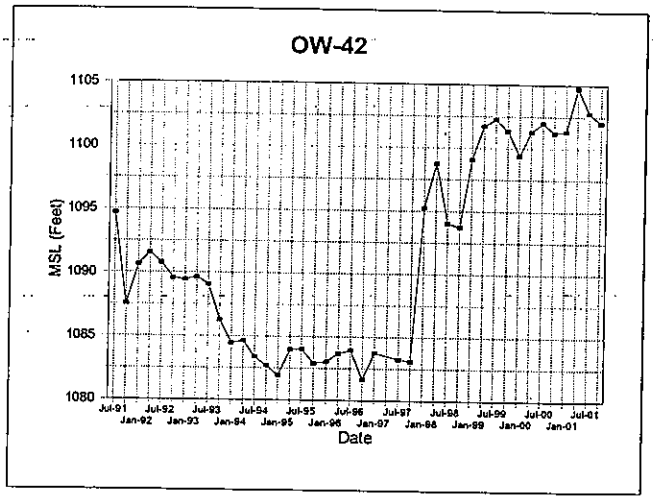


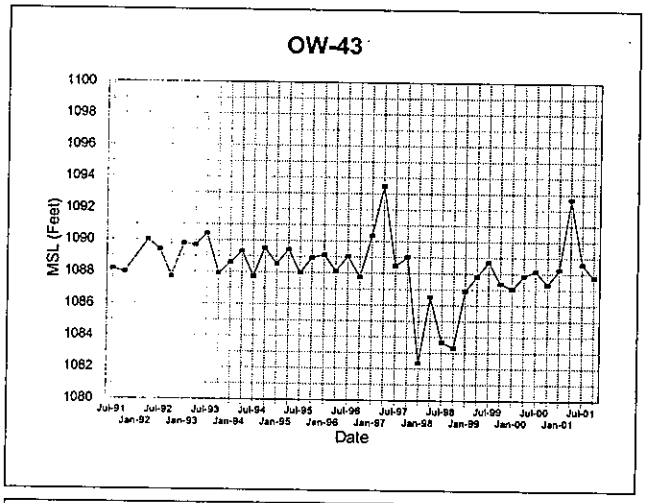
Prepared By: SGL Checked By: JBH1

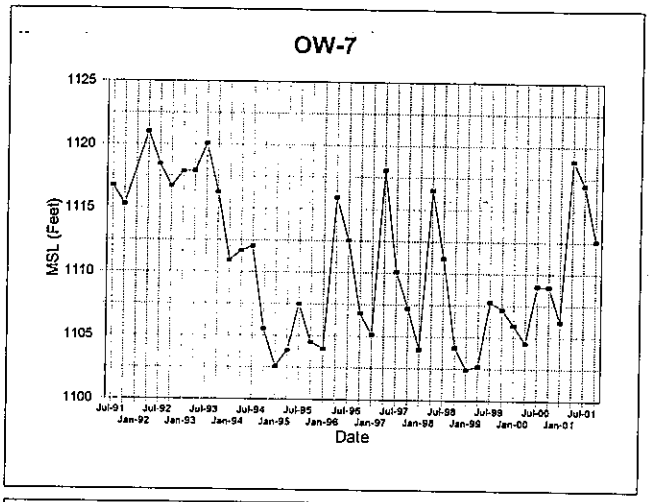
Flambeau Mining Company

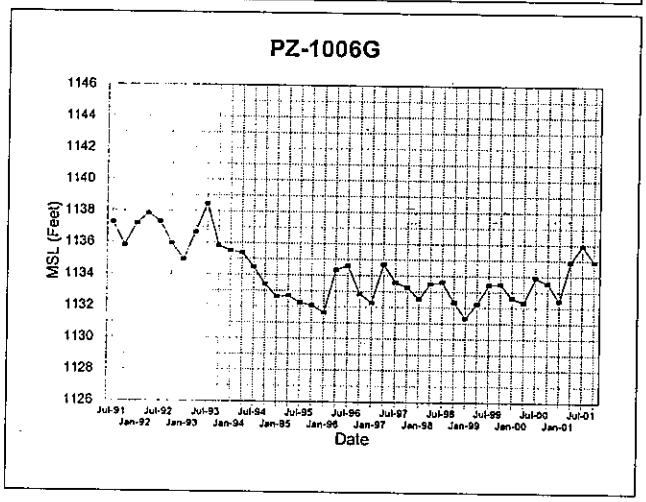
Groundwater Elevation Results

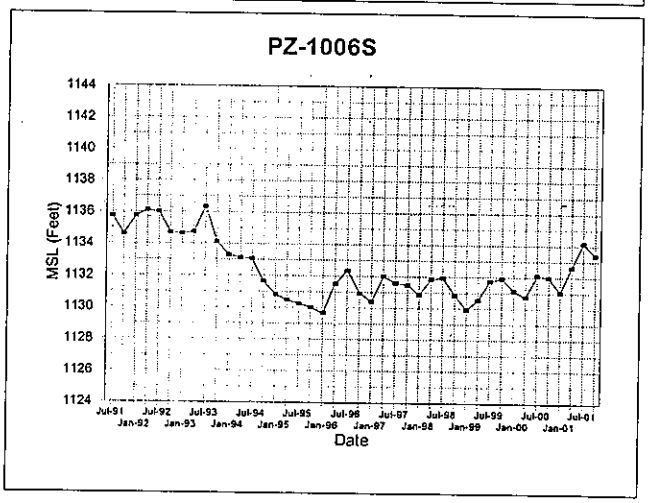












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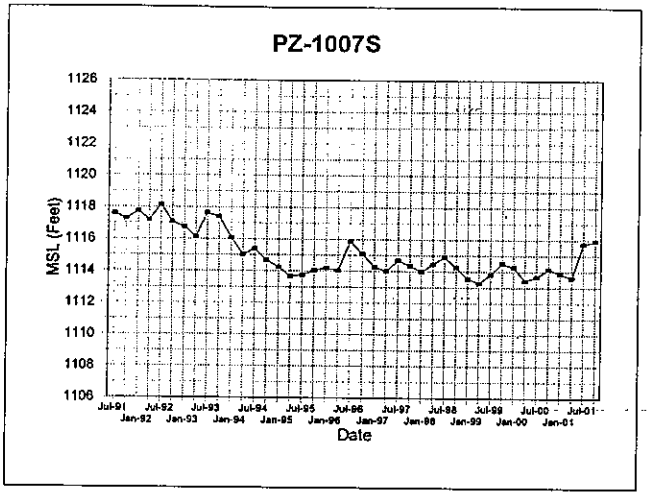
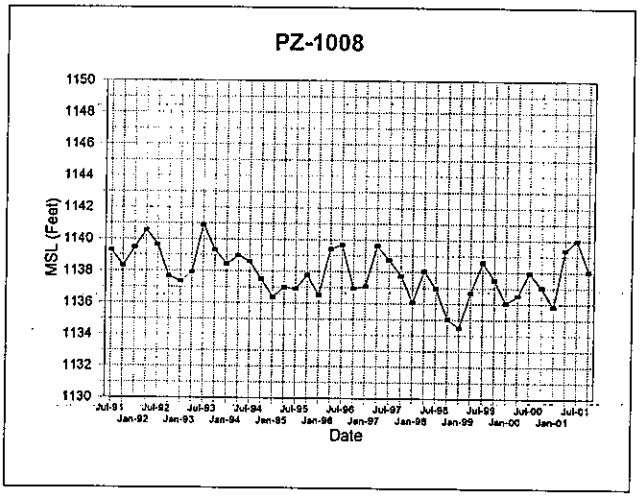
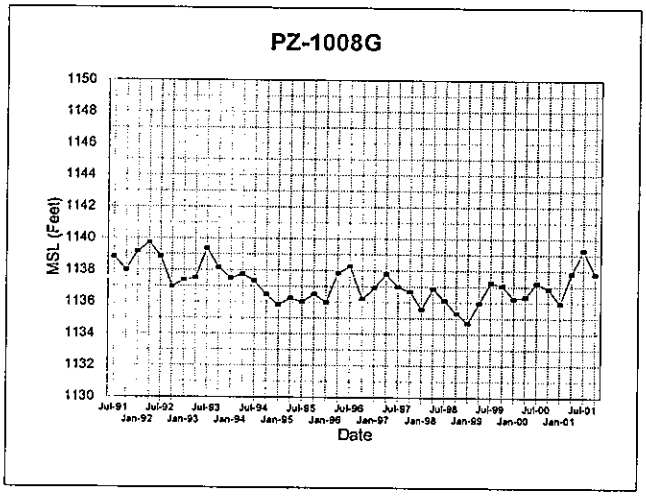
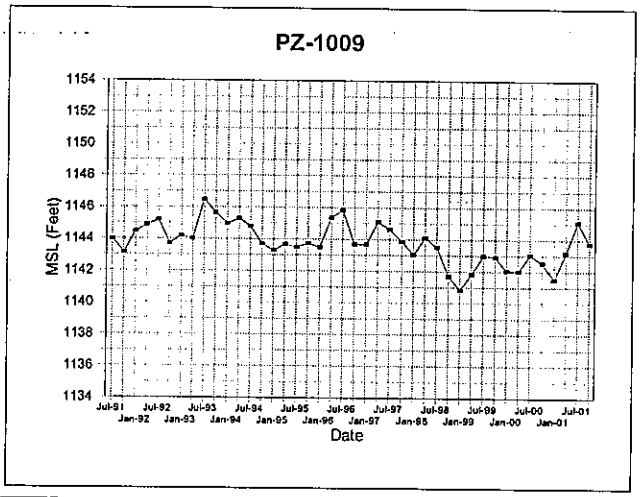
Flambeau Mining Company

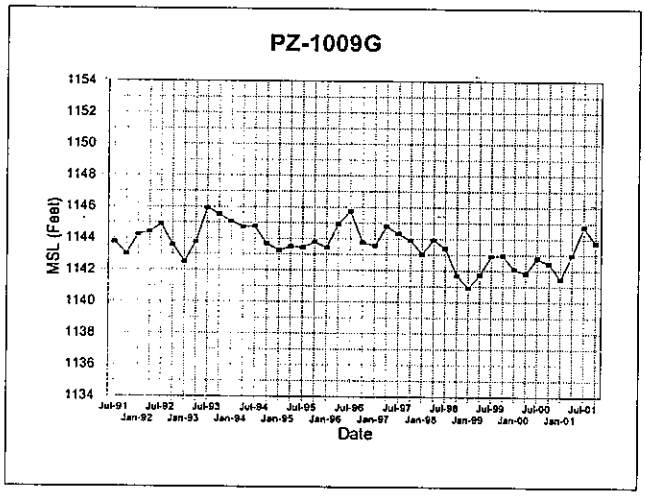
Groundwater Elevation Results

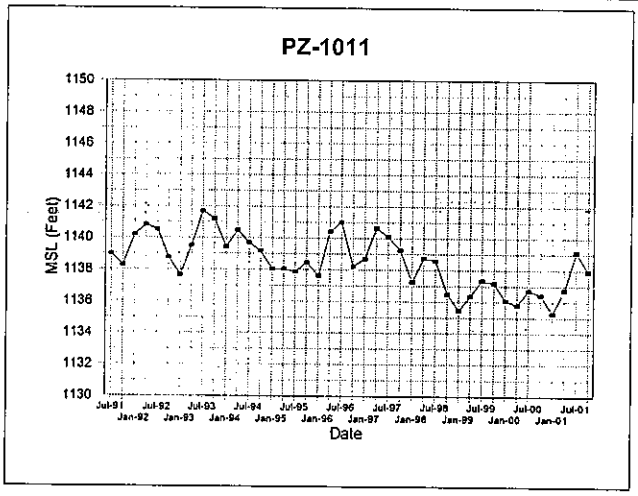








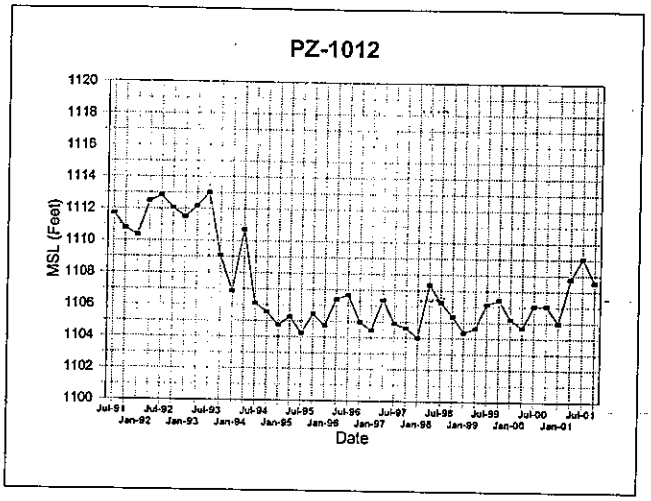


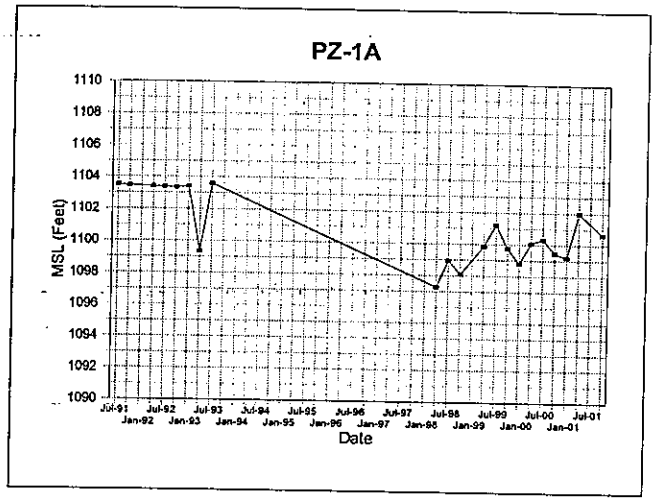


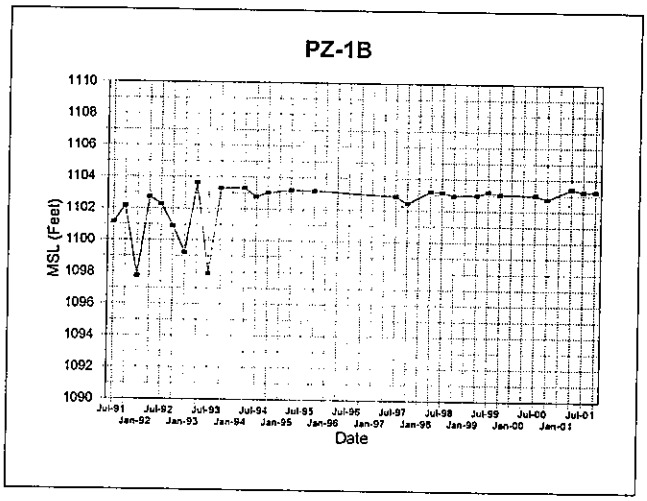
Prepared By: SGL Checked By: JBH1

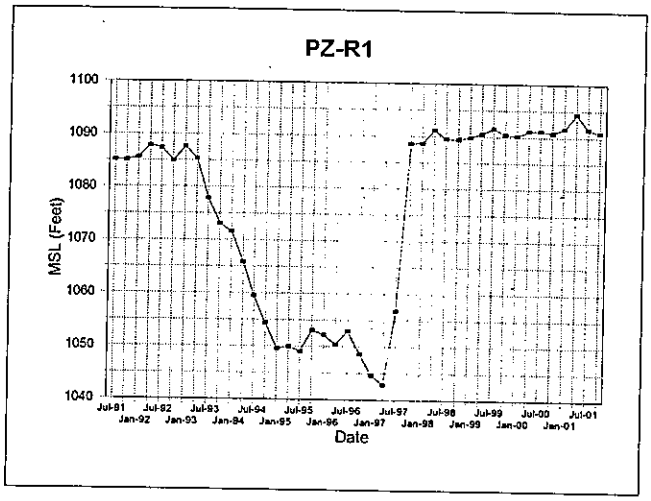
Flambeau Mining Company

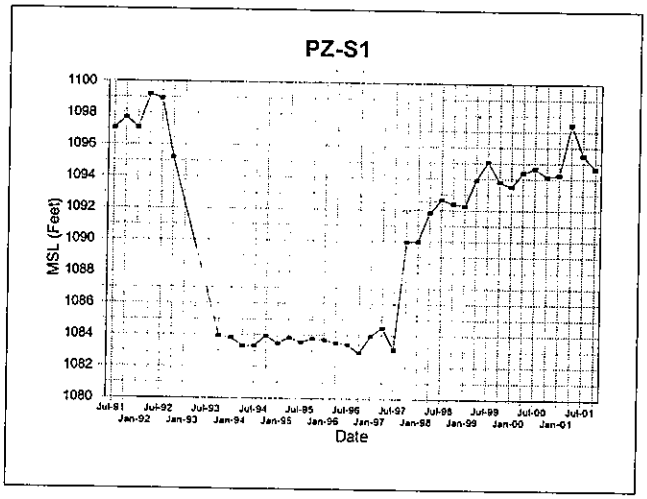
Groundwater Elevation Results

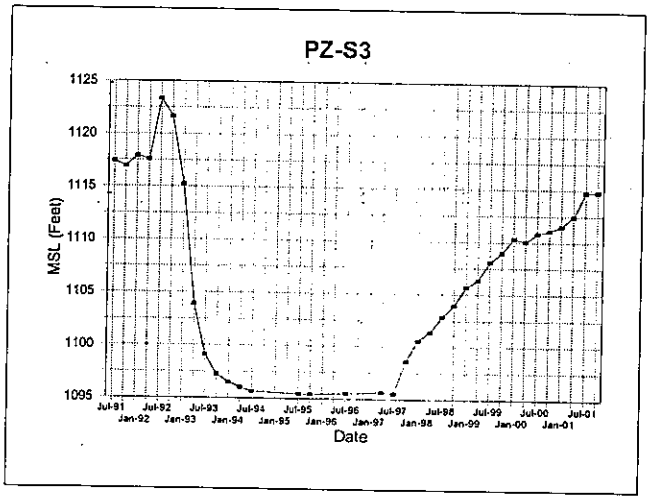












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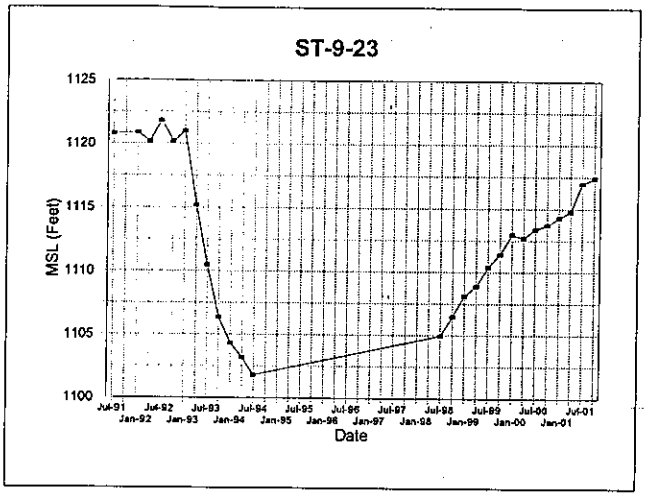
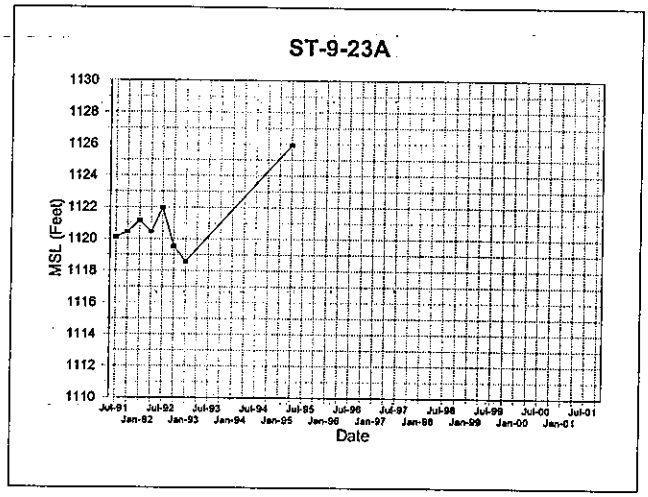
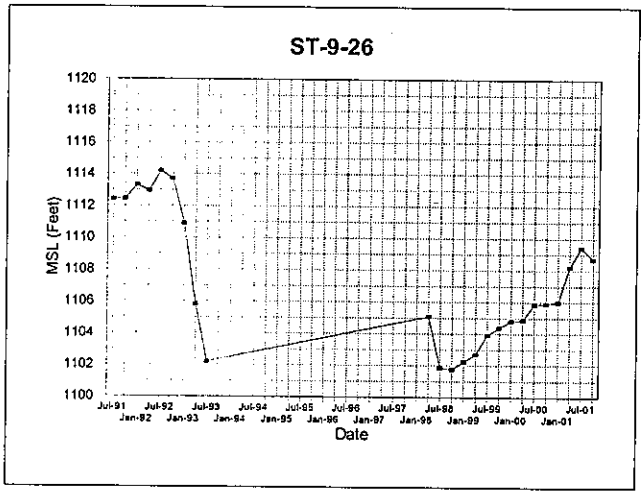
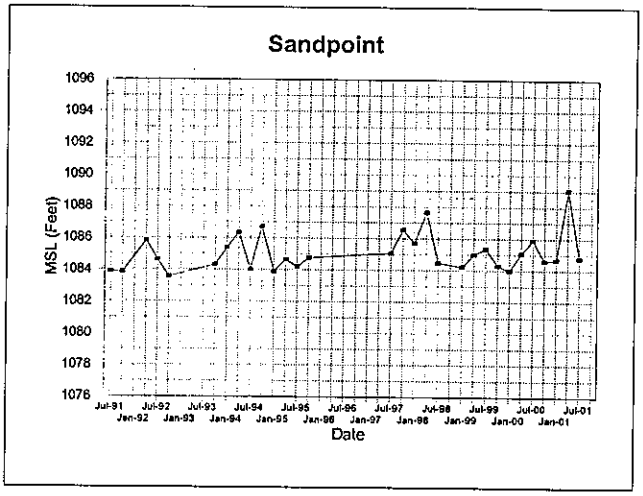
Flambeau Mining Company

