POWER RESOURCES

Smith Ranch - Highland
Uranium Project
P. O. Box 1210
Glenrock, Wyoming USA 82637
Casper: 307-235-1628
Douglas: 307-358-6541
Fax: 307-358-4533

January 15, 2004

United States Nuclear Regulatory Commission Official Hearing Exhibit			
In the Matter of:	STRATA ENERGY, INC. (Ross In Situ Recovery Uranium Project)		
ASLBP #:	12-915-01-MLA-BD01		
Docket #:	04009091		
Exhibit #:	NRC028 -00-BD01	Identified:	10/1/2014
Admitted:	10/1/2014	Withdrawn:	
Rejected:		Stricken:	
Other:			

Attn: Document Control Desk
Mr. Gary Janoskco, Chief
Fuel Cycle Licensing Branch, NMSS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Smith Ranch – Highland Uranium Project
Docket No. 40-8964, SUA-1548
A-Wellfield Ground Water Restoration Information

Dear Mr. Janoskco:

In accordance with directives from Mr. John Lusher, NRC Project Manager, Power Resources, Inc. (PRI) herein submits information concerning the completion of ground water restoration at the A-Wellfield. This information is intended to fulfill the requirements of License Condition 10.1.9