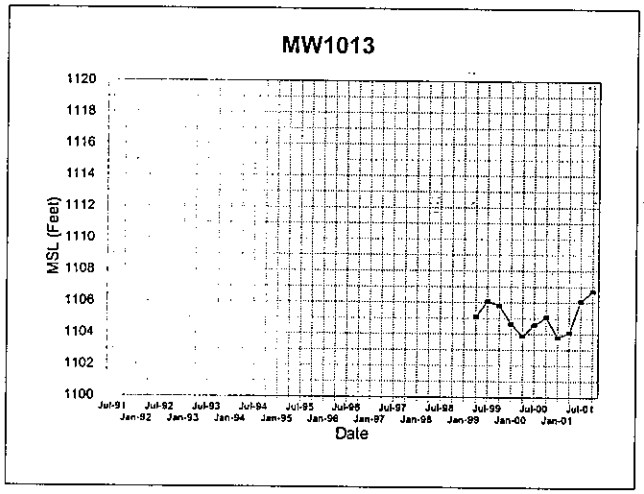
Groundwater Elevation Results

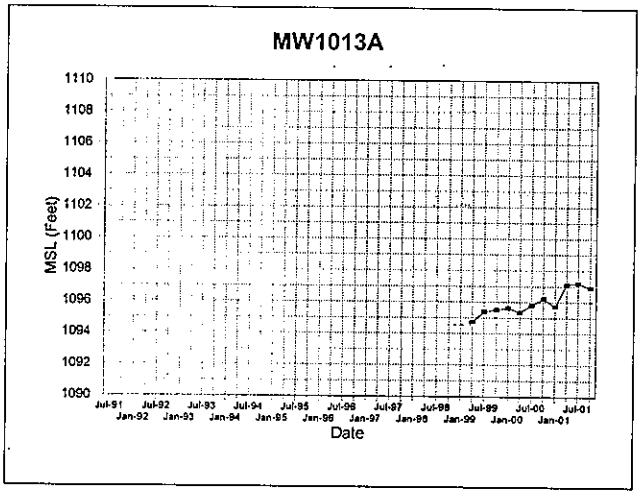








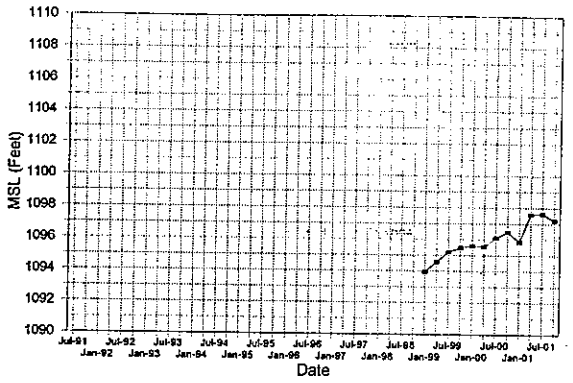




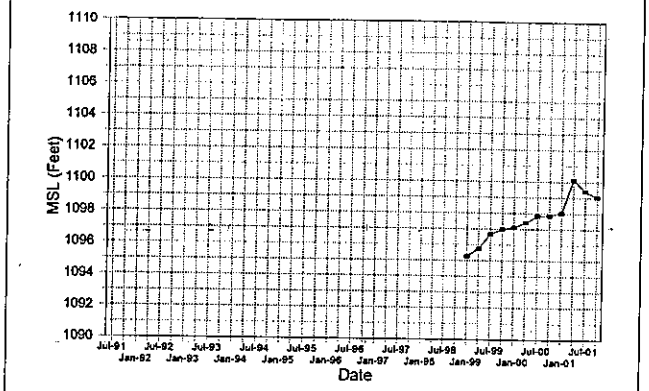
Flambeau Mining Company

Groundwater Elevation Results

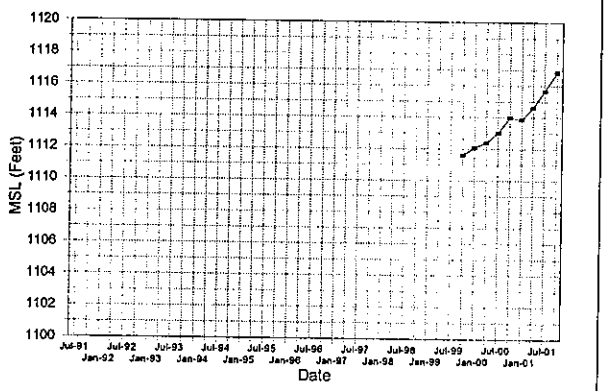
MW1013B



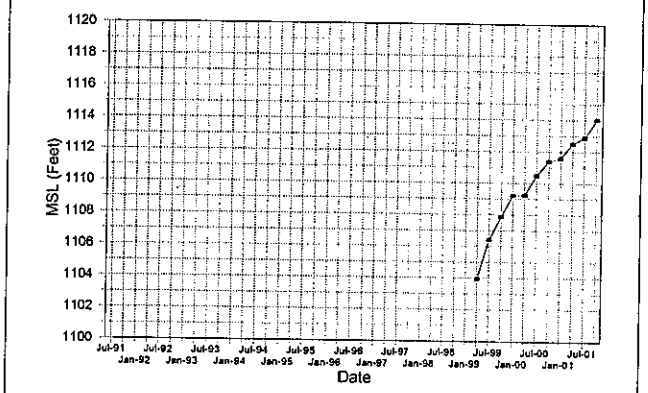
MW1013C



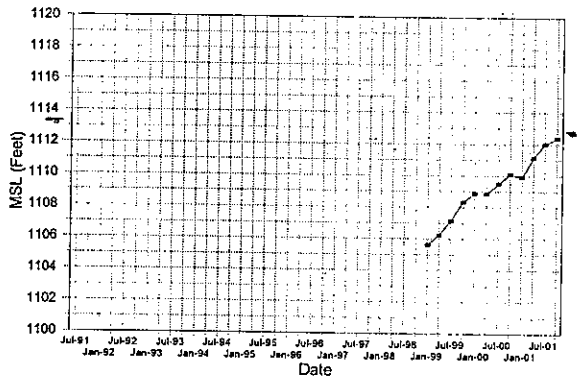
MW1014



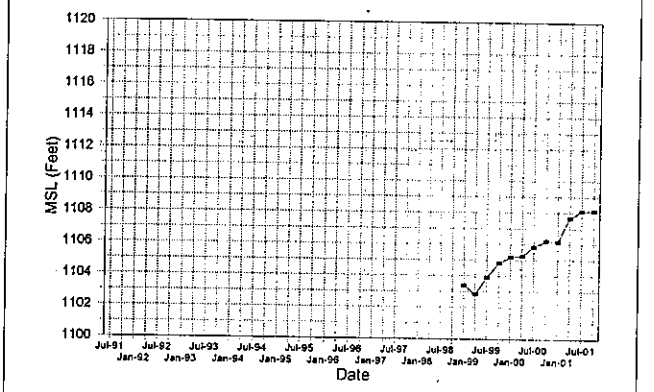
MW1014A



MW1014B

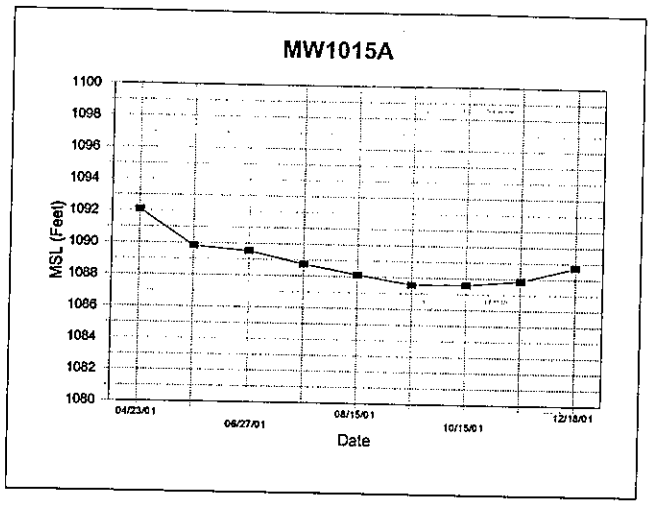


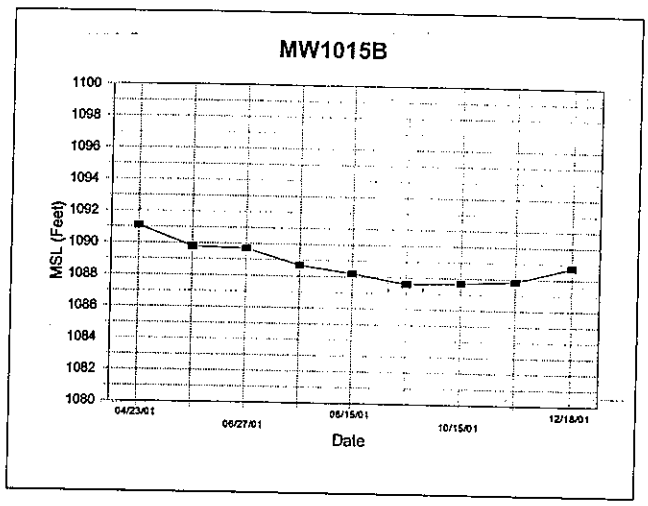
MW1014C



Flambeau Mining Company

Groundwater Elevation Results





Attachment 4

Trend Results In-Pit Wells and Wells MW-1015A and MW-1015B

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Alk (mg/l)	As (ug/l)	Ba (ug/l)	Cd (ug/l)	Ca (mg/l)	Cl (mg/l)	Cr (ug/l)	Cu (ug/l)	Hard (mg/l)	Fe (mg/l)	Pb (ug/l)
MW-1013	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Apr-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013B	Feb-99	630	-	-	-	-	-	-	36	2300	0.045	-
MW-1013B	Apr-99	550	-	-	-	-	-	-	16	2300	0.33	-
MW-1013B	Jul-99	620	< 42	< 50	< 21	630	35	16	33	2200	0.76	< 14
MW-1013B	Oct-99	540	< 42	< 50	< 4.2	650	35	14	< 9.4	2200	0.17	< 14
MW-1013B	Jan-00	560	17	< 50	< 2.1	600	28	18	< 4.7	2100	0.41	< 14
MW-1013B	Apr-00	520	12	< 50	< 3.1	630	35	< 6.2	19	2200	0.27	< 24
MW-1013B	Jul-00	660	< 21	< 50	< 2.3	670	< 40	5.1	14	2300	< 0.36	< 9.6
MW-1013B	Oct-00	620	-	-	-	-	-	-	< 12	2200	0.84	-
MW-1013B	Jan-01	590	-	-	-	-	-	-	< 12	1900	0.41	-
MW-1013B	Apr-01	530	-	-	-	-	-	-	35	2300	0.72	-
MW-1013B	Jul-01	490	< 15	< 50	3.3	700	-	6.4	33	2400	0.89	< 7.9
MW-1013B	Oct-01	560	18	< 50	< 1.7	600	-	4.8	69	2000	0.66	< 7.9
MW-1013C	Feb-99	480	-	-	-	-	-	-	100	2100	0.92	-
MW-1013C	Apr-99	430	-	-	-	-	-	-	75	2200	0.84	-
MW-1013C	Jul-99	430	83	< 50	< 21	570	50	< 4.2	50	2100	1.3	< 14
MW-1013C	Oct-99	400	< 42	< 50	< 4.2	610	50	7.2	< 9.4	2200	1.4	< 14
MW-1013C	Jan-00	510	< 15	< 50	< 2.1	550	58	< 4.2	< 4.7	2100	1.5	< 14
MW-1013C	Apr-00	460	14	< 50	< 3.1	590	50	< 6.2	11	2200	1.6	< 24
MW-1013C	Jul-00	520	< 21	< 50	< 2.3	620	56	< 4	< 12	2300	2.2	< 9.6
MW-1013C	Oct-00	540	-	-	-	-	-	-	< 12	2200	1.6	-
MW-1013C	Jan-01	520	-	-	-	-	-	-	< 12	2100	2.6	-
MW-1013C	Apr-01	440	-	-	-	-	-	-	< 13	2300	2.1	-
MW-1013C	Jul-01	460	< 15	< 50	< 1.7	630	-	< 3.4	< 13	2300	3.2	< 7.9
MW-1013C	Oct-01	480	22	< 50	< 1.7	550	-	< 3.4	< 13	2000	2.7	< 7.9

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Mg (mg/l)	Mn (ug/l)	CO2 [ug/l]	Hg (ug/l)	Field pH (s.u.)	Lab pH (s.u.)	K	Se (ug/l)	Ag (ug/l)	Na (mg/l)	TDS (mg/l)
MW-1013	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Apr-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013A	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1013B	Feb-99	-	25000	-	-	6.2	6.5	-	-	-	-	3100
MW-1013B	Apr-99	-	30000	-	-	6.2	6.4	-	-	-	-	3700
MW-1013B	Jul-99	150	29000	-	< 0.05	6.4	6.5	8.2	1.7 <	4.5	35	3800
MW-1013B	Oct-99	150	28000	180000	< 0.05	6.6	6.8	5.9	< 1.3 <	4.5	26	3700
MW-1013B	Jan-00	150	30000	-	< 0.05	6.4	6.4	6.4	< 1.3 <	4.5	33	3300
MW-1013B	Apr-00	150	32000	470000	< 0.05	6.6	6.3	8.5	< 7.8 <	4.7	27	3600
MW-1013B	Jul-00	160	34000	-	< 0.05	6.3	6.3	7.2	< 17 <	5.5	34	3200
MW-1013B	Oct-00	-	35000	-	-	6.3	6.9	-	-	-	-	3200
MW-1013B	Jan-01	-	30000	-	-	6.14	6.3	-	-	-	-	3300
MW-1013B	Apr-01	-	40000	410000	-	6.4	6.5	-	-	-	-	3300
MW-1013B	Jul-01	160	40000	-	< 0.05	6.09	6.3	-	< 10	6.5	-	3500
MW-1013B	Oct-01	130	34000	-	< 0.05	6.06	6.3	-	< 16	6	-	3200
MW-1013C	Feb-99	-	7200	-	-	6.3	6.6	-	-	-	-	3000
MW-1013C	Apr-99	-	7700	-	-	6.4	6.6	-	-	-	-	3300
MW-1013C	Jul-99	160	7300	-	< 0.05	6.4	6.7	23	3 <	4.5	35	2700
MW-1013C	Oct-99	170	7600	140000	< 0.05	6.8	6.7	26	< 1.3 <	4.5	29	3000
MW-1013C	Jan-00	170	7300	-	< 0.05	6.5	6.4	23	< 1.3	5.2	39	2900
MW-1013C	Apr-00	170	7800	270000	< 0.05	6.7	6.4	25	< 7.8 <	4.7	34	2900
MW-1013C	Jul-00	180	8400	-	< 0.05	6.3	6.4	24	< 17 <	5.5	45	3300
MW-1013C	Oct-00	-	8200	-	-	6.4	6.9	-	-	-	-	3200
MW-1013C	Jan-01	-	7800	-	-	6.27	6.4	-	-	-	-	3200
MW-1013C	Apr-01	-	9100	260000	-	6.3	6.5	-	-	-	-	3000
MW-1013C	Jul-01	180	9000	-	< 0.05	6.28	6.6	-	< 10 <	3.1	-	3500
MW-1013C	Oct-01	160	8500	-	< 0.05	6.22	6.5	-	< 16	6.8	-	3200

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (oC)	Grd Water El (Feet)
MW-1013	Apr-99	-	-	-	-	-	-	-	-	-	1105.11
MW-1013	Jul-99	-	-	-	-	-	-	-	-	-	1106.07
MW-1013	Oct-99	-	-	-	-	-	-	-	-	-	1105.8
MW-1013	Jan-00	-	-	-	-	-	-	-	-	-	1104.64
MW-1013	Apr-00	-	-	-	-	-	97	-	-	-	1103.87
MW-1013	Jul-00	-	-	-	-	-	-	-	-	-	1104.58
MW-1013	Oct-00	-	-	-	-	-	-	-	-	-	1105.06
MW-1013	Jan-01	-	-	-	-	-	-	-	-	-	1103.78
MW-1013	Apr-01	-	-	-	-	-	-	-	-	-	1104.08
MW-1013	Jul-01	-	-	-	-	-	-	-	-	-	1106.08
MW-1013	Oct-01	-	-	-	-	-	-	-	-	-	1106.69
MW-1013A	Apr-99	-	-	-	-	-	-	-	-	-	1094.73
MW-1013A	Jul-99	-	-	-	-	-	-	-	-	-	1095.38
MW-1013A	Oct-99	-	-	-	-	-	-	-	-	-	1095.51
MW-1013A	Jan-00	-	-	-	-	-	-	-	-	-	1095.62
MW-1013A	Apr-00	-	-	-	-	-	97	-	-	-	1095.36
MW-1013A	Jul-00	-	-	-	-	-	-	-	-	-	1095.79
MW-1013A	Oct-00	-	-	-	-	-	-	-	-	-	1096.2
MW-1013A	Jan-01	-	-	-	-	-	-	-	-	-	1095.72
MW-1013A	Apr-01	-	-	-	-	-	-	-	-	-	1097.1
MW-1013A	Jul-01	-	-	-	-	-	-	-	-	-	1097.19
MW-1013A	Oct-01	-	-	-	-	-	-	-	-	-	1096.9
MW-1013B	Feb-99	1400	-	None	3540	-	-	None	None	-	1093.95
MW-1013B	Apr-99	770	-	Slight	3130	-	-	None	Moderate	16	1094.58
MW-1013B	Jul-99	1600	< 120	None	3020	-	-	Slight	Slight	18.3	1095.2
MW-1013B	Oct-99	1900	< 120	None	3200	-	-	Slight	Slight	14.2	1095.49
MW-1013B	Jan-00	1700	< 120	None	3000	-	-	None	Slight	12.6	1095.59
MW-1013B	Apr-00	1200	< 120	None	3120	-	230	None	Slight	8.7	1095.54
MW-1013B	Jul-00	1600	< 120	None	3000	2800	-	None	Slight	16	1096.09
MW-1013B	Oct-00	1500	< 120	None	3180	1800	-	None	Slight	13.9	1096.45
MW-1013B	Jan-01	1600	< 120	None	3230	2700	174	None	V.Slight	11.2	1095.86
MW-1013B	Apr-01	1600	< 120	None	3400	2600	203	None	V.Slight	14	1097.57
MW-1013B	Jul-01	1600	130	None	3290	2700	252	None	V.Slight	15.7	1097.63
MW-1013B	Oct-01	1600	130	None	3320	3000	201	None	V.Slight	14.4	1097.19
MW-1013C	Feb-99	1300	-	None	3170	-	-	None	None	-	1095.27
MW-1013C	Apr-99	920	-	None	3030	-	-	None	None	13.5	1095.73
MW-1013C	Jul-99	870	660	Slight	3020	-	-	None	VSlight	-	1096.67
MW-1013C	Oct-99	2000	660	None	3300	-	-	None	Moderate	9.6	1096.97
MW-1013C	Jan-00	1700	630	None	2700	-	-	Vslight	Slight	10.4	1097.1
MW-1013C	Apr-00	1700	610	None	3370	-	177	None	Moderate	8.5	1097.39
MW-1013C	Jul-00	1600	620	None	3100	2800	-	None	VSlight	13.8	1097.84
MW-1013C	Oct-00	1600	370	None	3310	2500	-	None	VSlight	11.9	1097.86
MW-1013C	Jan-01	1600	480	None	3310	2800	80	None	VSlight	11.4	1098.03
MW-1013C	Apr-01	1600	330	None	3000	2700	84	None	Vslight	13.8	1100.12
MW-1013C	Jul-01	1600	570	None	3400	2800	30	None	VSlight	15	1099.39
MW-1013C	Oct-01	1700	510	None	3380	3100	21	None	VSlight	12.6	1099.04

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Alk (mg/l)	As (ug/l)	Ba (ug/l)	Cd (ug/l)	Ca (mg/l)	Cl (mg/l)	Cr (ug/l)	Cu (ug/l)	Hard (mg/l)	Fe (mg/l)	Pb (ug/l)
MW-1014	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Apr-00											
MW-1014	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Apr-00	390	15	59	< 3.1	330	< 50	< 6.2	< 6	1300	0.55	< 24
MW-1014A	Jul-00	430	< 21	58	< 2.3	360	< 25	12	< 12	1400	1.2	< 9.6
MW-1014A	Oct-00	430	-	-	-	-	-	-	< 12	1400	0.96	-
MW-1014A	Jan-01	410	-	-	-	-	-	-	< 12	1200	0.83	-
MW-1014A	Apr-01	430	-	-	-	-	-	-	< 13	1400	0.69	-
MW-1014A	Jul-01	420	< 15	< 50	< 1.7	370	-	5.3	< 13	1500	0.7	< 7.9
MW-1014A	Oct-01	430	37	< 50	< 1.7	330	- <	3.4	< 13	1300	1.5	< 7.9
MW-1014B	Feb-99	510	-	-	-	-	-	-	810	2100	0.062	-
MW-1014B	Apr-99	460	-	-	-	-	-	-	420	2100	0.033	-
MW-1014B	Jul-99	540	70	< 50	31	580	49	13	520	2100	0.072	< 14
MW-1014B	Oct-99	570	< 42	< 50	10	640	43	7.4	530	2200	< 0.01	< 14
MW-1014B	Jan-00	490	< 15	< 50	10	550	< 100	< 4.2	500	1900	0.055	< 14
MW-1014B	Apr-00	480	< 7.5	< 50	10	600	42	< 6.2	520	2100	< 0.15	< 24
MW-1014B	Jul-00	510	< 21	< 50	8.9	600	38	< 4	330	2200	< 0.36	< 9.6
MW-1014B	Oct-00	520	-	-	-	-	-	-	430	2200	< 0.36	-
MW-1014B	Jan-01	550	-	-	-	-	-	-	450	1900	< 0.36	-
MW-1014B	Apr-01	520	-	-	-	-	-	-	530	2000	< 0.15	-
MW-1014B	Jul-01	440	< 15	< 50	6.2	600	-	8.9	480	2200	< 0.15	< 7.9
MW-1014B	Oct-01	510	20	< 50	4.3	530	- <	3.4	490	1900	< 0.15	< 7.9
MW-1014C	Feb-99	360	-	-	-	-	-	- <	4.7	980	14	-
MW-1014C	Apr-99	330	-	-	-	-	-	- <	4.7	1000	15	-
MW-1014C	Jul-99	370	< 42	< 50	< 21	280	32 <	4.2	16	930	14	< 14
MW-1014C	Oct-99	380	< 42	< 50	< 4.2	290	33 <	4.2 <	9.4	960	14	< 14
MW-1014C	Jan-00	320	< 15	25	< 2.1	250	31 <	0.42 <	0.47	810	12	< 14
MW-1014C	Apr-00	320	14	< 50	< 3.1	260	33 <	6.2 <	6	870	13	< 24
MW-1014C	Jul-00	350	39	< 50	< 2.3	270	36	4.2 <	12	890	13	< 9.6
MW-1014C	Oct-00	390	-	-	-	-	-	- <	12	840	12	-
MW-1014C	Jan-01	340	-	-	-	-	-	- <	12	760	11	-
MW-1014C	Apr-01	330	-	-	-	-	-	- <	13	830	12	-
MW-1014C	Jul-01	330	21	< 50	< 1.7	240	-	4.7 <	13	810	11	< 7.9
MW-1014C	Oct-01	350	15	< 50	< 1.7	210	- <	3.4 <	13	710	9.6	< 7.9

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Mg (mg/l)	Mn (ug/l)	CO2 [ug/l]	Hg (ug/l)	Field pH (s.u.)	Lab pH (s.u.)	K	Se (ug/l)	Ag (ug/l)	Na (mg/l)	TDS (mg/l)
MW-1014	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Apr-00											
MW-1014	Jul-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jan-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Apr-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Jul-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-01	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Apr-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Jul-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Oct-99	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Jan-00	-	-	-	-	-	-	-	-	-	-	-
MW-1014A	Apr-00	120	7200	150000	< 0.05	6.9	6.6	12	< 7.8	< 4.7	34	1800
MW-1014A	Jul-00	130	7100	-	< 0.05	6.6	6.6	12	< 17	< 5.5	35	2200
MW-1014A	Oct-00	-	6700	-	-	6.7	6.9	-	-	-	-	2300
MW-1014A	Jan-01	-	5400	-	-	6.46	6.6	-	-	-	-	1900
MW-1014A	Apr-01	-	6700	180000	-	6.3	6.7	-	-	-	-	1700
MW-1014A	Jul-01	130	6500	-	< 0.05	6.24	6.6	-	< 10	< 3.1	-	2000
MW-1014A	Oct-01	110	6000	-	< 0.05	6.34	6.7	-	< 16	< 3.1	-	1900
MW-1014B	Feb-99	-	23000	-	-	6.2	6.3	-	-	-	-	2900
MW-1014B	Apr-99	-	23000	-	-	6.2	6.4	-	-	-	-	3300
MW-1014B	Jul-99	170	23000	-	< 0.05	6.3	6.4	25	2.2	< 45	93	3100
MW-1014B	Oct-99	150	23000	300000	< 0.05	6.4	6.5	17	1.4	< 4.5	24	3100
MW-1014B	Jan-00	140	20000	-	< 0.05	6.5	6.2	18	2.6	< 0.45	27	3200
MW-1014B	Apr-00	150	22000	560000	< 0.05	6.4	6.2	23	< 7.8	< 4.7	26	3200
MW-1014B	Jul-00	160	21000	-	< 0.05	6.3	6.4	22	< 17	< 5.5	42	3000
MW-1014B	Oct-00	-	21000	-	-	6.3	6.6	-	-	-	-	2900
MW-1014B	Jan-01	-	18000	-	-	6.29	6.3	-	-	-	-	2600
MW-1014B	Apr-01	-	19000	470000	-	6.1	6.3	-	-	-	-	3300
MW-1014B	Jul-01	160	20000	-	< 0.05	6.01	6.3	-	< 10	< 3.1	-	3000
MW-1014B	Oct-01	140	18000	-	< 0.05	6.05	6.4	-	< 16	7.2	-	2900
MW-1014C	Feb-99	-	4300	-	-	6.3	6.5	-	-	-	-	1200
MW-1014C	Apr-99	-	4500	-	-	6.3	6.5	-	-	-	-	1200
MW-1014C	Jul-99	56	4000	-	< 0.05	6.4	6.5	4.8	1.8	< 45	11	1200
MW-1014C	Oct-99	56	4000	160000	< 0.05	6.6	6.7	4	< 1.3	< 4.5	9.6	1200
MW-1014C	Jan-00	48	3200	-	< 0.05	6.6	6.5	6.3	1.9	< 0.45	12	1200
MW-1014C	Apr-00	51	3600	260000	< 0.05	6.7	6.3	7.6	< 7.8	< 4.7	9.4	1000
MW-1014C	Jul-00	54	3500	-	< 0.05	6.4	6.5	7.4	< 17	< 5.5	12	1400
MW-1014C	Oct-00	-	3200	-	-	6.4	6.7	-	-	-	-	1300
MW-1014C	Jan-01	-	2900	-	-	6.46	6.4	-	-	-	-	1100
MW-1014C	Apr-01	-	3100	220000	-	6.2	6.5	-	-	-	-	1100
MW-1014C	Jul-01	49	3000	-	< 0.05	6.15	6.5	-	< 10	< 3.1	-	1100
MW-1014C	Oct-01	44	2900	-	< 0.05	6.17	6.6	-	< 1.6	4.6	-	990

There is no page B-54.

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Sulf (mg/l)	Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (oC)	Grd Water El (Feet)
MW-1014	Apr-99	-	-	-	-	-	-	-	-	-	-
MW-1014	Jul-99	-	-	-	-	-	-	-	-	-	-
MW-1014	Oct-99	-	-	-	-	-	-	-	-	-	1111.6
MW-1014	Jan-00	-	-	-	-	-	-	-	-	-	1112.07
MW-1014	Apr-00						160				1112.41
MW-1014	Jul-00	-	-	-	-	-	-	-	-	-	1113
MW-1014	Oct-00	-	-	-	-	-	-	-	-	-	1113.98
MW-1014	Jan-01	-	-	-	-	-	-	-	-	-	1113.86
MW-1014	Apr-01	-	-	-	-	-	-	-	-	-	1114.62
MW-1014	Jul-01	-	-	-	-	-	-	-	-	-	1115.67
MW-1014	Oct-01	-	-	-	-	-	-	-	-	-	1116.86
MW-1014A	Apr-99	-	-	-	-	-	-	-	-	-	1103.93
MW-1014A	Jul-99	-	-	-	-	-	-	-	-	-	1106.42
MW-1014A	Oct-99	-	-	-	-	-	-	-	-	-	1107.87
MW-1014A	Jan-00	-	-	-	-	-	-	-	-	-	1109.22
MW-1014A	Apr-00	970	< 120	None	2220	-	165	None	None	11.2	1109.24
MW-1014A	Jul-00	960	< 120	None	2000	2000	-	None	None	15.4	1110.5
MW-1014A	Oct-00	880	< 120	None	2250	1800	-	None	Vslight	14.1	1111.39
MW-1014A	Jan-01	970	< 120	None	2310	1900	113	Slight	VSlight	NA	1111.59
MW-1014A	Apr-01	920	< 120	None	2300	1900	138	None	Slight	12.1	1112.51
MW-1014A	Jul-01	960	< 120	None	2250	2000	147	None	Slight	17.4	1112.88
MW-1014A	Oct-01	1000	< 120	None	2280	2200	152	Vslight	Slight	14.3	1114.03
MW-1014B	Feb-99	1200	-	None	3280	-	-	None	Slight	-	1105.62
MW-1014B	Apr-99	770	-	None	2890	-	-	None	None	14.2	1106.23
MW-1014B	Jul-99	580	2500	None	3540	-	-	None	Moderate	17.4	1107.13
MW-1014B	Oct-99	1600	5000	None	3200	-	-	None	Moderate	12.1	1108.33
MW-1014B	Jan-00	1400	4100	None	3000	-	-	None	Slight	12.1	1108.88
MW-1014B	Apr-00	1500	3700	None	2940		290	None	Slight	14.2	1108.85
MW-1014B	Jul-00	1600	2500	None	3000	2700	-	None	Slight	15.1	1109.47
MW-1014B	Oct-00	1500	2100	None	3240	2400	-	None	Moderate	13.1	1110.09
MW-1014B	Jan-01	1400	2800	None	3140	2600	226	None	Slight	10.5	1109.89
MW-1014B	Apr-01	1400	3500	None	3200	2500	207	None	Moderate	13.5	1111.14
MW-1014B	Jul-01	1500	1900	None	2990	2700	235	None	Moderate	16.5	1112.02
MW-1014B	Oct-01	1600	1600	None	3150	2900	219	None	Moderate	13.4	1112.38
MW-1014C	Feb-99	520	-	None	1900	-	-	None	None	-	1103.39
MW-1014C	Apr-99	440	-	None	1623	-	-	None	None	13.5	1102.83
MW-1014C	Jul-99	370	2200	None	1657	-	-	None	None	13.2	1103.9
MW-1014C	Oct-99	700	2100	None	1600	-	-	None	None	9.9	1104.81
MW-1014C	Jan-00	540	1700	None	1500	-	-	None	None	10.5	1105.18
MW-1014C	Apr-00	440	1800	None	1470	-	88	None	None	11.9	1105.25
MW-1014C	Jul-00	480	1700	None	1400	1400	-	None	None	13.7	1105.82
MW-1014C	Oct-00	450	1500	None	1490	1200	-	None	None	11.5	1106.21
MW-1014C	Jan-01	450	1200	None	1452	1300	64	None	None	10.9	1106.15
MW-1014C	Apr-01	420	1300	None	1400	1300	55	None	None	12.8	1107.65
MW-1014C	Jul-01	420	1200	None	1360	1300	40	None	None	13.7	1108.11
MW-1014C	Oct-01	410	1100	None	1354	1300	56	None	None	12.2	1108.1

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

Well	Date	Alk (mg/l)		As (ug/l)	Ba (ug/l)		Cd (ug/l)	Ca (mg/l)	Cl (mg/l)		Cr (ug/l)		Cu (ug/l)	Hard (mg/l)	Fe (mg/l)		Pb (ug/l)
MW-1015A	Apr-01	75	<	2.3	22	<	0.23	-	-	<	0.57	<	2.7	88	0.0082	<	0.92
MW-1015A	May-01	77	<	2.3	19	<	0.23	-	-	<	0.57	<	2.7	83	< 0.005	<	0.92
MW-1015A	Jun-01	75	<	2.3	18	<	0.23	-	-	<	0.57	<	2.7	85	< 0.005	<	0.92
MW-1015A	Jul-01	75	<	2.3	17	<	0.23	-	-	<	0.57	<	2.7	90	< 0.005	<	0.92
MW-1015A	Aug-01	76	<	2.3	17	<	0.23	-	-	<	0.57	<	2.7	90	< 0.005	<	0.92
MW-1015A	Sep-01	79	<	2.3	15	<	0.23	-	-	<	0.57	<	2.7	82	0.02	<	0.92
MW-1015A	Oct-01	77		2.3	14	<	0.23	19	-	<	0.57	<	2.7	78	< 0.005	<	0.92
MW-1015B	Apr-01	180	<	2.3	51	<	0.23	-	-	<	0.57	<	2.7	140	0.069	<	0.92
MW-1015B	May-01	180	<	2.3	48	<	0.23	-	-	<	0.57	<	2.7	140	< 0.005	<	0.92
MW-1015B	Jun-01	180	<	2.3	46	<	0.23	-	-	<	0.57	<	2.7	140	< 0.005	<	0.92
MW-1015B	Jul-01	180	<	2.3	47	<	0.23	-	-	<	0.57	<	2.7	150	< 0.005	<	0.92
MW-1015B	Aug-01	180	<	2.3	49	<	0.23	-	-	<	0.57	<	2.7	150	< 0.005	<	0.92
MW-1015B	Sep-01	180	<	2.3	43	<	0.23	-	-	<	0.57	<	2.7	130	0.0052	<	0.92
MW-1015B	Oct-01	180	<	2.3	41	<	0.23	30	-	<	0.57	<	2.7	130	< 0.005	<	0.92

Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

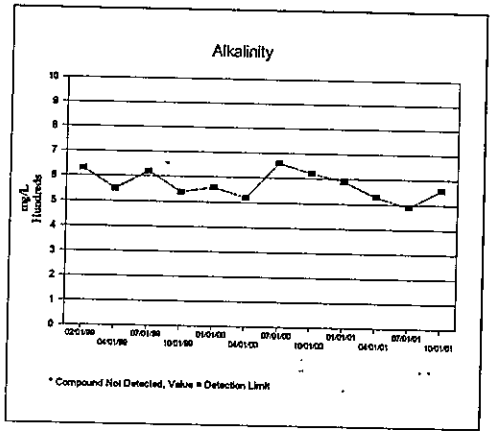
Well	Date	Mg (mg/l)	Mn (ug/l)	CO2 [ug/l]	Hg (ug/l)	Field pH (s.u.)	Lab pH (s.u.)	K	Se (ug/l)	Ag (ug/l)	Na (mg/l)	TDS (mg/l)
MW-1015A	Apr-01	-	< 2	-	< 0.05	7.1	7	-	< 1.6	< 0.56	-	120
MW-1015A	May-01	-	2.5	-	< 0.05	7	7	-	< 1.6	< 0.56	-	110
MW-1015A	Jun-01	-	4.2	-	< 0.05	7	6.9	-	< 1.6	< 0.56	-	110
MW-1015A	Jul-01	-	7.5	-	< 0.05	6.55	7.1	-	< 1.6	< 0.56	-	110
MW-1015A	Aug-01	-	9.7	-	< 0.05	6.68	7.2	-	< 1.6	0.99	-	100
MW-1015A	Sep-01	-	15	-	< 0.05	7.19	6.9	-	< 1.6	< 0.56	-	150
MW-1015A	Oct-01	7.4	10	-	< 0.05	6.6	7	-	< 1.6	< 0.56	-	130
MW-1015B	Apr-01	-	140	-	< 0.05	7.6	7.7	-	< 1.6	< 0.56	-	290
MW-1015B	May-01	-	36	-	< 0.05	7.8	7.6	-	< 1.6	< 0.56	-	220
MW-1015B	Jun-01	-	23	-	< 0.05	7.6	7.9	-	< 1.6	< 0.56	-	220
MW-1015B	Jul-01	-	19	-	< 0.05	7.32	7.8	-	< 1.6	< 0.56	-	240
MW-1015B	Aug-01	-	13	-	< 0.05	7.53	7.7	-	< 1.6	< 0.56	-	240
MW-1015B	Sep-01	-	18	-	< 0.05	7.67	7.5	-	< 1.6	< 0.56	-	290
MW-1015B	Oct-01	12	8.6	-	< 0.05	7.1	7.7	-	< 1.6	< 0.56	-	310

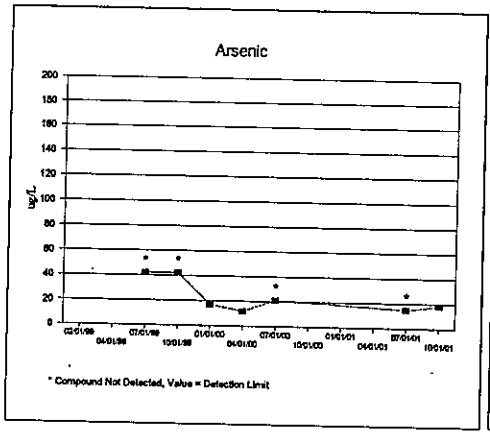
Groundwater Quality Results - In Pit Wells
MW-1015A and MW-1015B
February 1999 - November 2001

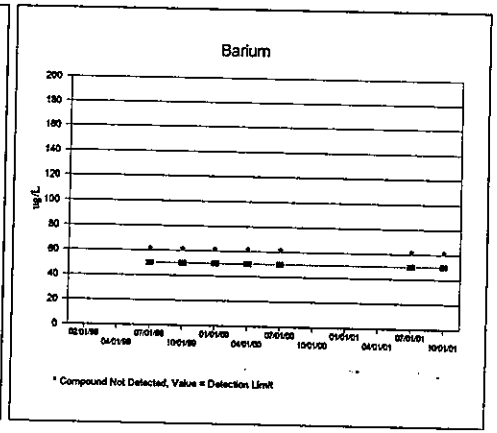
Well	Date		Sulf (mg/l)		Zn (ug/l)	Color (After Filter)	Field Cond (umho)	Lab Cond (umho)	Redox (mV)	Odor	Turbidity (Purging)	Temp (oC)	Grd Water El (Feet)
MW-1015A	Apr-01		8.2	<	12	None	160	190	-	None	None	9.6	1092.09
MW-1015A	May-01		9.2	<	12	None	150	190	-	None	None	11.6	1089.83
MW-1015A	Jun-01		8.4	<	12	None	150	190	-	None	None	12.9	1089.53
MW-1015A	Jul-01		9.8	<	12	None	153	200	-	None	None	12.6	1088.74
MW-1015A	Aug-01		7.6	<	12	None	158.7	190	-	None	None	12.6	1088.12
MW-1015A	Sep-01		7.8	<	12	None	159.9	190	-	None	None	10.2	1087.55
MW-1015A	Oct-01		10	<	12	None	160	190	-	None	None	11.3	1087.58
MW-1015B	Apr-01	<	5	<	12	None	460	500	-	Slight	None	8.3	1091.09
MW-1015B	May-01		5.1	<	12	None	470	510	-	None	None	9.6	1089.79
MW-1015B	Jun-01	<	5	<	12	None	450	500	-	None	None	12.8	1089.69
MW-1015B	Jul-01	<	5	<	12	None	451	490	-	None	None	12.9	1088.67
MW-1015B	Aug-01		5.3	<	12	None	462	480	-	None	None	11	1088.21
MW-1015B	Sep-01	<	5	<	12	None	458	500	-	None	None	10.7	1087.59
MW-1015B	Oct-01	<	5	<	12	None	450	490	-	None	None	10.1	1087.67

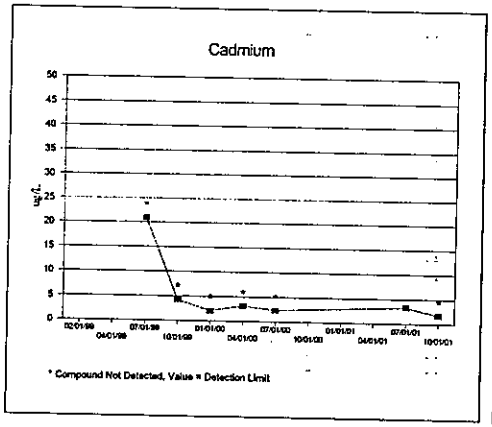
Flambeau Mining Company
Groundwater Quality Results

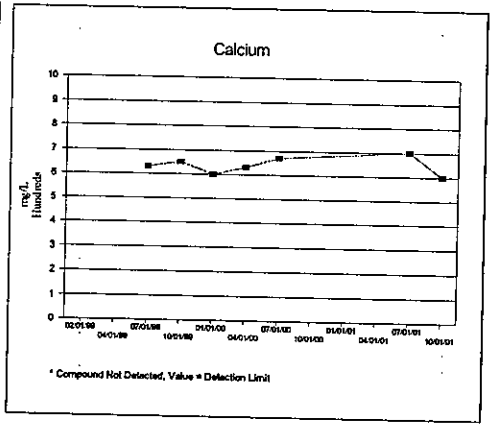
MW-1013B

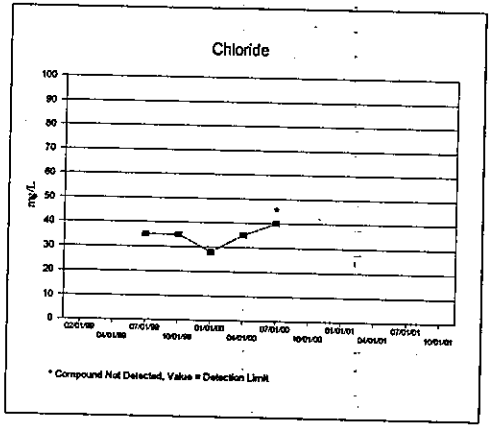


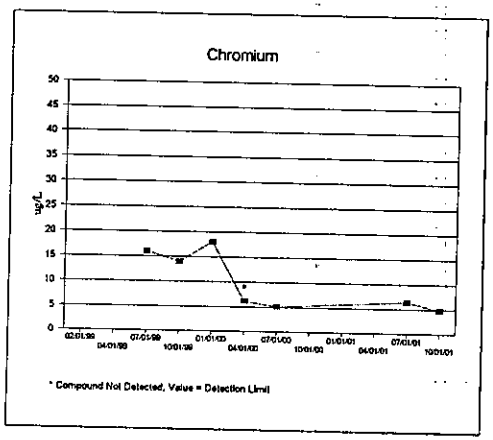


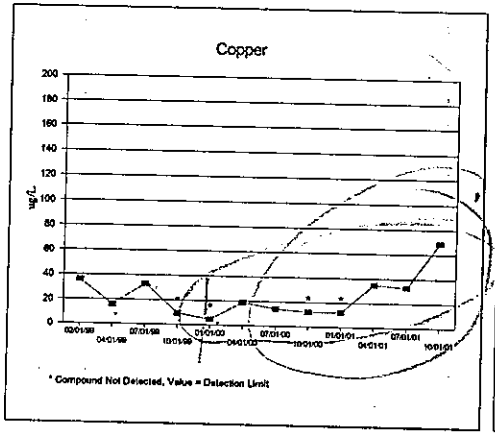


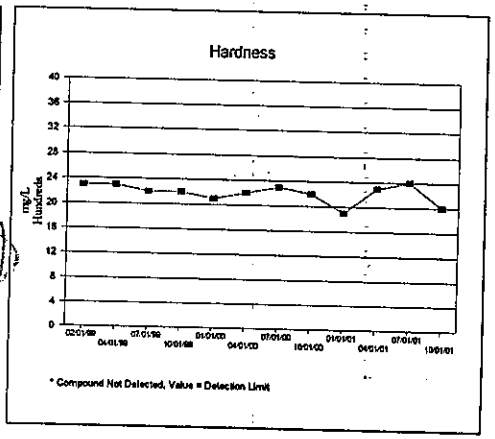






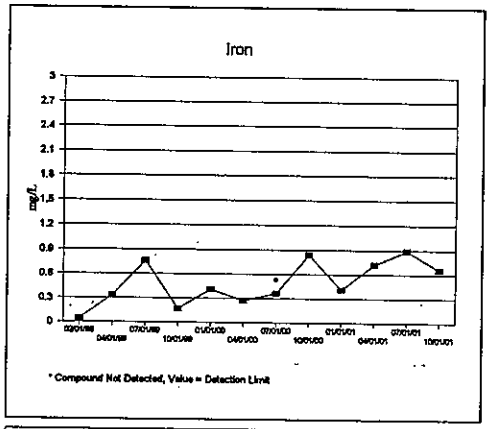


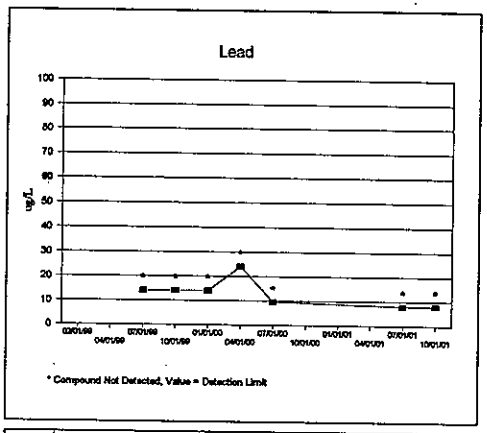


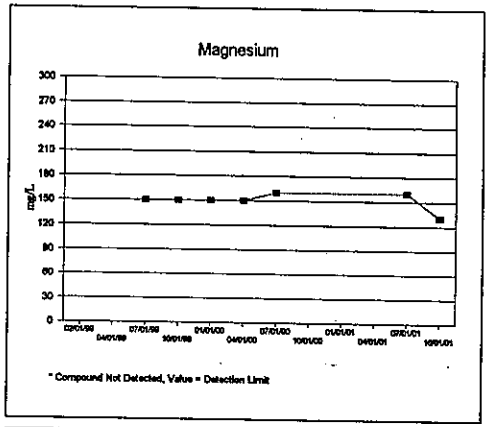


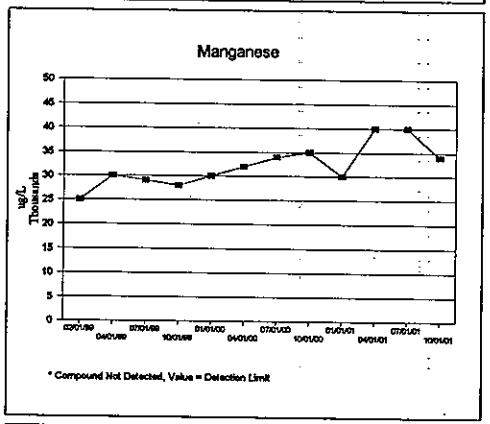
Flambeau Mining Company
Groundwater Quality Results

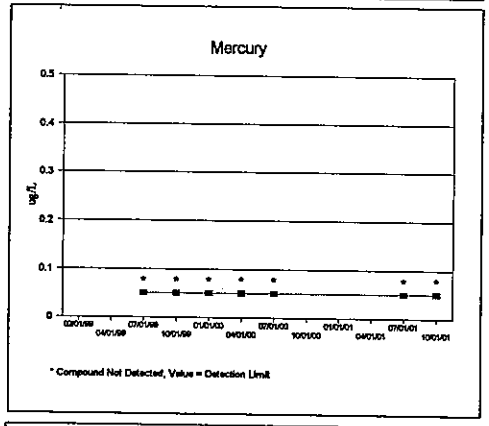
MW-1013B

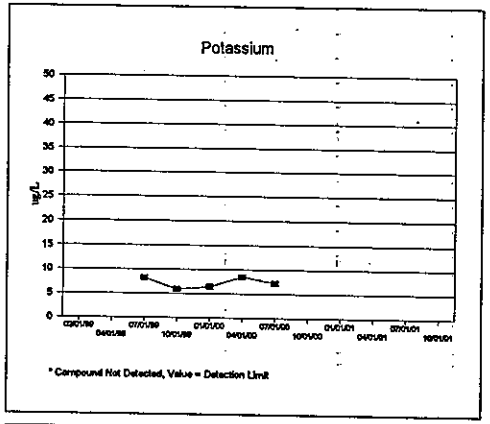


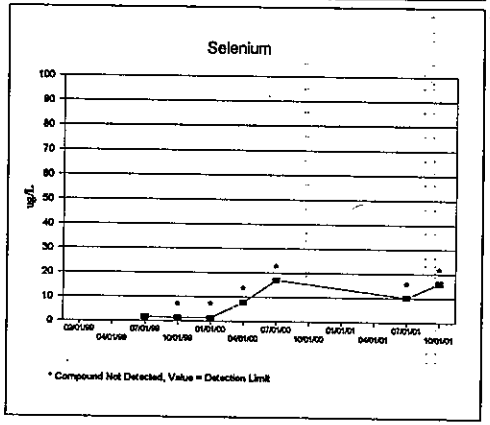


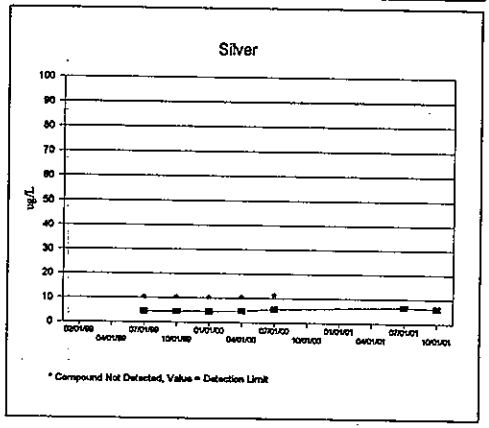


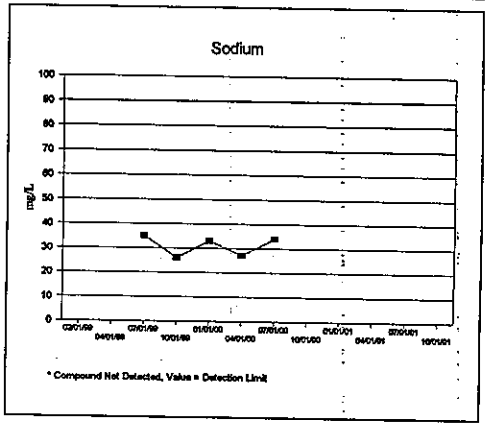












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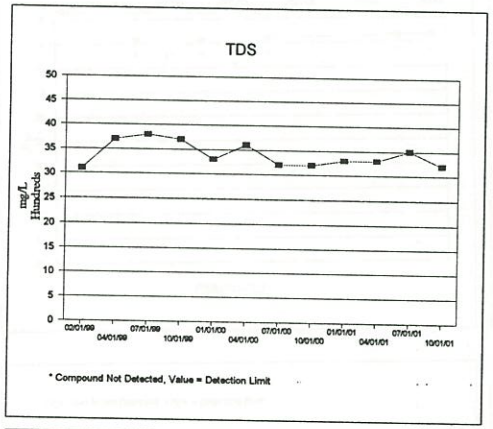

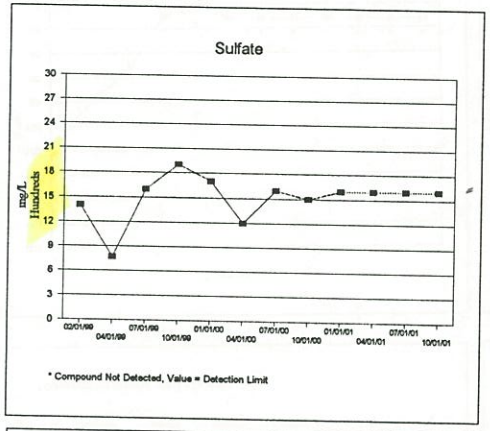

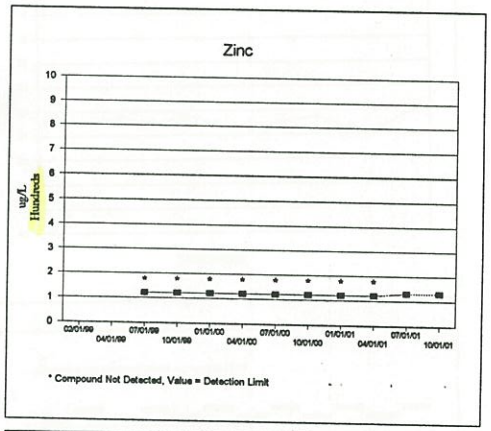

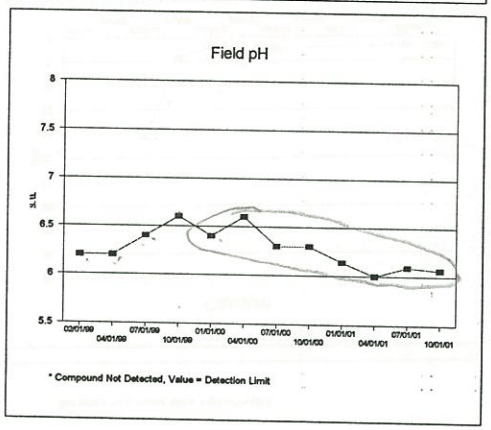

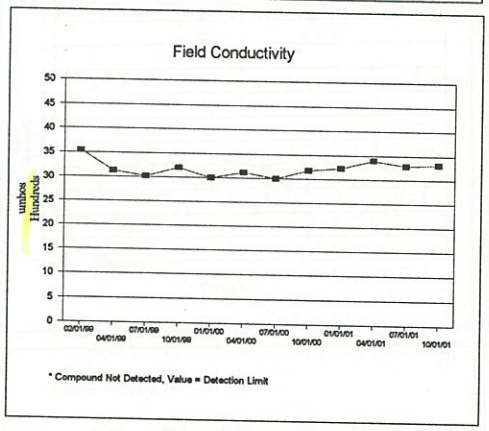

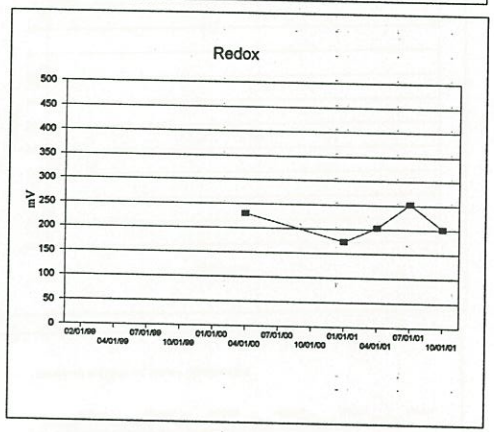

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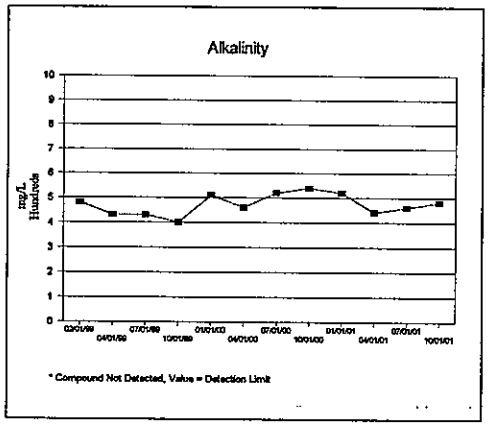

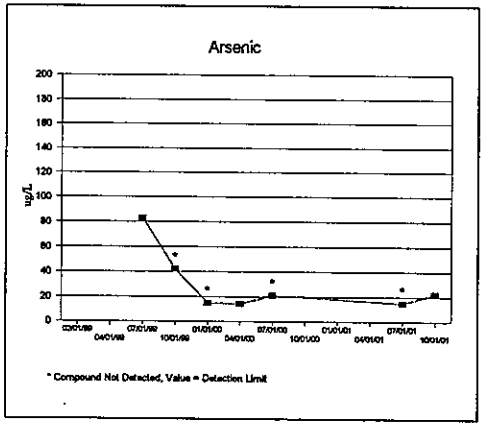

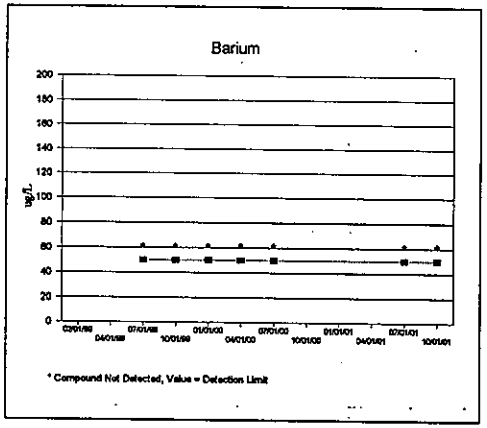

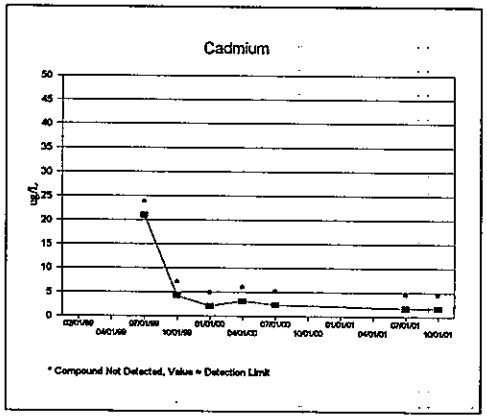

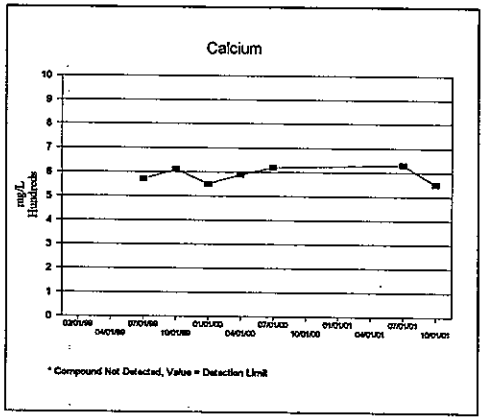

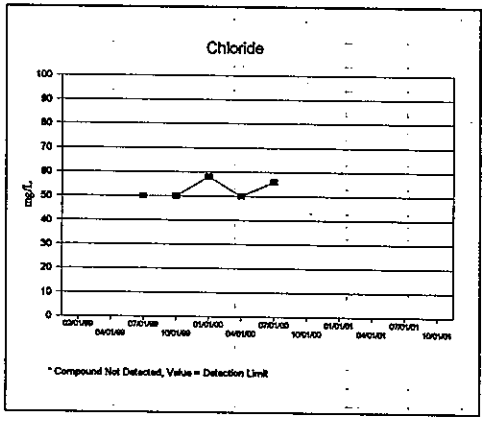

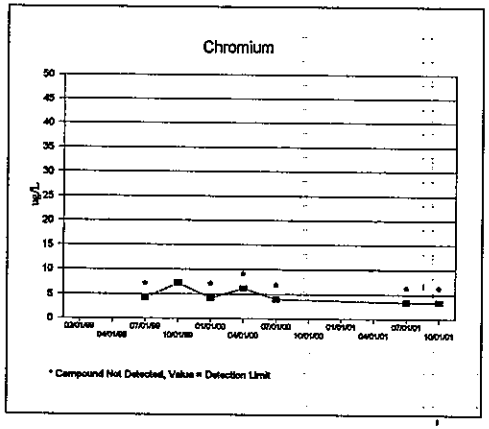

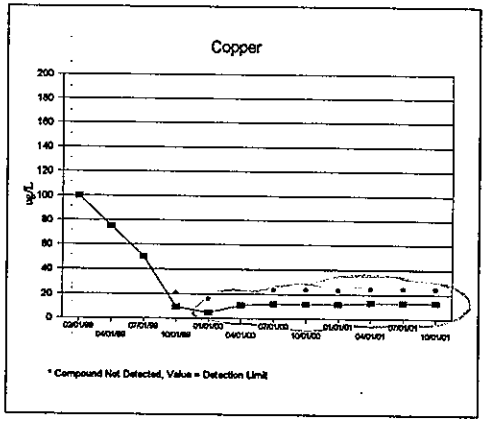

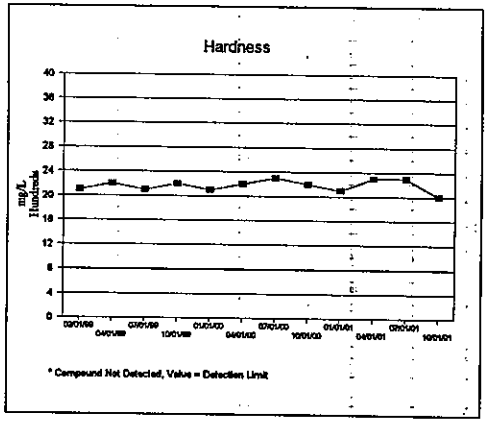

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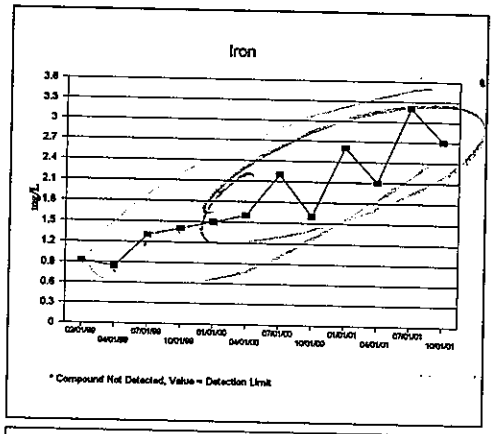

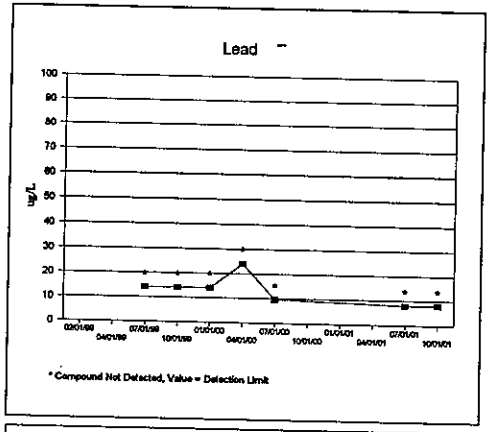

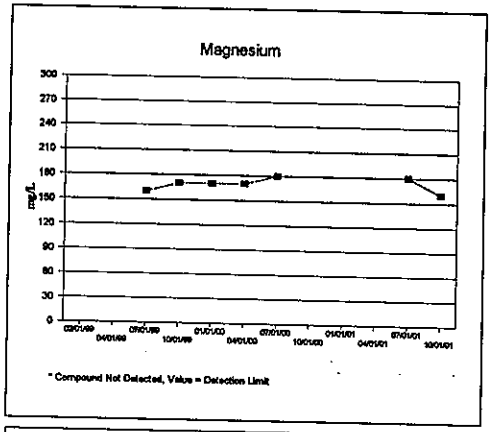

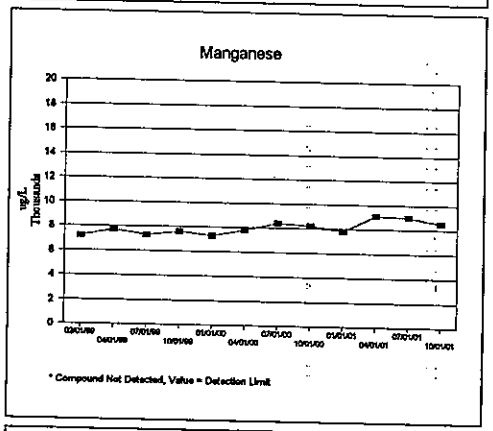

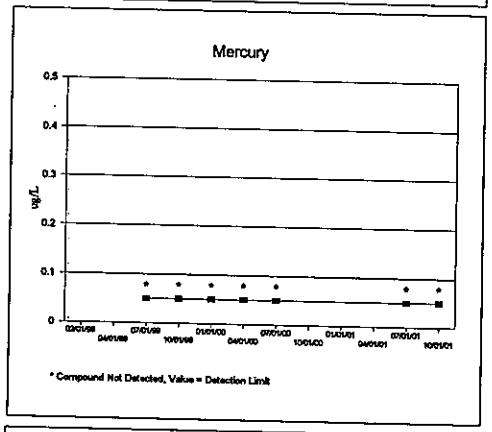

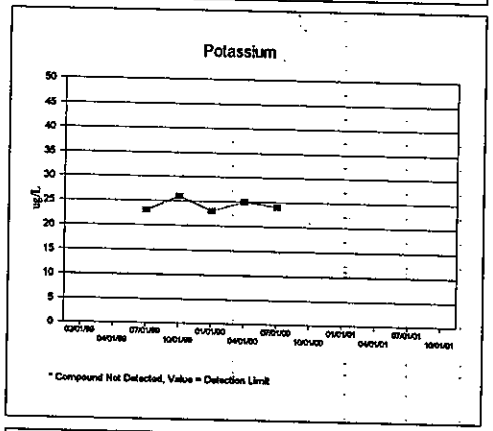

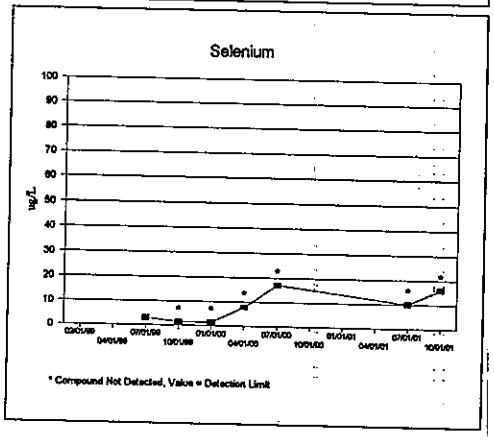

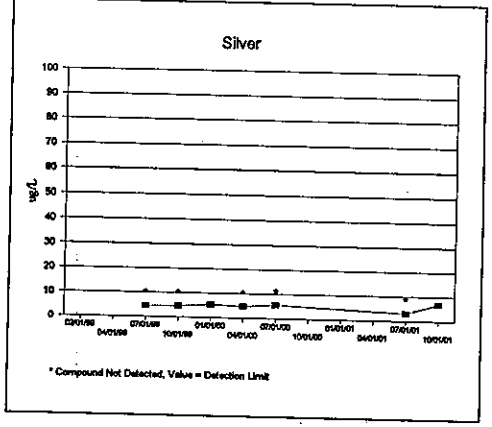

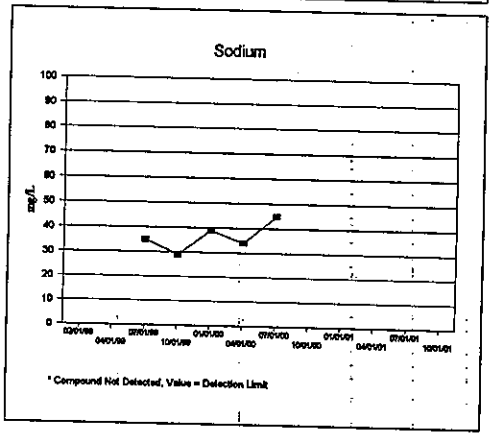

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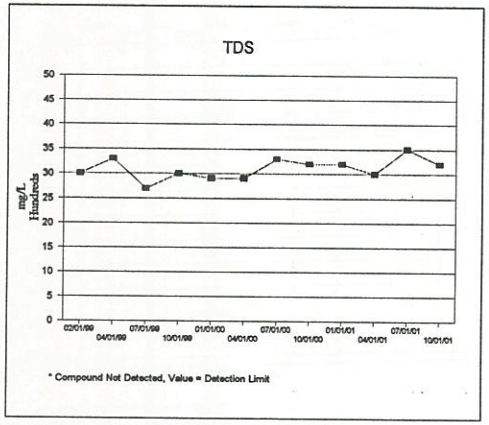
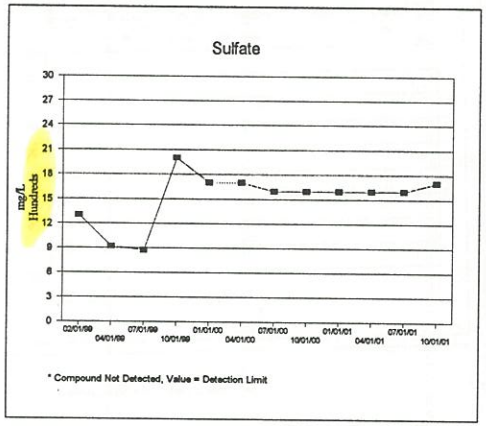
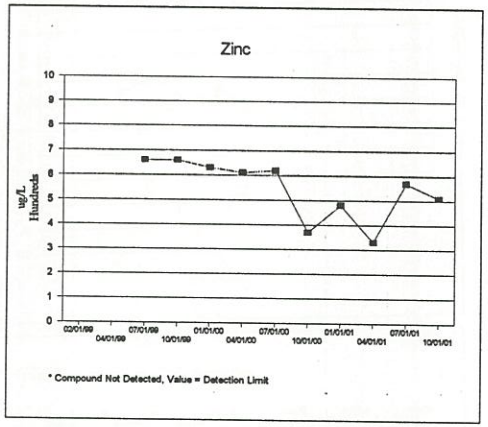
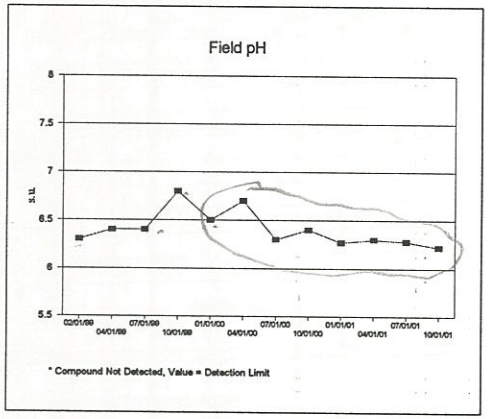
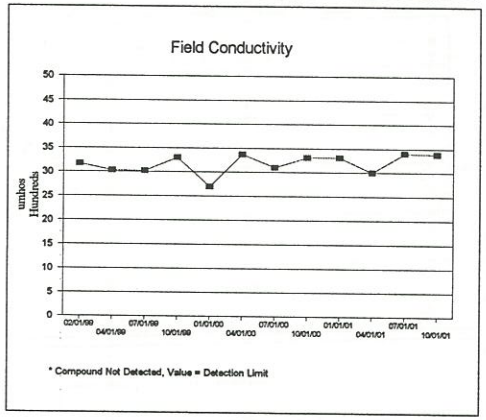
MW-1013C

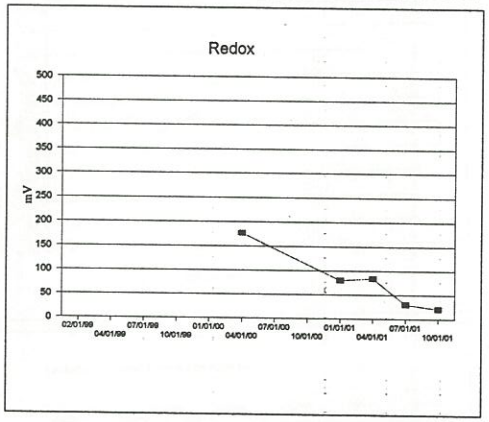












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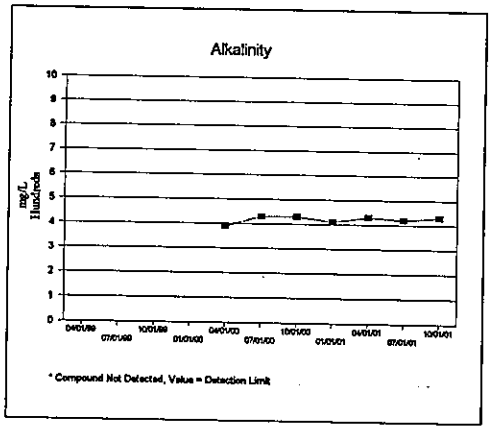

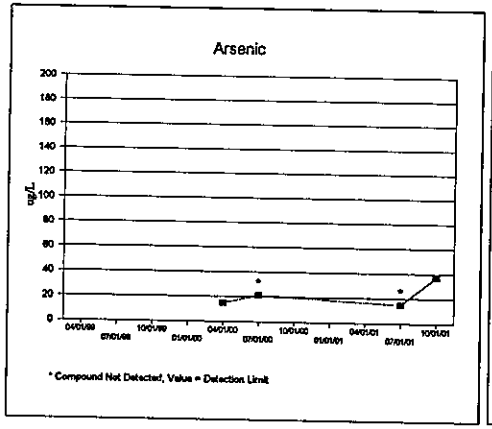

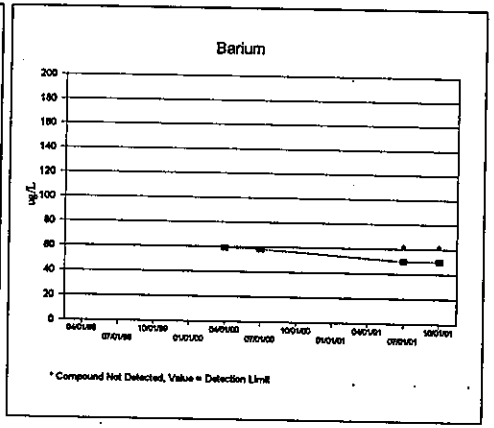

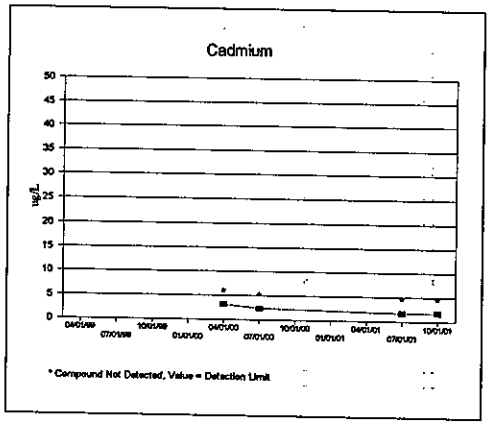

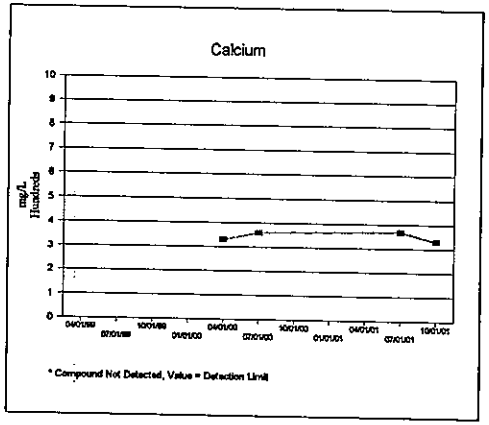

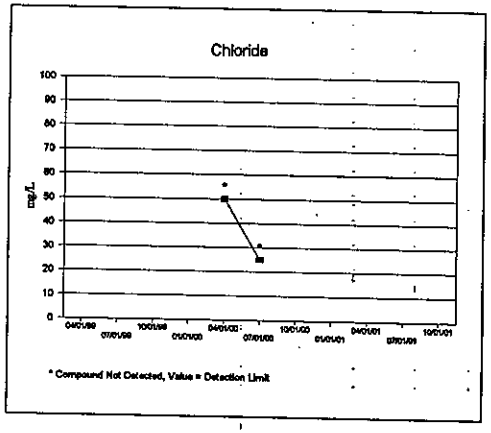

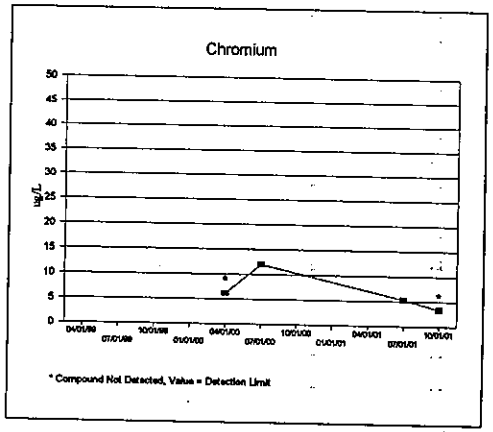

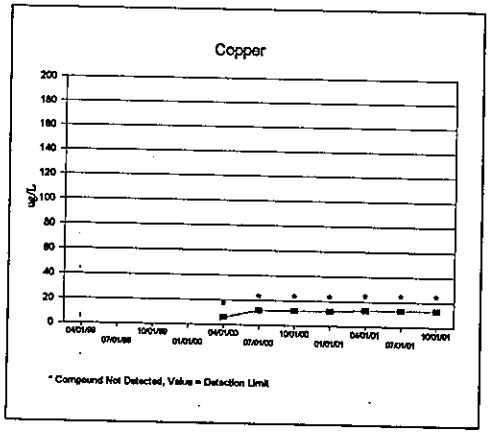

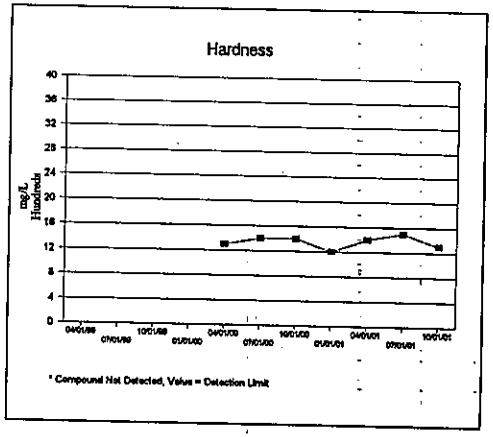

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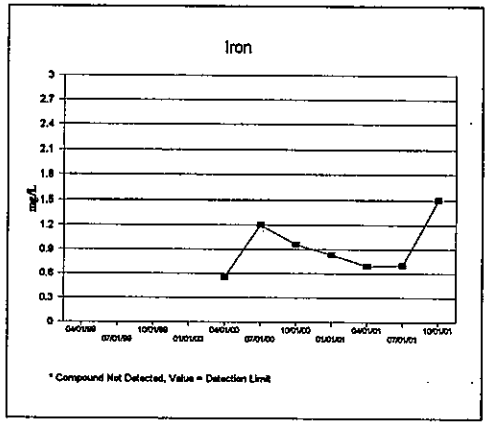

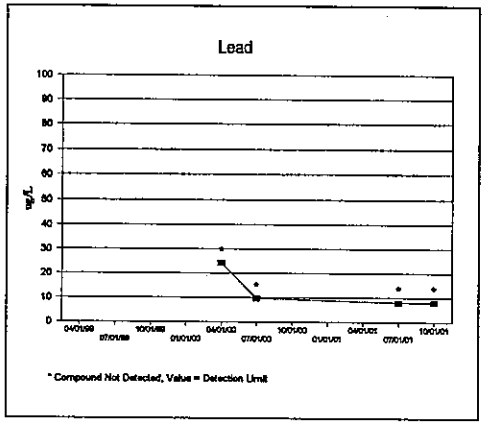

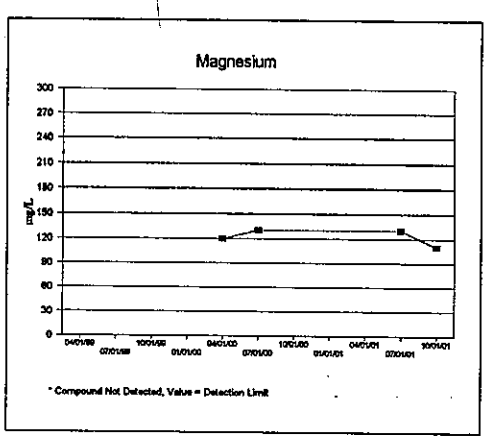

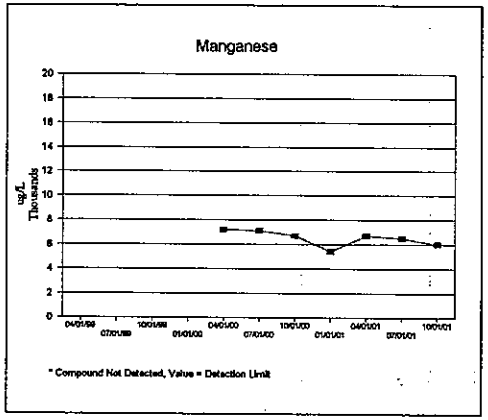

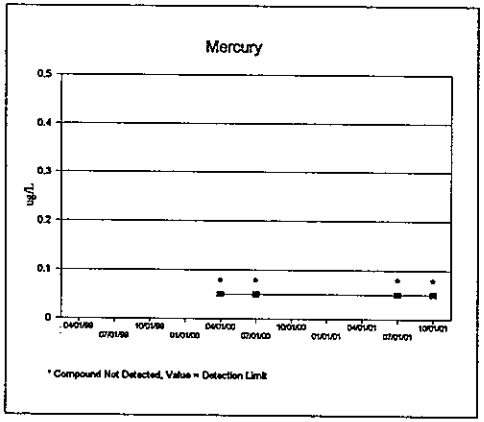

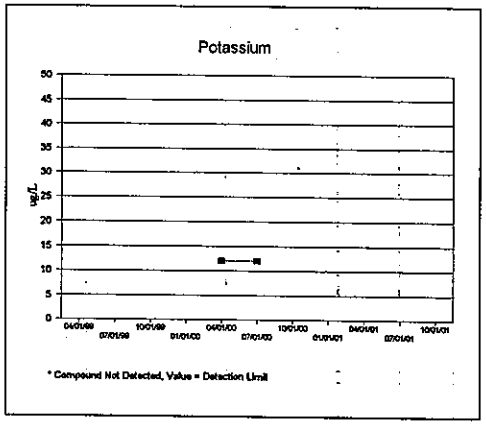

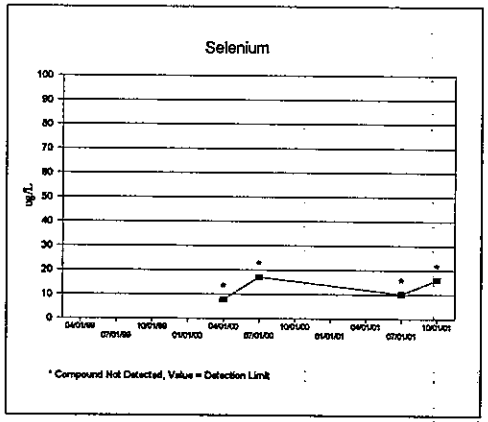

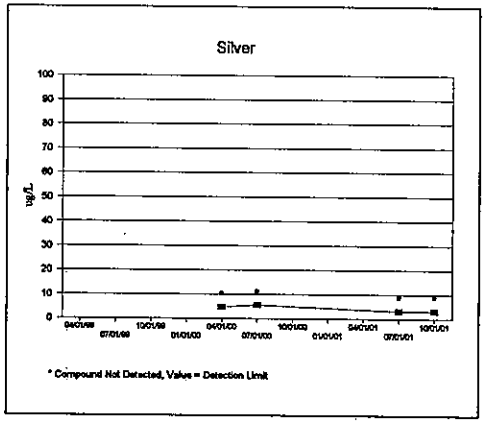

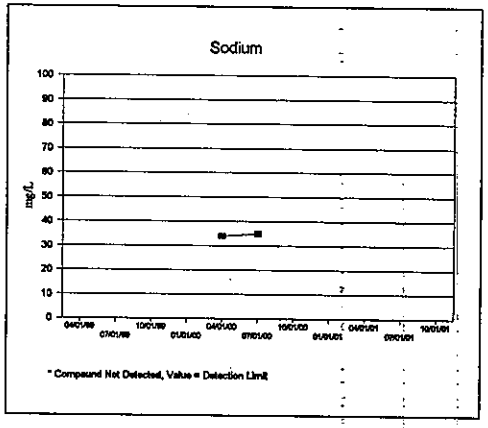

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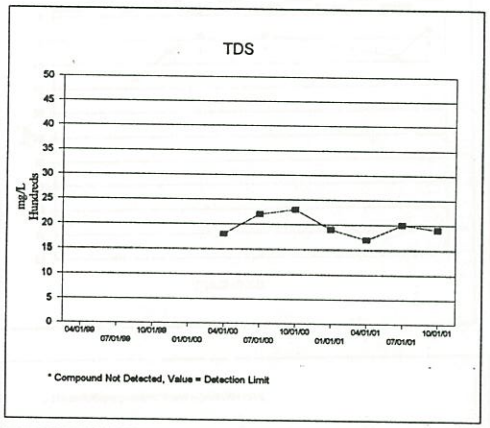

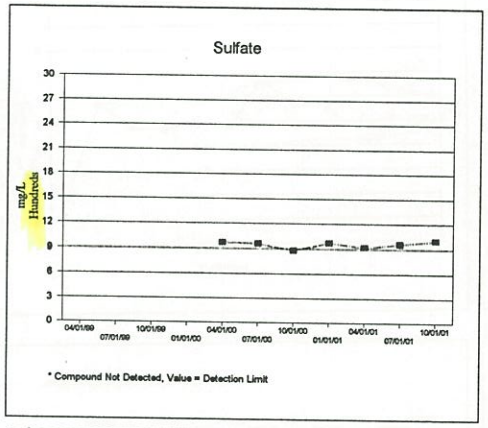

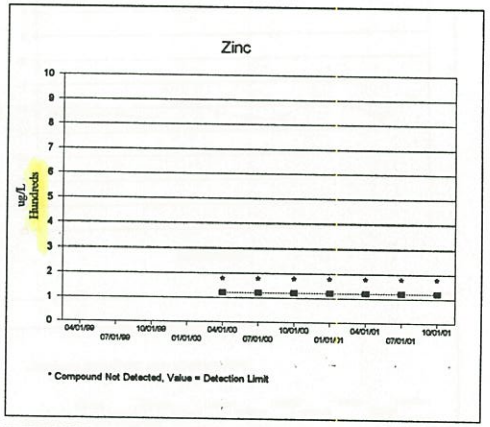

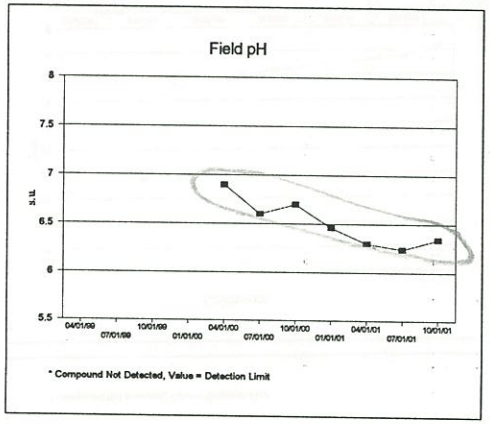

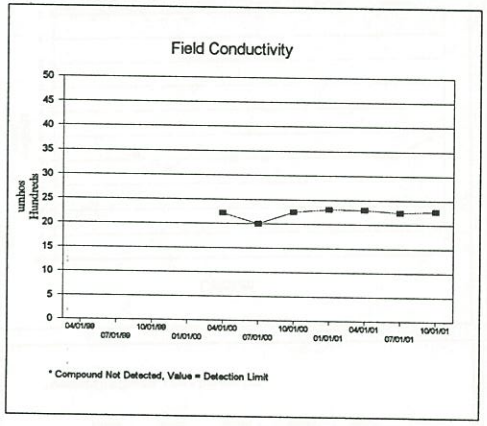

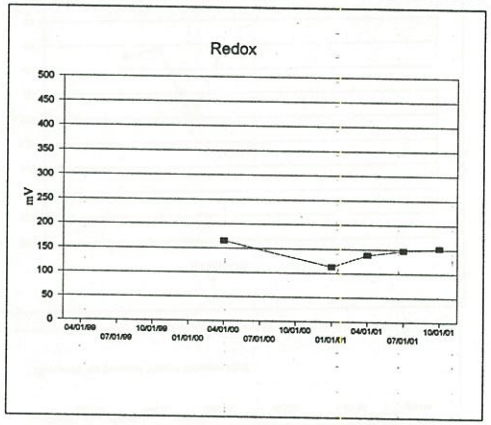

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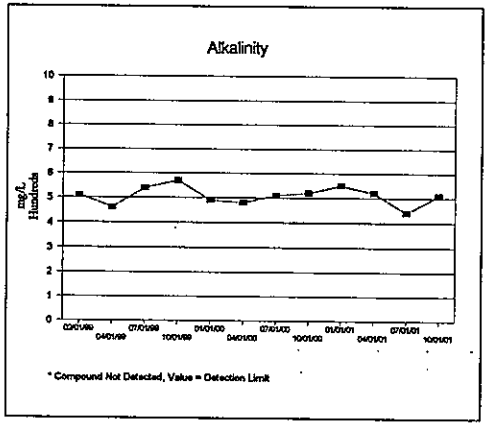

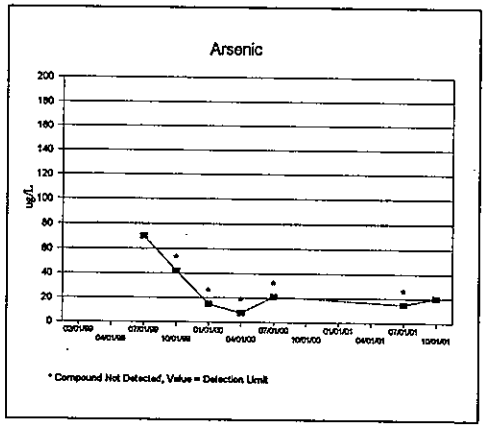

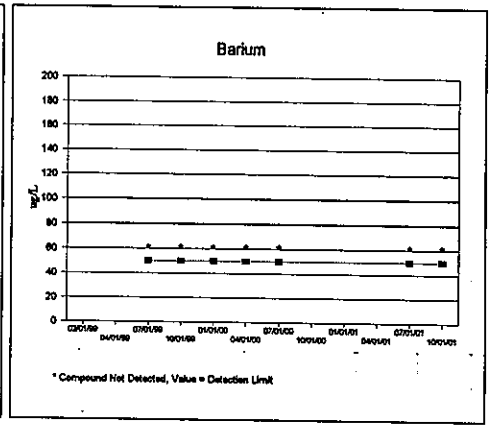

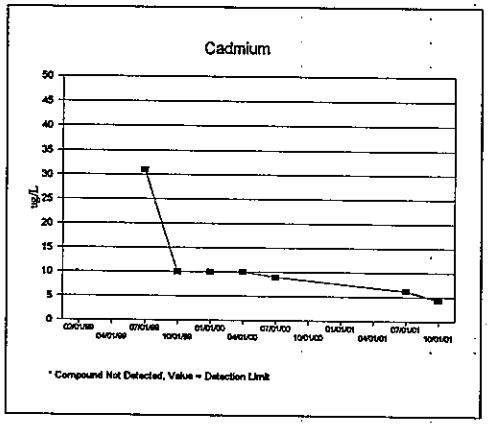

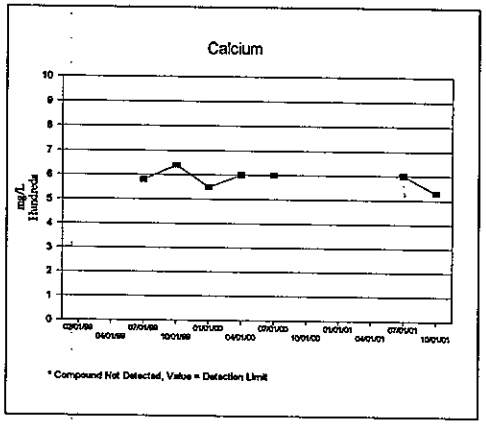

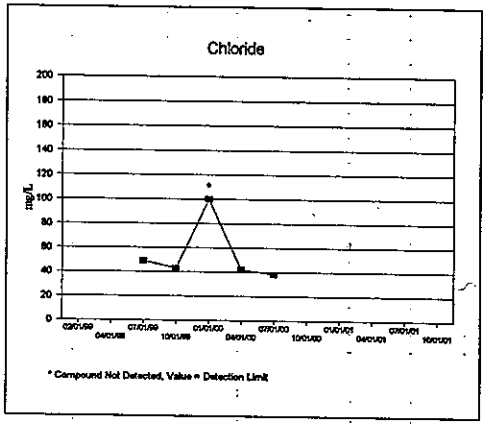

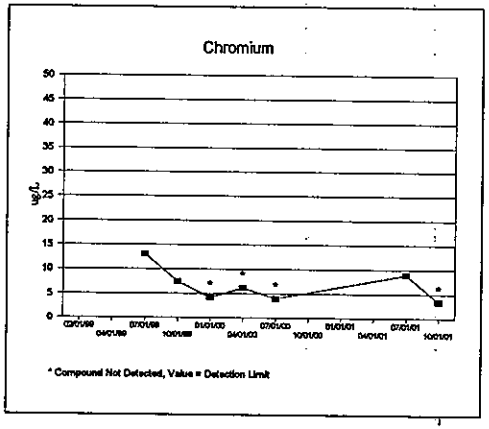

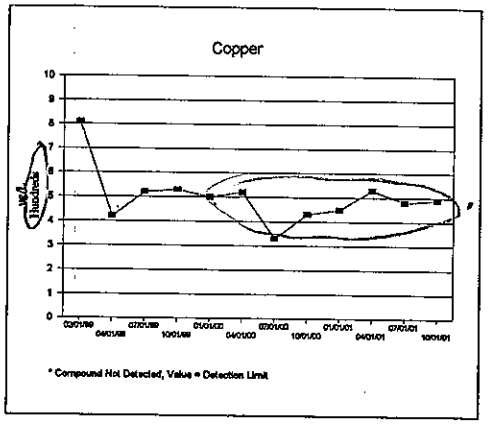

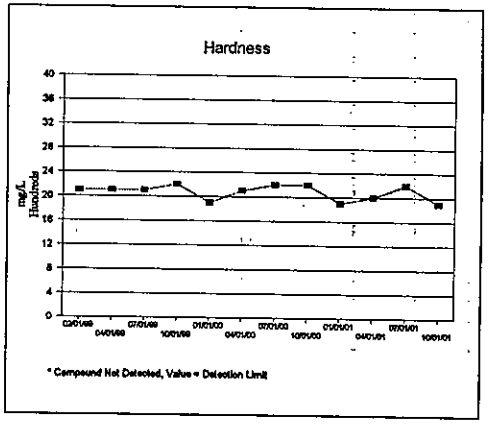

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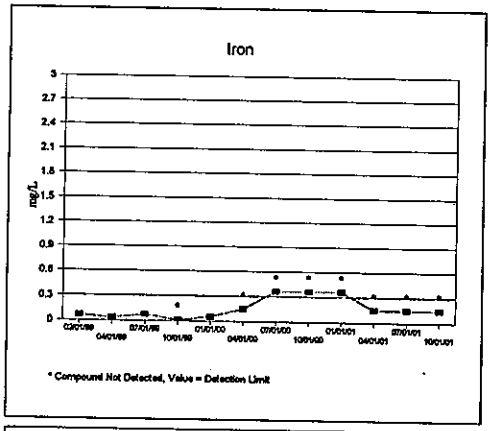

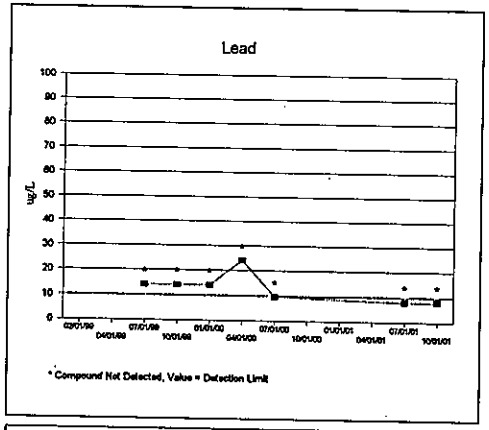

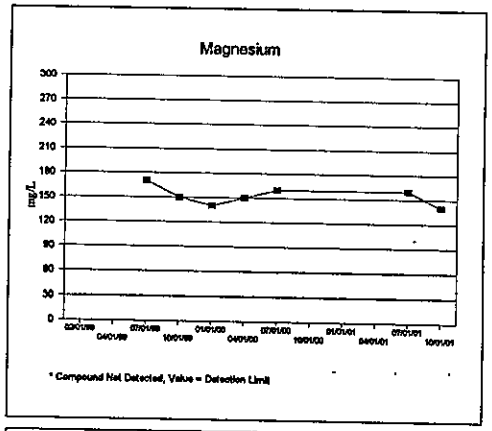

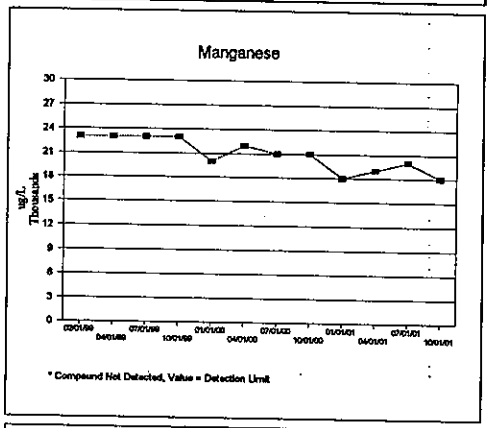

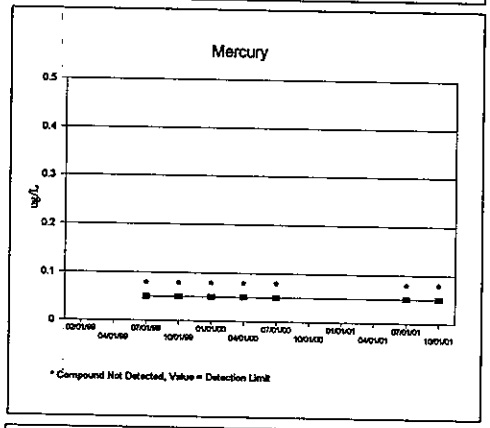

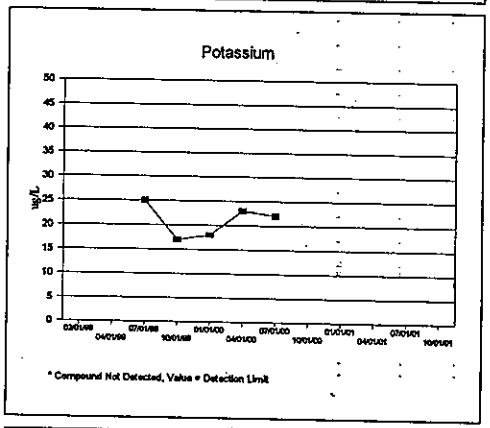

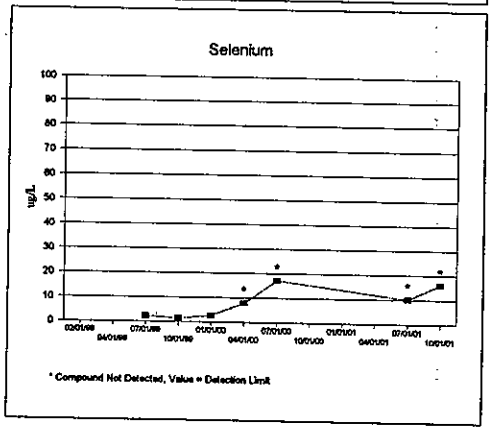

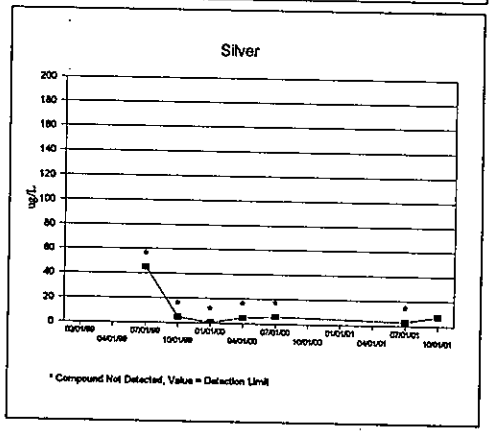

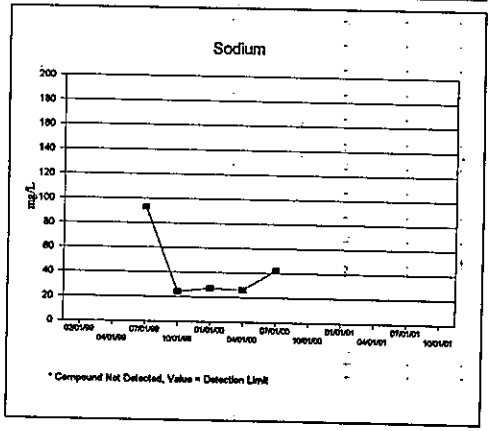

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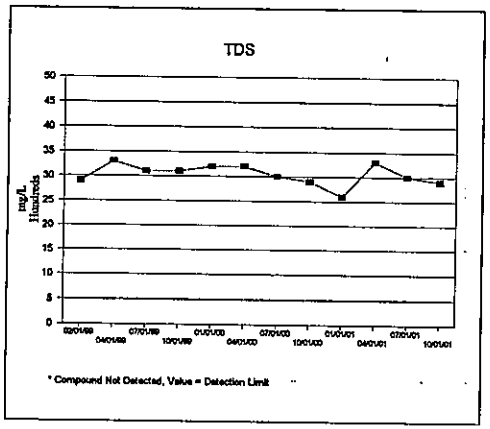

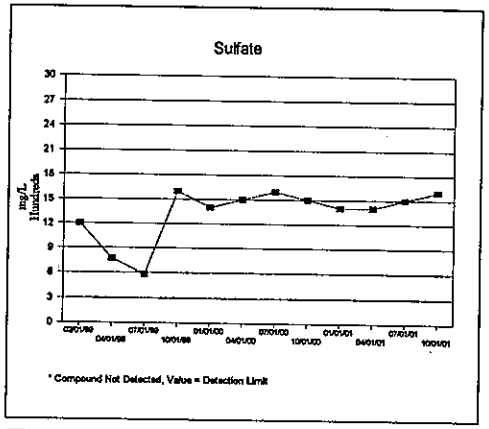

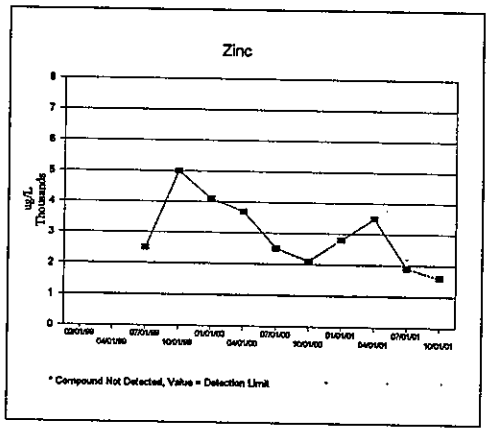

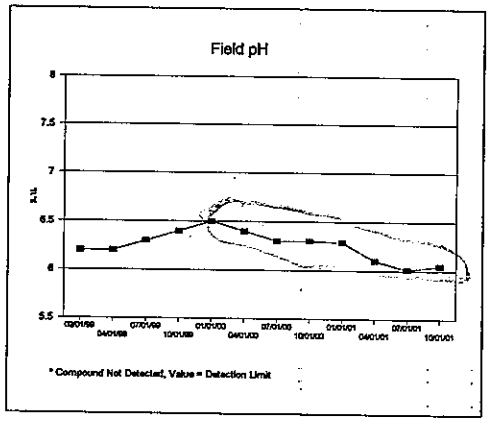

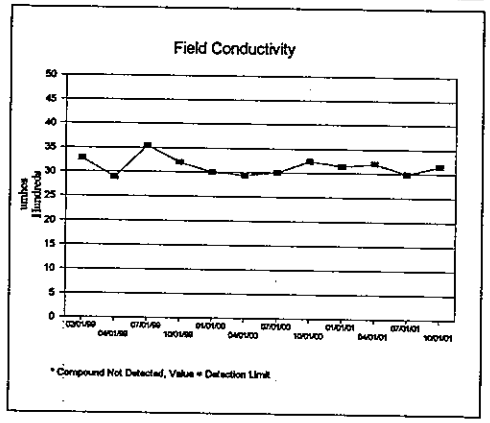

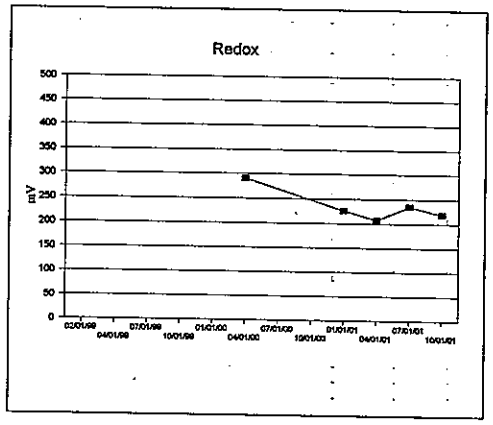

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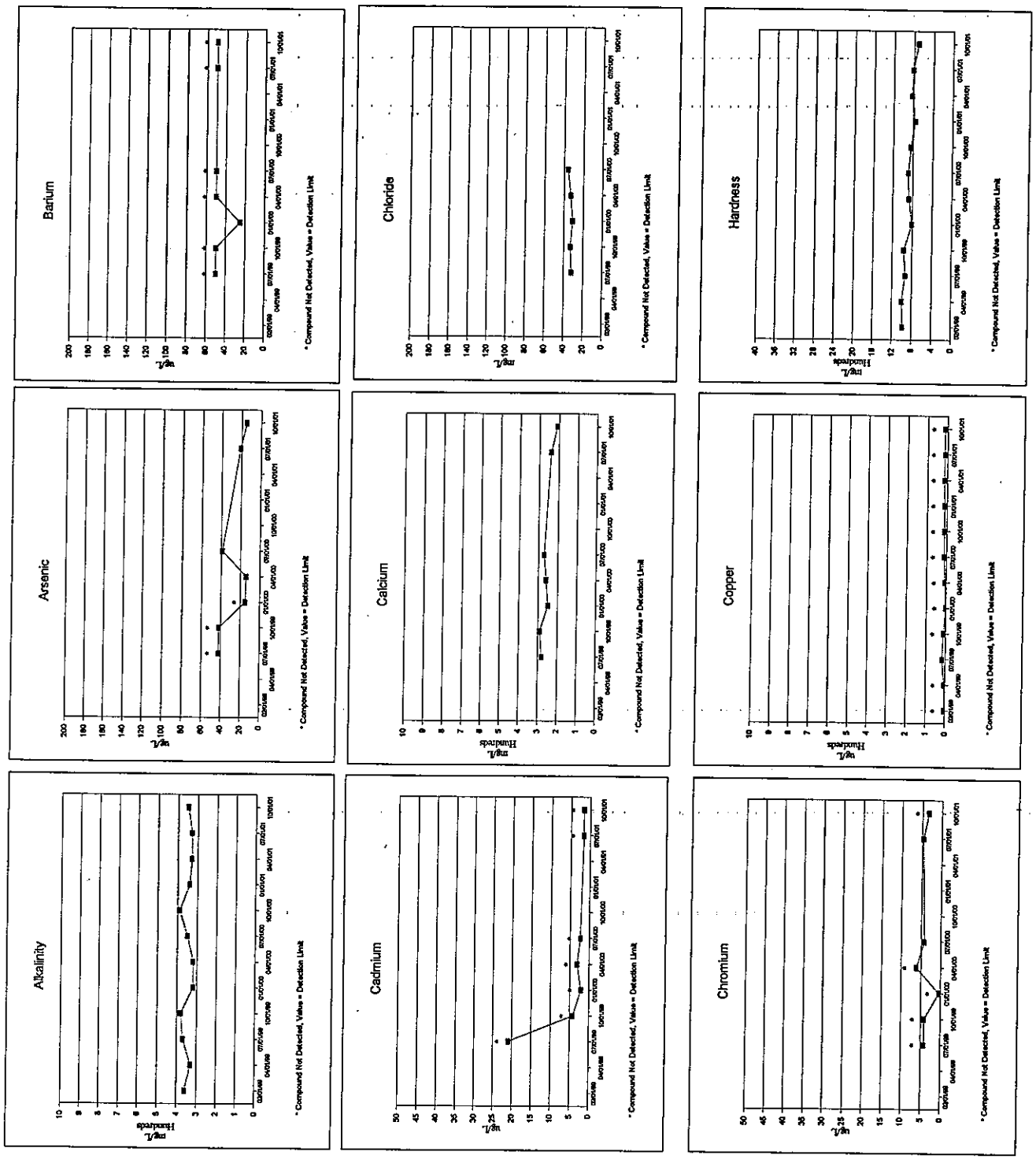

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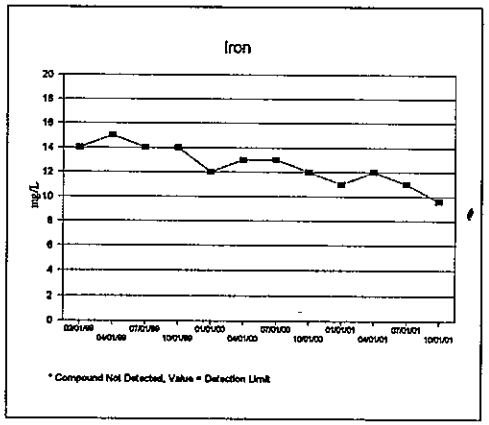
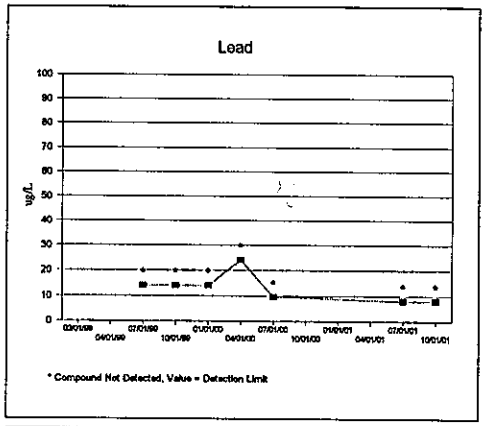
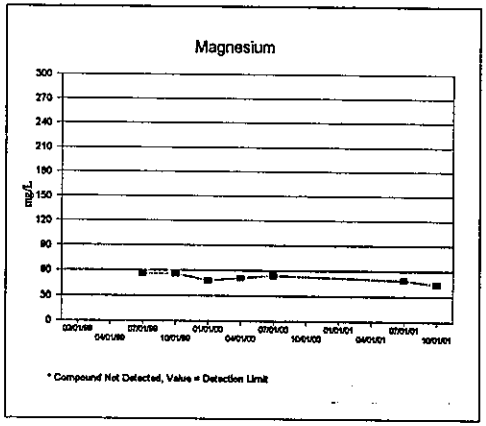
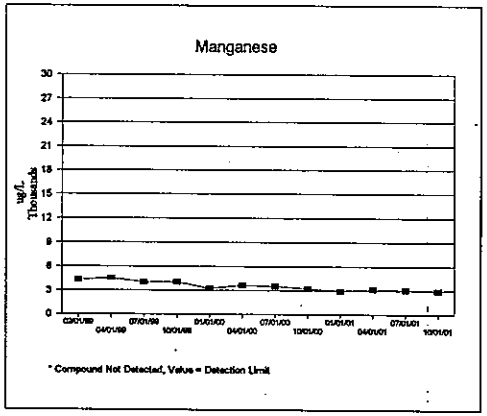
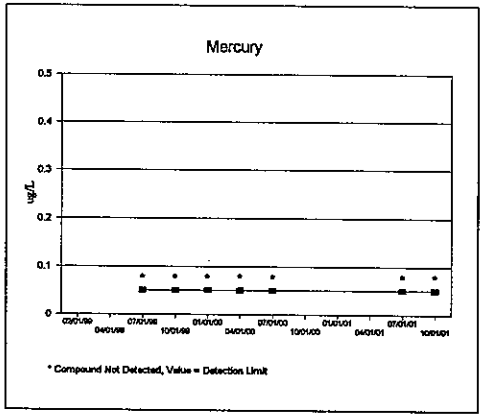
MW-1014C

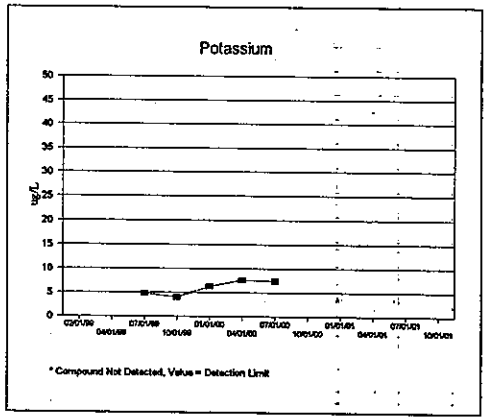


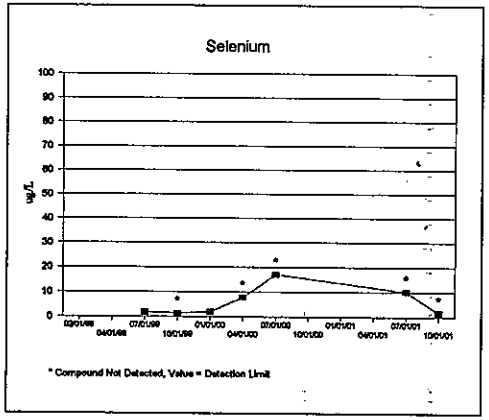


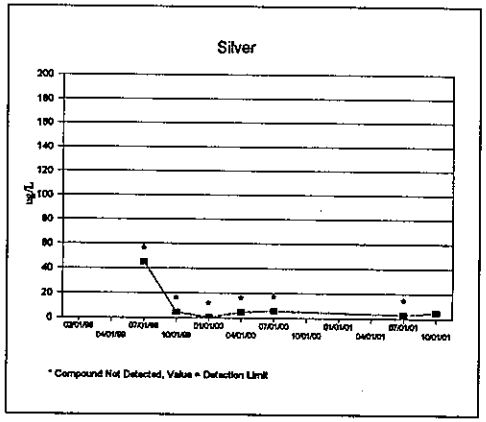


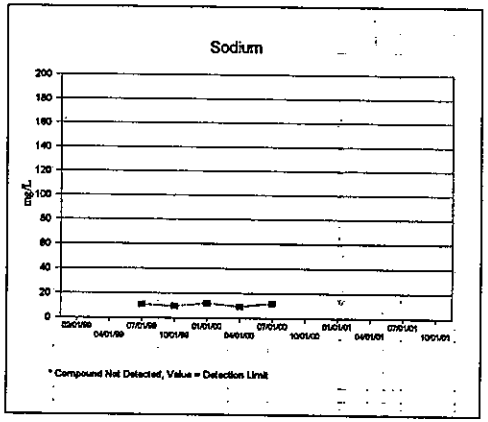












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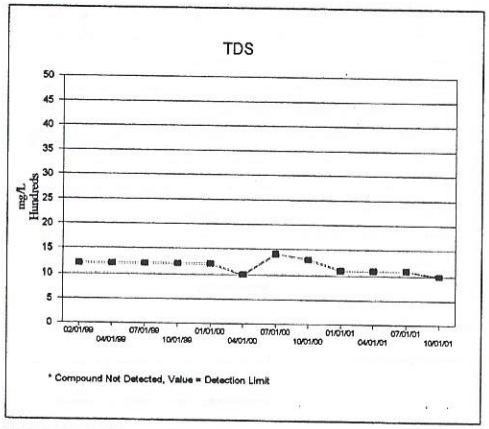

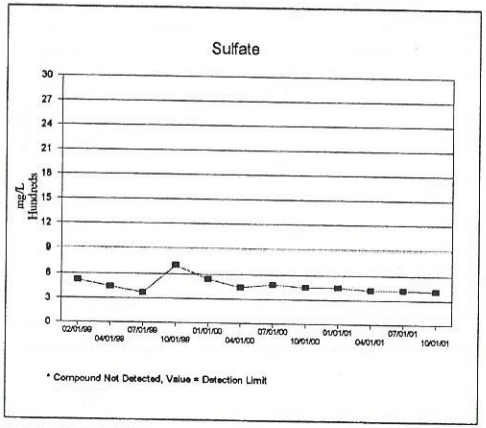

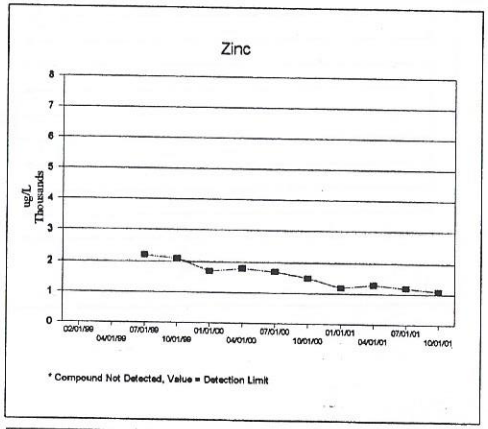

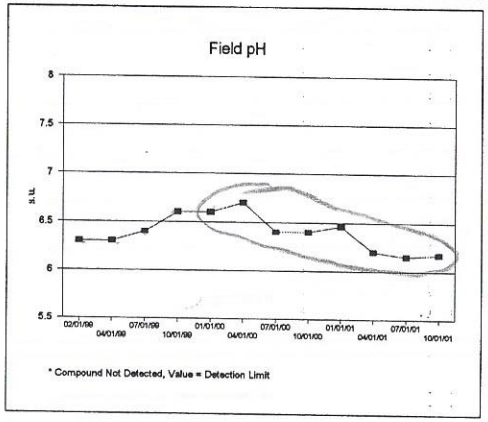

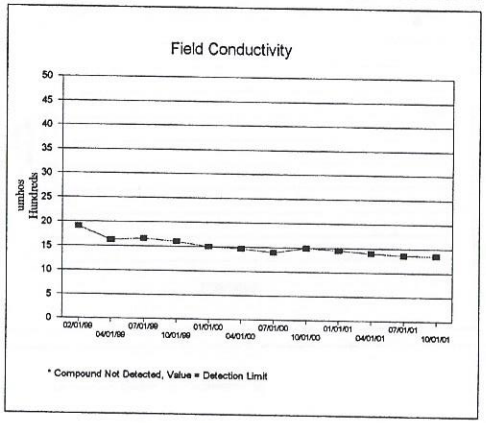

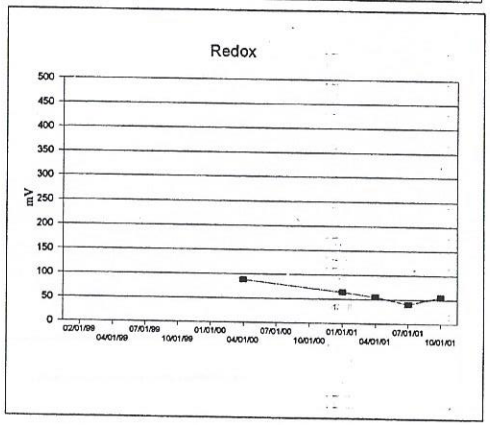

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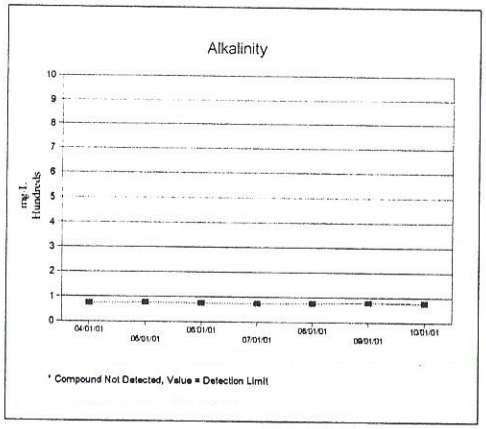

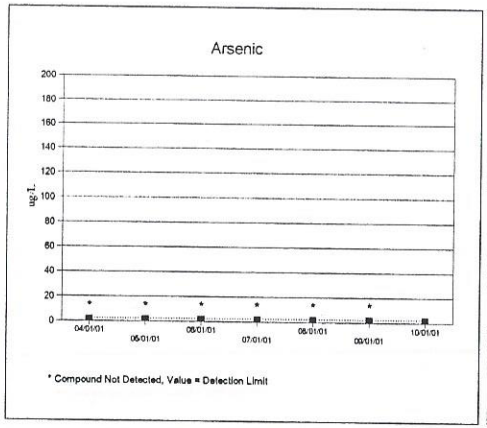

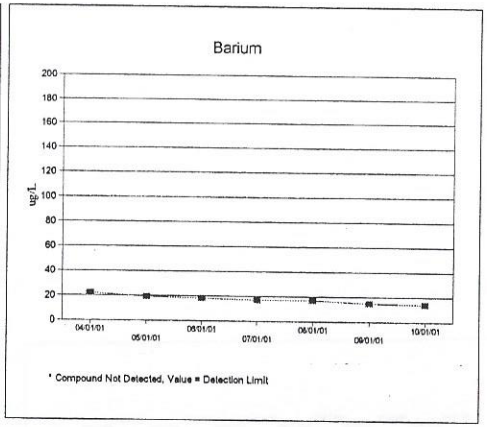

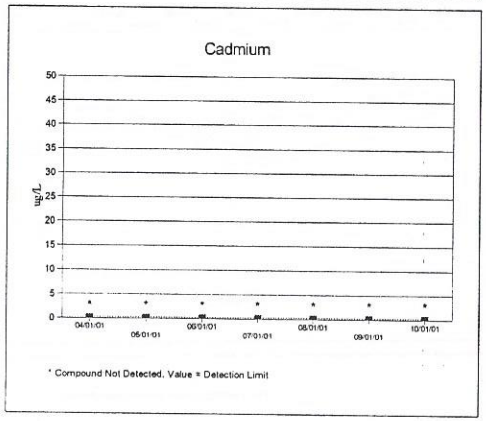

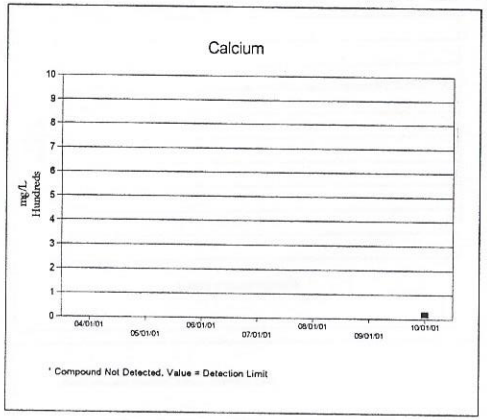

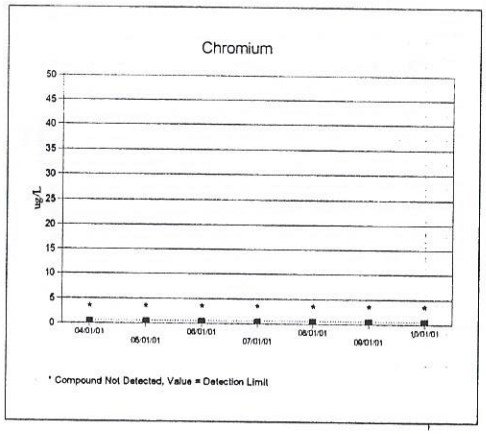

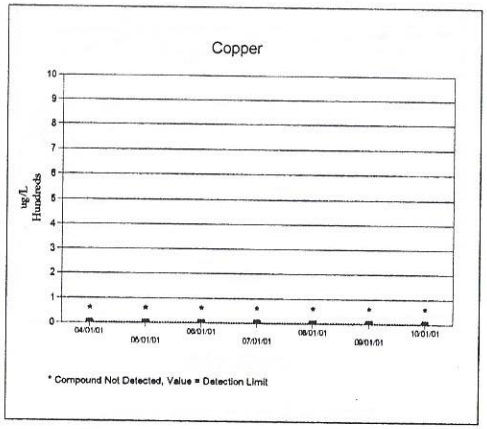

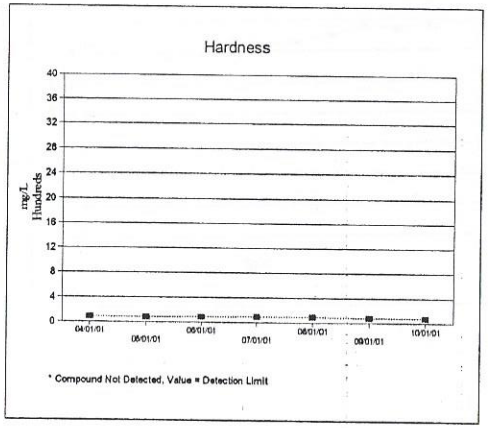

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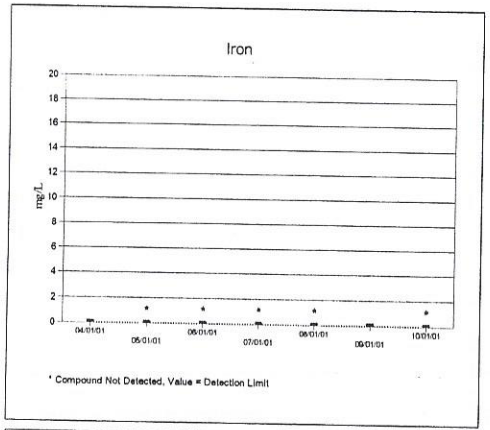

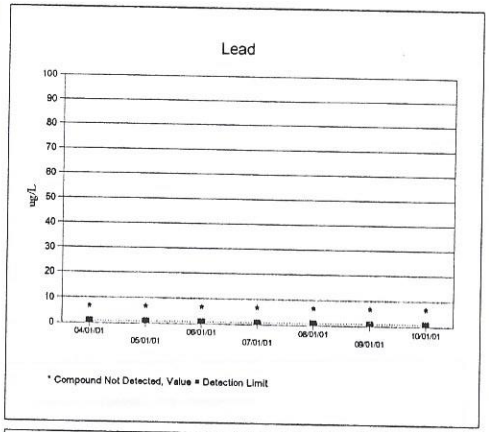

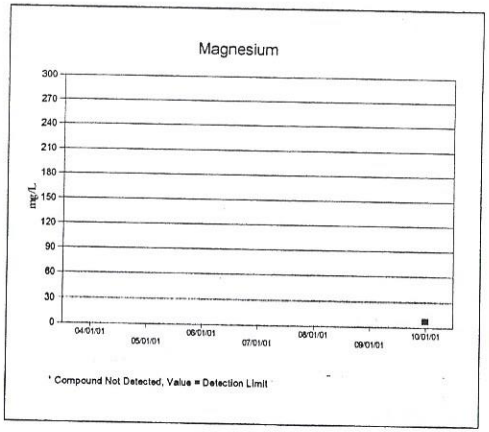

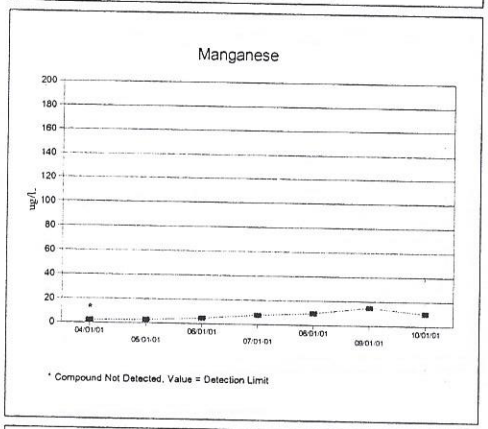

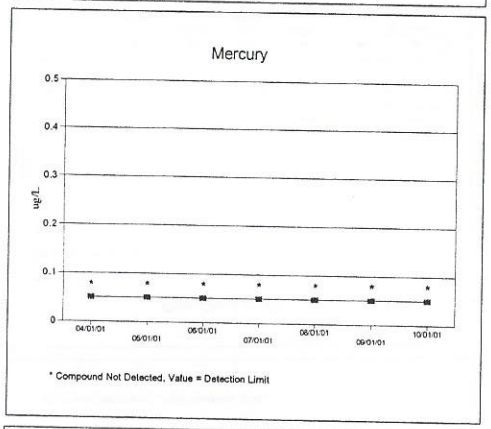

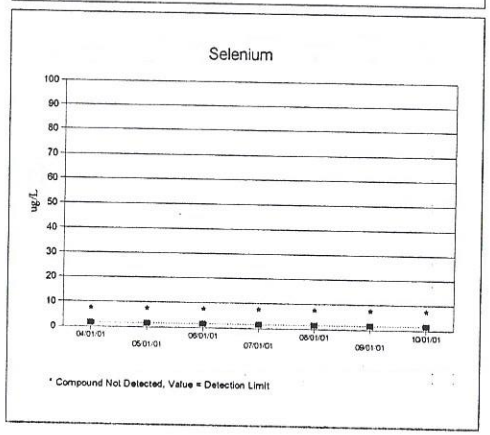

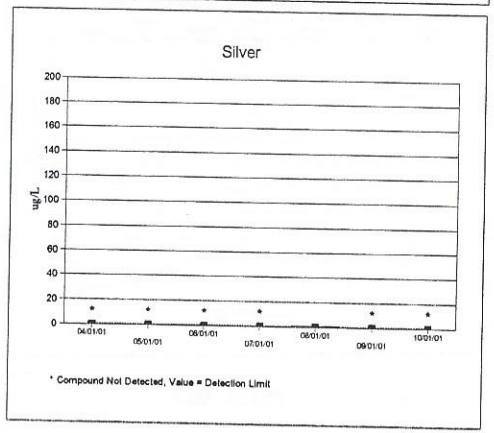

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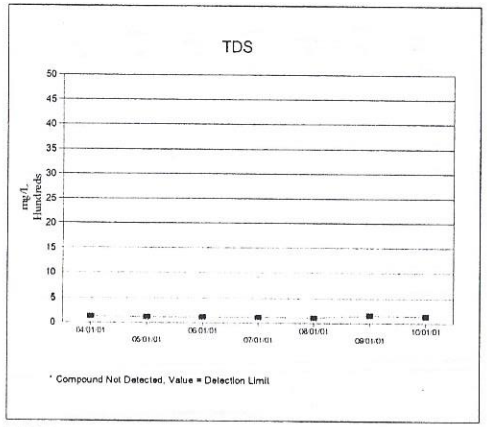
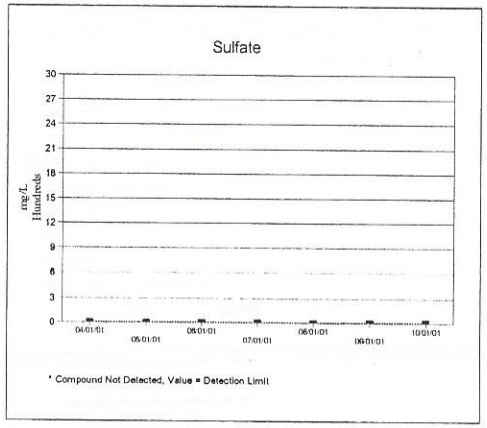
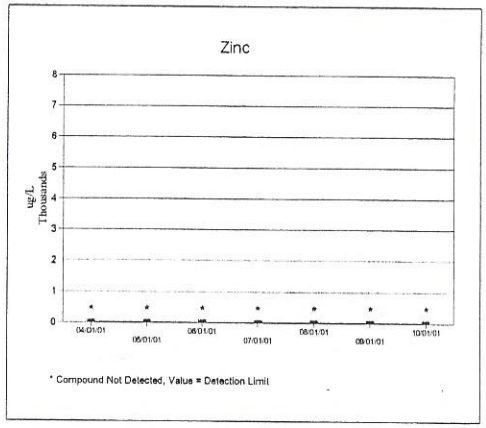
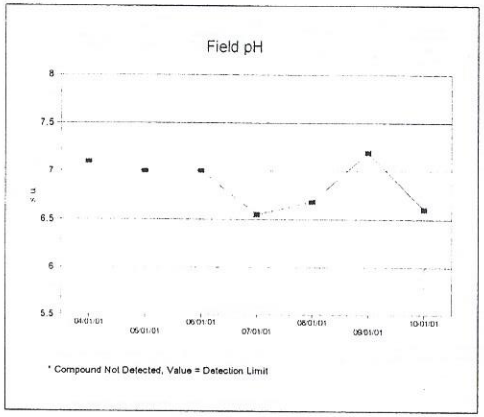
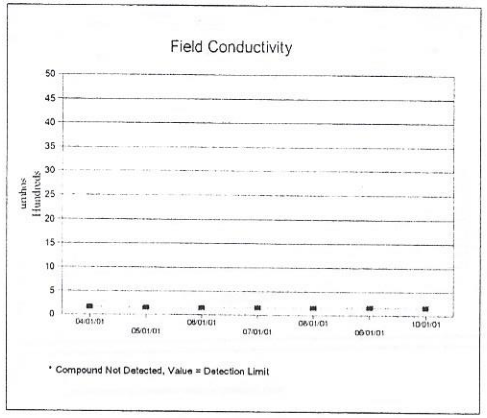




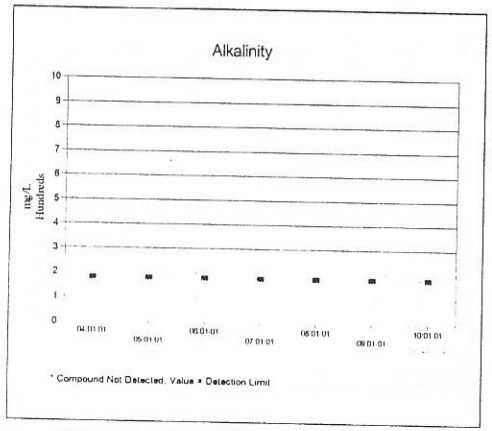


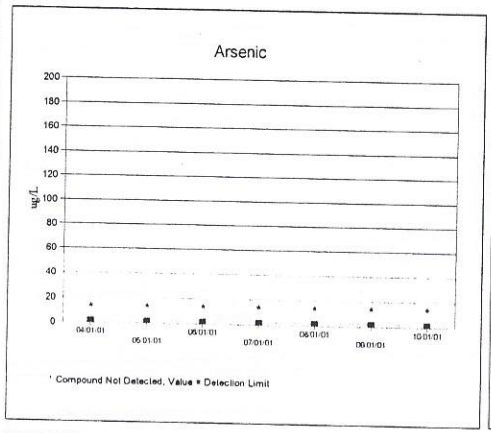


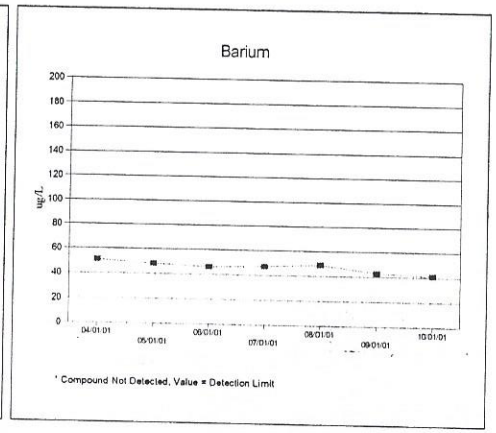


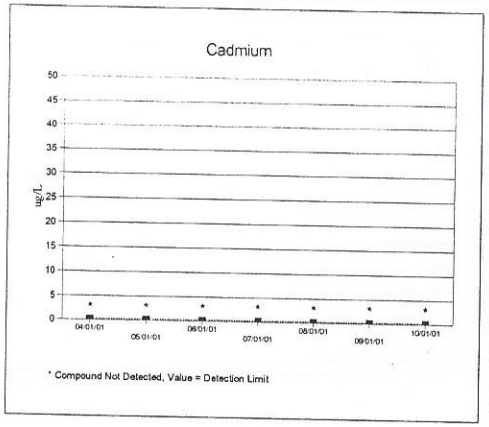
Flambeau Mining Company
Groundwater Quality Results

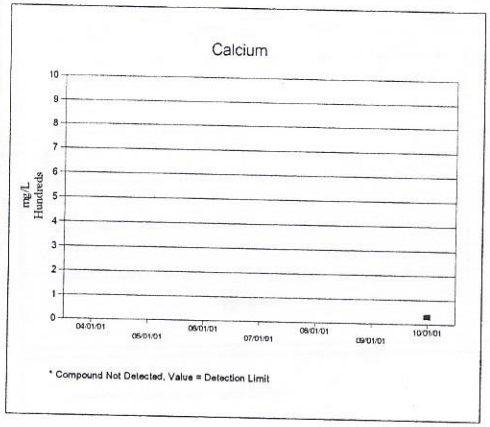
MW-1015B

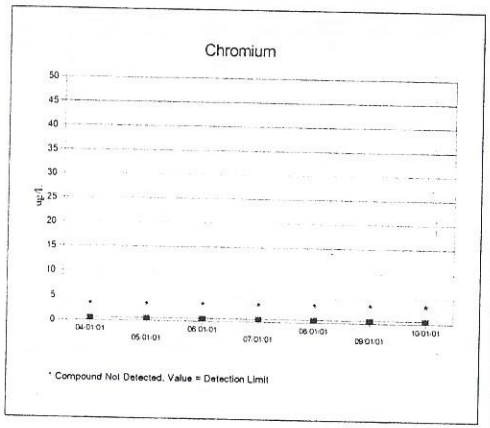


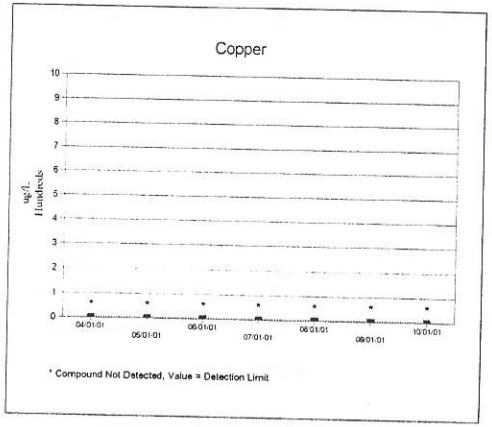


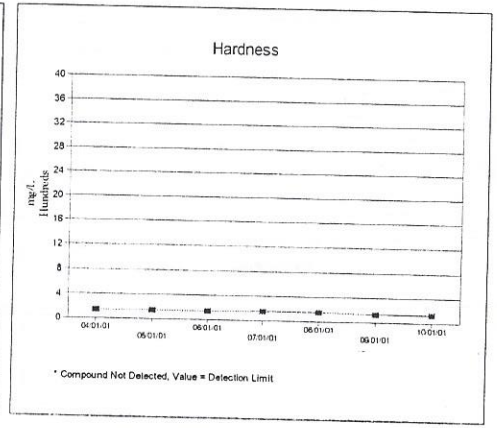






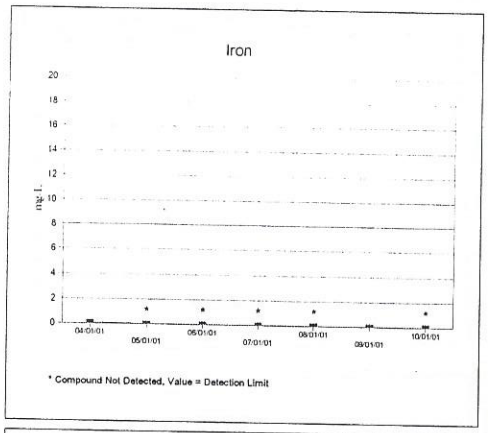


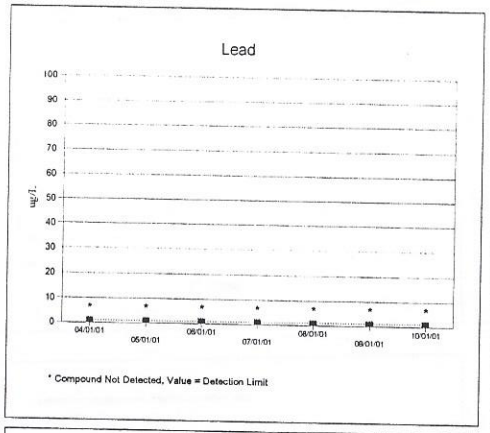


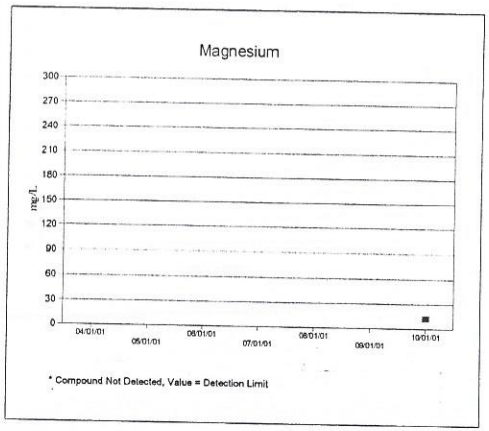


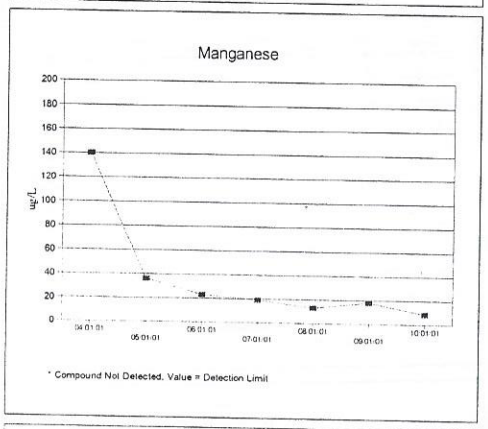
Flambeau Mining Company
Groundwater Quality Results

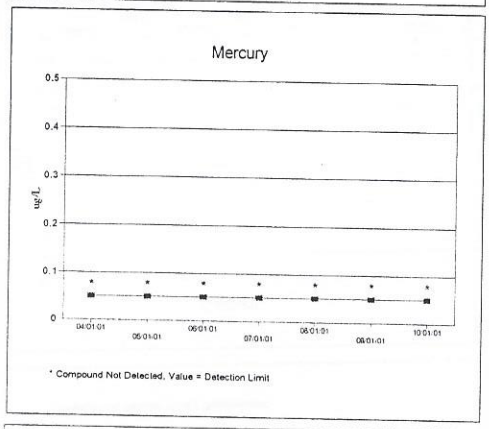
MW-1015B

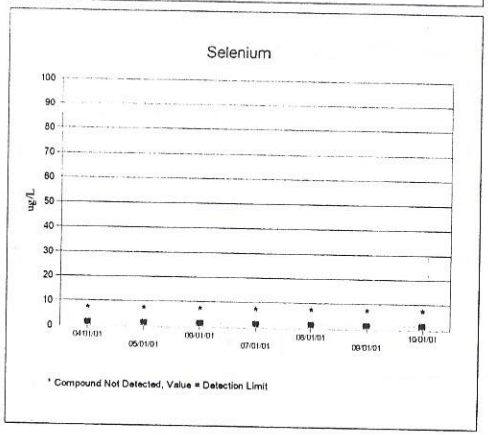


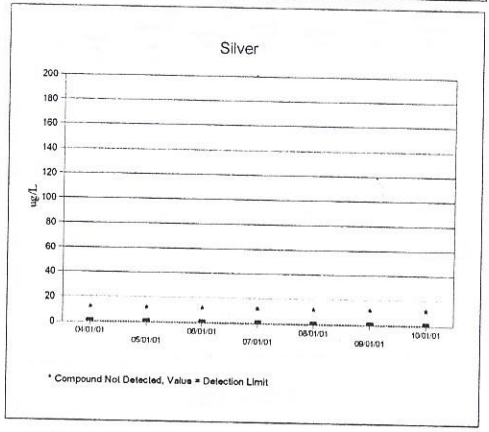






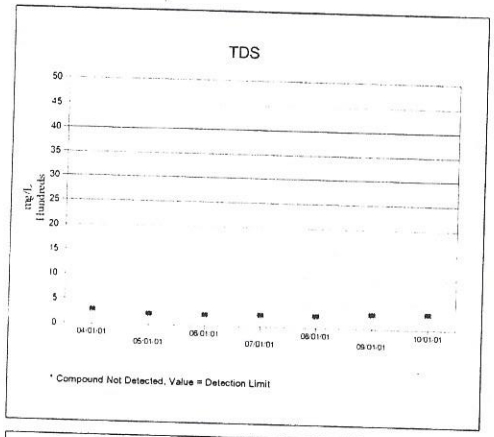


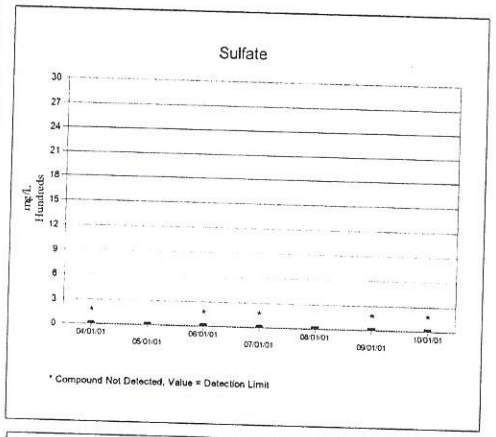


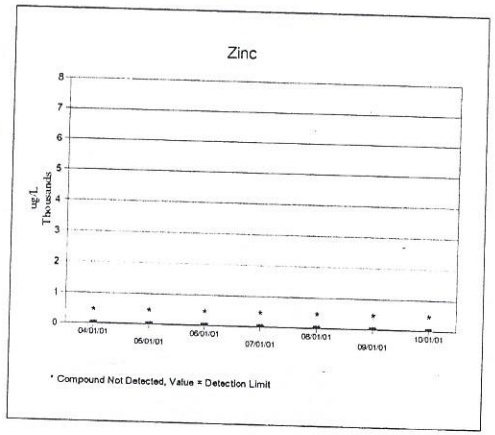


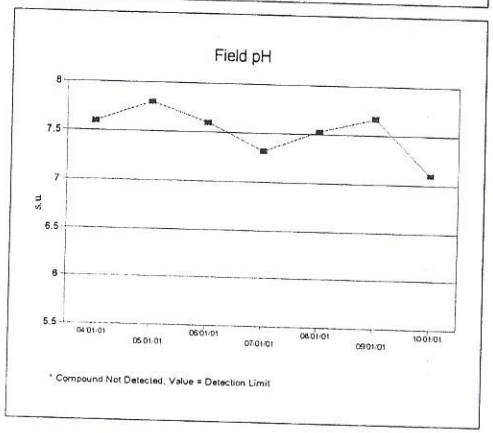
Flambeau Mining Company
Groundwater Quality Results

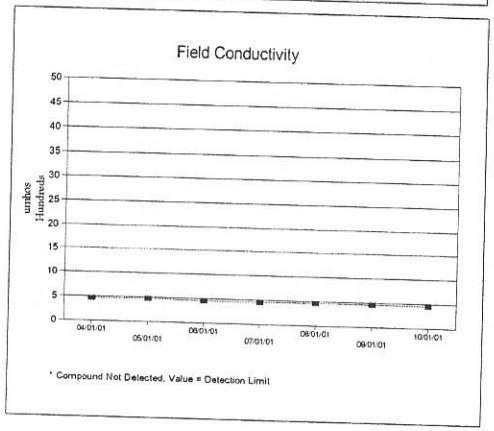
MW-1015B











Summary Statistics and Trend Results (In-Pit Wells and MW-1015A and MW-1015B)
February 1999 - November 2001

		MW-1013					MW-1013A					MW-1013B				
		Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level
Alk	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	-18	0.25
As	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	43%	5	-1	1
Ba	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	0%	7	0	1
Cd	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	14%	6	3	0.72
Ca	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	100%	7	3	0.772
Cr	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	86%	7	-9	0.238
Cu	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	67%	12	5	0.789
Hard	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	-8	0.638
Fe	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	92%	11	26	0.05 +
Pb	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	0%	7	0	1
Mg	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	100%	7	2	0.886
Mn	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	43	0.003 +
Hg	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	0%	7	0	1
Se	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	14%	3	-2	4
Ag	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	7	29%	7	9	0.238
TDS	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	-15	0.345
Sulf	(mg/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	11	0.503
Zn	(ug/l)	0	NA	0	NA	NA	0	NA	0	NA	NA	10	20%	10	16	0.186
Field pH	(s.u.)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	-28	0.062 -
Field Cond	(umho)	0	NA	0	NA	NA	0	NA	0	NA	NA	12	100%	12	17	0.28
Redox	(mV)	0	NA	0	NA	NA	0	NA	0	NA	NA	5	100%	5	0	1

(1) All non-detects greater than two times the minimum detected value omitted from analysis.
+ : Implies statistically increasing trend.
- : Implies statistically decreasing trend.
NA: Not applicable.

Summary Statistics and Trend Results (In-Pit Wells and MW-1015A and MW-1015B)
February 1999 - November 2001

		MW-1013C					MW-1014					MW-1014A				
		Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level
Alk	(mg/l)	12	100%	12	16	0.31	0	NA	0	NA	NA	7	100%	7	5	0.562
As	(ug/l)	7	43%	6	-2	0.86	0	NA	0	NA	NA	4	50%	4	1	1
Ba	(ug/l)	7	0%	7	0	1	0	NA	0	NA	NA	4	50%	4	-5	0.209
Cd	(ug/l)	7	0%	7	0	1	0	NA	0	NA	NA	4	0%	4	0	1
Ca	(mg/l)	7	100%	7	4	0.667	0	NA	0	NA	NA	4	100%	4	1	1
Cr	(ug/l)	7	14%	7	-4	0.667	0	NA	0	NA	NA	4	50%	4	-1	1
Cu	(ug/l)	12	33%	12	-34	0.02	0	NA	0	NA	NA	7	0%	7	0	1
Hard	(mg/l)	12	100%	12	11	0.503	0	NA	0	NA	NA	7	100%	7	3	0.772
Fe	(mg/l)	12	100%	12	55	0 +	0	NA	0	NA	NA	7	100%	7	3	0.772
Pb	(ug/l)	7	0%	7	0	1	0	NA	0	NA	NA	4	0%	4	0	1
Mg	(mg/l)	7	100%	7	6	0.472	0	NA	0	NA	NA	4	100%	4	-1	1
Mn	(ug/l)	12	100%	12	44	0.002 +	0	NA	0	NA	NA	7	100%	7	14	0.05
Hg	(ug/l)	7	0%	7	0	1	0	NA	0	NA	NA	4	0%	4	0	1
Se	(ug/l)	7	14%	3	-2	4	0	NA	0	NA	NA	4	0%	4	0	1
Ag	(ug/l)	7	29%	7	5	0.562	0	NA	0	NA	NA	4	0%	4	0	1
TDS	(mg/l)	12	100%	12	18	0.25	0	NA	0	NA	NA	7	100%	7	-2	0.886
Sulf	(mg/l)	12	100%	12	11	0.503	0	NA	0	NA	NA	7	100%	7	3	0.772
Zn	(ug/l)	10	100%	10	-28	0.013	0	NA	0	NA	NA	7	0%	7	0	1
Field pH	(s.u.)	12	100%	12	-28	0.062 -	0	NA	0	NA	NA	7	100%	7	-15	0.03
Field Cond	(umho)	12	100%	12	23	0.134	0	NA	0	NA	NA	7	100%	7	8	0.31
Redox	(mV)	5	100%	5	-8	0.084	0	NA	0	NA	NA	5	100%	5	2	0.816

(1) All non-detects greater than two times the minimum detected value omitted from analysis.
+ : Implies statistically increasing trend.
- : Implies statistically decreasing trend.
NA: Not applicable.

Summary Statistics and Trend Results (In-Pit Wells and MW-1015A and MW-1015B)
February 1999 - November 2001

		MW-1014B					MW-1014C					MW-1015A				
		Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	Mann-Kendall p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	Mann-Kendall p-Level	Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	Mann-Kendall p-Level
Alk	(mg/l)	12	100%	12	0	1	12	100%	12	-5	0.789	7	100%	7	9	0.238
As	(ug/l)	7	29%	6	-1	1	7	57%	5	4	0.484	7	14%	7	6	0.472
Ba	(ug/l)	7	0%	7	0	1	7	14%	7	-2	0.886	7	100%	7	-20	0.001 -
Cd	(ug/l)	7	100%	7	-18	0.006 -	7	0%	7	0	1	7	0%	7	0	1
Ca	(mg/l)	7	100%	7	-4	0.667	7	100%	7	-13	0.07	1	100%	1	0	NA
Cr	(ug/l)	7	43%	7	-7	0.382	7	29%	7	7	0.382	7	0%	7	0	1
Cu	(ug/l)	12	100%	12	-10	0.546	12	8%	12	-7	0.688	7	0%	7	0	1
Hard	(mg/l)	12	100%	12	-5	0.789	12	100%	12	-47	0 -	7	100%	7	-6	0.472
Fe	(mg/l)	12	33%	5	-2	0.816	12	100%	12	-50	0 -	7	29%	7	-1	1
Pb	(ug/l)	7	0%	7	0	1	7	0%	7	0	1	7	0%	7	0	1
Mg	(mg/l)	7	100%	7	-4	0.667	7	100%	7	-12	0.103	1	100%	1	0	NA
Mn	(ug/l)	12	100%	12	-45	0.001 -	12	100%	12	-53	0 -	7	86%	7	19	0.002 +
Hg	(ug/l)	7	0%	7	0	1	7	0%	7	0	1	7	0%	7	0	1
Se	(ug/l)	7	43%	3	1	2	7	29%	4	-1	1	7	0%	7	0	1
Ag	(ug/l)	7	14%	6	5	0.47	7	14%	6	5	0.47	7	14%	7	2	0.886
TDS	(mg/l)	12	100%	12	-15	0.345	12	100%	12	-23	0.134	7	100%	7	2	0.886
Sulf	(mg/l)	12	100%	12	23	0.134	12	100%	12	-25	0.101	7	100%	7	3	0.772
Zn	(ug/l)	10	100%	10	-24	0.037	10	100%	10	-39	0 -	7	0%	7	0	1
Field pH	(s.u.)	12	100%	12	-23	0.134	12	100%	12	-15	0.345	7	100%	7	-6	0.472
Field Cond	(umho)	12	100%	12	-6	0.738	12	100%	12	-57	0 -	7	100%	7	9	0.238
Redox	(mV)	5	100%	5	-4	0.484	5	100%	5	-6	0.234	0	NA	0	NA	NA

(1) All non-detects greater than two times the minimum detected value omitted from analysis.
+ : Implies statistically increasing trend.
- : Implies statistically decreasing trend.
NA: Not applicable.

Summary Statistics and Trend Results (In-Pit Wells and MW-1015A and MW-1015B)
February 1999 - November 2001

MW-1015B

		Total Samples	Percent Detects	Number Used In Test (1)	Mann-Kendall S	p-Level
Alk	(mg/l)	7	100%	7	0	1
As	(ug/l)	7	0%	7	0	1
Ba	(ug/l)	7	100%	7	-13	0.07
Cd	(ug/l)	7	0%	7	0	1
Ca	(mg/l)	1	100%	1	0	NA
Cr	(ug/l)	7	0%	7	0	1
Cu	(ug/l)	7	0%	7	0	1
Hard	(mg/l)	7	100%	7	-4	0.667
Fe	(mg/l)	7	29%	7	-3	0.772
Pb	(ug/l)	7	0%	7	0	1
Mg	(mg/l)	1	100%	1	0	NA
Mn	(ug/l)	7	100%	7	-19	0.002 -
Hg	(ug/l)	7	0%	7	0	1
Se	(ug/l)	7	0%	7	0	1
Ag	(ug/l)	7	0%	7	0	1
TDS	(mg/l)	7	100%	7	10	0.187
Sulf	(mg/l)	7	29%	7	-1	1
Zn	(ug/l)	7	0%	7	0	1
Field pH	(s.u.)	7	100%	7	-8	0.31
Field Cond	(umho)	7	100%	7	-6	0.472
Redox	(mV)	0	NA	0	NA	NA

(1) All non-detects greater than two times the minimum detected value omitted from analysis.
+ : Implies statistically increasing trend.
- : Implies statistically decreasing trend.
NA: Not applicable.

Appendix C

Macroinvertebrate (Crayfish) Sampling

Blue Iris Environmental, Inc.
Memorandum

September 2, 2001

TO: Jana Murphy

FR: Bill West, Blue Iris Environmental, Inc.

RE: Report of Activities Conducted in 2001 Associated with Collection and Analysis of Crayfish from the Flambeau River, Ladysmith, Wisconsin

Introduction

On July 24, 2001, Bill West of Blue Iris Environmental, Inc., completed crayfish collection activities at three sites on the Flambeau River downstream of Ladysmith, Wisconsin. The purpose of this activity was to fulfill requirements of the Flambeau Mining Permit which requires Flambeau Mining Company (Flambeau) to conduct metals analysis of crayfish at selected sites upstream and downstream of the now reclaimed Flambeau Mine Site. The permit requires that a minimum of 25 crayfish be collected at the following sites, which are also shown on Figure 1.

- The Flambeau River at the Blackberry Lane access (upstream site)
- The Flambeau River at Meadowbrook Creek (downstream site)
- The Flambeau River at the site of the former Port Arthur Dam (downstream site)

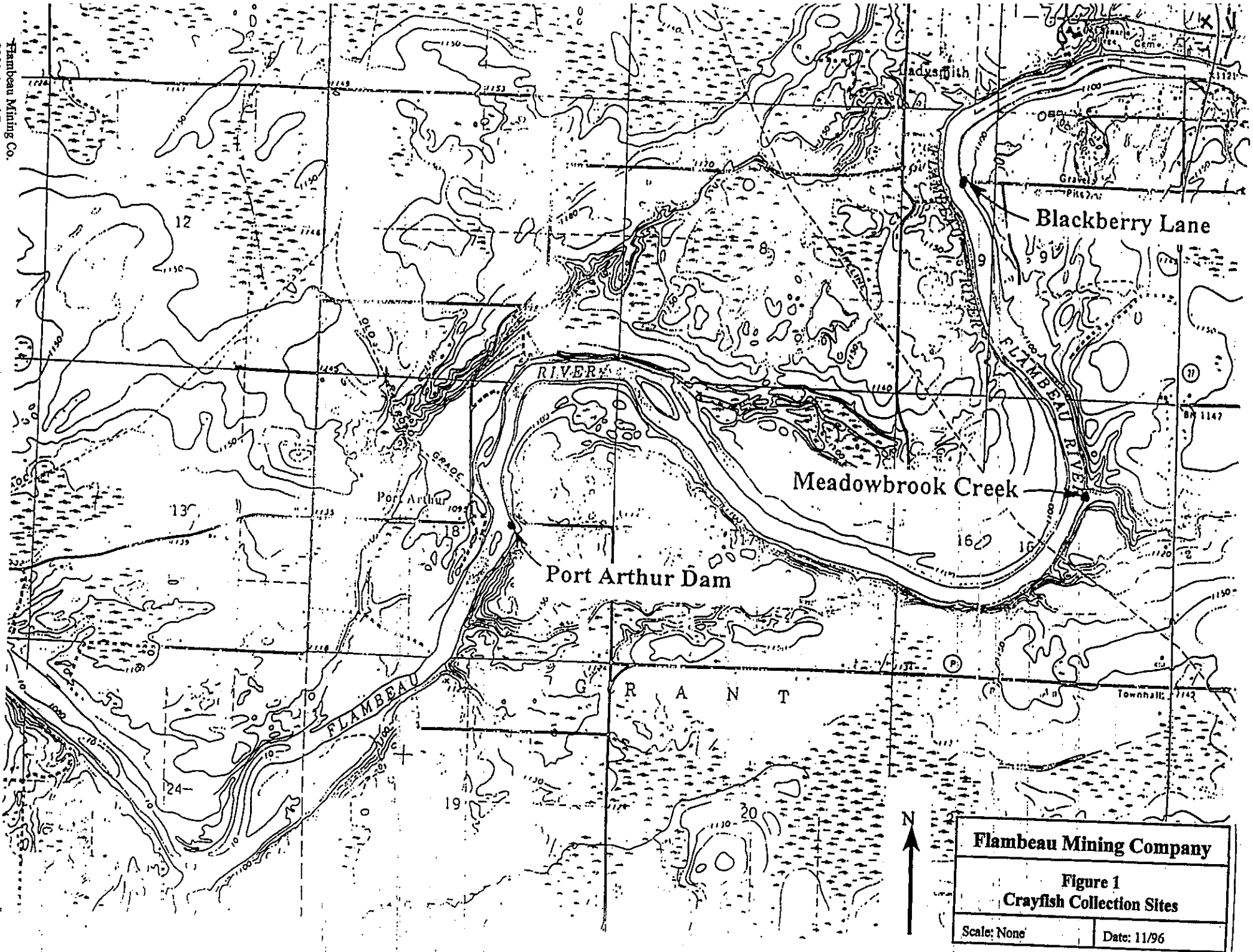
As in previous years, collection efforts were conducted during the mid to late summer to take advantage of increased crayfish activity.

Methodology

All samples were collected using an 8 by 18-inch rectangular net with 800 to 900 micron mesh size. Crayfish were collected by using a kick seine method.

Specimens were composited for each site in a Ziploc bag and placed on ice. Specimens were transported to Northern Lake Service, Crandon, Wisconsin for metals analysis.

N5811 Twelve Corners Road, Black Creek, Wisconsin 54106 : ph-920-730-5684 : fax-920-738-7774 :email-blueiris@famvid.com


Blackberry Lane
Meadowbrook Creek
Port Arthur Dam
Ladysmith
Port Arthur
RIVER
FLAMBEAU
GRANT
N
Flambeau Mining Company
Figure 1
Crayfish Collection Sites
Scale: None
Date: 11/96

Crayfish were collected during the following time windows:

Site Location	Time of Collection	Number of Crayfish
Blackberry Lane	8:15 a.m.	30
Port Arthur Dam	9:15 a.m.	30
Meadowbrook Creek	10:15 a.m.	30

Results and Discussion

Water levels in the Flambeau River in the early portion of the summer of 2001 were fairly high. Water levels toward the later part of summer including the window during which the crayfish were collected were considered normal to slightly low. Water level in the river on the day of collection was about bank stage at Blackberry Lane to a foot below bank stage at the downstream locations. Water temperature during the collection was 22.3 °C at Blackberry Lane, 23.1 °C at Meadowbrook Creek and 22.8 °C at Port Arthur Dam.

The results of the analysis of the crayfish appear in Table 1. Raw laboratory results are provided in Appendix 1. The results represent a composite from all crayfish collected per site. Whole bodies were used for analysis. A review of the data indicates that no relative difference in parameter concentrations from upstream locations to downstream locations is evident. Data for the three sites are similar when compared to each other and, with the exception of cadmium, data are also comparable to previous year's results. Results for cadmium for both upstream and downstream samples are higher than previous year's data, however, all sites show a similar, if not identical increase. Such increases, are not deemed to be attributable to any post-mining activity or condition.

Table 1
Metals Analysis of Crayfish
Flambeau River, Ladysmith, Wisconsin
Results in mg/kg
1991 - 2001

Sample ID	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Aluminum	Mercury	Arsenic	Selenium	Silver
Blackberry Lane											
1991	0.1	1.0	17	0.4	1.2	23	36	0.1	0.24	0.14	0.2
1992	<0.1	0.4	16	<0.2	0.1	43	46	0.1	0.30	0.13	<0.1
1993	0.03	<0.09	15	0.2	<0.05	16	28	<0.2	<0.09	<0.19	0.06
1994	0.02	0.92	9.9	<0.22	<0.05	12	17	<0.02	<0.75	<1.93	<0.09
1995	<0.04	0.96	21	<0.19	<0.23	21	48	<0.05	<0.41	<0.44	<0.05
1996	<0.06	<0.16	20	0.40	<0.97	16	24	<0.02	0.33	<0.13	<0.25
1997	<0.070	0.67	18	<0.41>	<1.2	20	17	<0.025>	<0.82	<0.95	<0.44
1998	<0.038>	<0.17>	15	<0.47>	<0.71	14	15	<0.067	<0.45>	<0.28	<0.035
1999	<0.049	<0.24>	12	<0.17>	<0.80	10	36	<0.027	<0.28	<0.32	<0.040
2000	<0.063	<0.18	8.8	<0.20	<1.6	9.4	11	<0.10	<0.42	<0.34	<0.093
2001	0.32	<0.53>	14	0.86	<2.1	18	46	<0.033	<0.29	<0.21	<0.17

Crayfish Metals Analysis (cont)

Sample ID	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Aluminum	Mercury	Arsenic	Selenium	Silver
Meadowbrook Creek											
1991	0.1	1.6	20	0.5	1.3	27	36	0.1	0.29	0.15	0.2
1992	<0.1	0.5	19	<0.2	0.2	39	82	0.11	0.4	0.12	<0.1
1993	0.04	<0.09	15	0.2	<0.04	15	18	<0.20	<0.08	<0.35	0.08
1994	0.02	0.74	22	<0.29	<0.09	17	31	<0.03	<0.66	<1.64	<0.08
1995	<0.05	0.71	27	<0.23	<0.33	19	69	<0.06	<0.60	<0.64	<0.07
1996	<0.08	<0.22	28	0.74	<1.3	16	30	<0.02	<0.26	<0.14	<0.35
1997	<0.066	<0.49>	24	<0.55>	<1.1	17	42	<0.029	<0.78	<0.91	<0.41
1998	<0.037	<0.19>	24	<0.34>	<0.72	14	32	<0.067	<0.50>	<0.28	<0.036
1999	<0.047	<0.11	13	<0.20>	<0.76	8.6	14	<0.027	<0.23	<0.26	<0.038
2000	<0.056	<0.36>	21	<0.36>	<1.4	14	18	<0.10	<0.49>	<0.34	<0.082
2001	0.40	1.1	26	0.85	<2.0	17	67	<0.034	<0.30	<0.22	<0.17

Crayfish Metals Analysis (cont)

Sample ID	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Aluminum	Mercury	Arsenic	Selenium	Silver
Port Arthur											
1991	0.1	1.6	20	0.5	1.2	21	27	0.3	0.28	0.15	0.2
1992	<0.1	0.4	14	1.5	0.2	33	430	0.1	0.34	0.14	<0.1
1993	0.03	<0.09	12	<0.15	<0.04	11	22	<0.2	<0.1	<0.36	0.09
1994	0.04	0.92	18	<1.4	<0.10	15	28	<0.02	<0.76	<1.88	<0.09
1995	<0.04	4.5	24	0.05	<0.25	16	130	<0.06	<0.45	<0.48	<0.05
1996	<0.07	0.17	28	0.44	<1.1	16	68	<0.02	<0.28	<0.42	<0.28
1997	<0.049	<0.26>	22	<0.53>	<0.81	16	11	0.065	<0.74	<0.86	<0.30
1998	<0.037	<0.27>	24	<0.20>	<0.72	15	29	<0.067	<0.46>	<0.29	<0.036
1999	<0.048	<0.12	14	<0.15	<0.78	8.9	17	<0.027	<0.27	<0.31	<0.039
2000	<0.062	<0.25>	16	<0.29>	<1.6	12	25	<0.10	<0.37	<0.30	<0.091
2001	0.39	0.86	23	0.97	<2.1	17	48	<0.033	<0.31	<0.23	<0.17

Data for Blackberry Lane is represented by Sample ID#260836, Meadowbrook Creek by ID#260837, and Port Arthur Dam by ID#260838
Data appearing in brackets (<>) fall between the level of detection (LOD) and level of quantitation (LOQ)

Prepared by: WMW
Checked by: BJW

Appendix 1

Ph: (715)-478-2777 Fax: (715)-478-3060

Client: Blue Iris Environmental Inc
Attn: William M West
N5811 Twelve Corners Road
Black Creek,WI 54106

Project: Flambeau Mining Company

Printed: 08/27/01 Code: S

NLS Project: 61631

NLS Customer: 90830

FMC-CR-BBL NLS ID: 260836
Ref. Line 1 COC 50129 FMC-CR-BBL Matrix: MS
Collected: 07/23/01 08:15 Received: 07/25/01

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Aluminum, tot. as Al	46	mg/Kg WWB	10	4.2	15	08/22/01	SW846 6010	721026460
Arsenic, total as As by furnace AAS	ND	mg/Kg WWB	10	0.29	1.0	08/20/01	SW846 7060	721026460
Cadmium, tot. as Cd	0.32	mg/Kg WWB	1	0.093	0.30	08/20/01	SW846 6010	721026460
Chromium, tot. as Cr	[0.53]	mg/Kg WWB	1	0.19	0.70	08/20/01	SW846 6010	721026460
Copper, tot. as Cu	14	mg/Kg WWB	1	0.095	0.32	08/20/01	SW846 6010	721026460
Lead, tot. as Pb	ND	mg/Kg WWB	1	2.1	7.8	08/16/01	SW846 6010	721026460
Mercury (Tissue) by CVAA	ND	mg/Kg WWB	1	0.033	0.11	08/24/01	SW846 7470	721026460
Nickel, tot. as Ni	0.86	mg/Kg WWB	1	0.21	0.70	08/20/01	SW846 6010	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg WWB	10	0.21	0.75	08/21/01	SW846 7740	721026460
Silver, tot. as Ag	ND	mg/Kg WWB	1	0.17	0.64	08/20/01	SW846 6010	721026460
Zinc, tot. as Zn	18	mg/Kg WWB	1	0.15	0.15	08/20/01	SW846 6010	721026460
Metals digestion - total soil/sludge ICP	yes		-			08/16/01	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	yes		-			08/16/01	SW846 3050	721026460

FMC-CR-MBC NLS ID: 260837
Ref. Line 2 COC 50129 FMC-CR-MBC Matrix: MS
Collected: 07/23/01 10:15 Received: 07/25/01

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Aluminum, tot. as Al	67	mg/Kg WWB	10	4.0	14	08/22/01	SW846 6010	721026460
Arsenic, total as As by furnace AAS	ND	mg/Kg WWB	10	0.30	1.1	08/20/01	SW846 7060	721026460
Cadmium, tot. as Cd	0.40	mg/Kg WWB	1	0.089	0.28	08/20/01	SW846 6010	721026460
Chromium, tot. as Cr	1.1	mg/Kg WWB	1	0.18	0.67	08/20/01	SW846 6010	721026460
Copper, tot. as Cu	26	mg/Kg WWB	1	0.091	0.30	08/20/01	SW846 6010	721026460
Lead, tot. as Pb	ND	mg/Kg WWB	1	2.0	7.5	08/16/01	SW846 6010	721026460
Mercury (Tissue) by CVAA	ND	mg/Kg WWB	1	0.034	0.11	08/24/01	SW846 7470	721026460
Nickel, tot. as Ni	0.85	mg/Kg WWB	1	0.20	0.68	08/20/01	SW846 6010	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg WWB	10	0.22	0.79	08/21/01	SW846 7740	721026460
Silver, tot. as Ag	ND	mg/Kg WWB	1	0.17	0.62	08/20/01	SW846 6010	721026460
Zinc, tot. as Zn	17	mg/Kg WWB	1	0.14	0.14	08/20/01	SW846 6010	721026460
Metals digestion - total soil/sludge ICP	yes		-			08/16/01	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	yes		-			08/16/01	SW846 3050	721026460

Ph: (715)-478-2777 Fax: (715)-478-3060

Client: Blue Iris Environmental Inc
Attn: William M West
N5811 Twelve Corners Road
Black Creek,WI 54106

Project: Flambeau Mining Company

Printed: 08/27/01 Code: S

NLS Project: 61631

NLS Customer: 90830

FMC-CR-PAD NLS ID: 260838

Ref. Line 3 COC 50129 FMC-CR-PAD Matrix: MS
Collected: 07/23/01 09:15 Received: 07/25/01

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Aluminum, tot. as Al	48	mg/Kg WWB	10	4.1	15	08/22/01	SW846 6010	721026460
Arsenic, total as As by furnace AAS	ND	mg/Kg WWB	10	0.31	1.1	08/20/01	SW846 7060	721026460
Cadmium, tot. as Cd	0.39	mg/Kg WWB	1	0.090	0.29	08/20/01	SW846 6010	721026460
Chromium, tot. as Cr	0.86	mg/Kg WWB	1	0.19	0.68	08/20/01	SW846 6010	721026460
Copper, tot. as Cu	23	mg/Kg WWB	1	0.092	0.31	08/20/01	SW846 6010	721026460
Lead, tot. as Pb	ND	mg/Kg WWB	1	2.1	7.6	08/16/01	SW846 6010	721026460
Mercury (Tissue) by CVAA	ND	mg/Kg WWB	1	0.033	0.11	08/24/01	SW846 7470	721026460
Nickel, tot. as Ni	0.97	mg/Kg WWB	1	0.21	0.68	08/20/01	SW846 6010	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg WWB	10	0.23	0.80	08/21/01	SW846 7740	721026460
Silver, tot. as Ag	ND	mg/Kg WWB	1	0.17	0.62	08/20/01	SW846 6010	721026460
Zinc, tot. as Zn	17	mg/Kg WWB	1	0.14	0.14	08/20/01	SW846 6010	721026460
Metals digestion - total soil/sludge ICP	yes	-				08/16/01	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	yes	-				08/16/01	SW846 3050	721026460

Values in brackets represent results greater than the LOD but less than or equal to the LOQ and are within a region of "Less-Certain Quantitation". Results greater than the LOQ are considered to be in the region of "Certain Quantitation".

LOD = Limit of Detection
DWB = Dry Weight Basis
LOQ = Limit of Quantitation
NA = Not Applicable
ND = Not Detected
%DWB = (mg/kg DWB) / 10000
1000 ug/L = 1 mg/L

Reviewed by: Thomas K. Krueger

Authorized by:
R. T. Krueger
President

Note: LOD's in brackets indicate LOD is greater than CRQL
CRQL = Contract Required Quantitation Limit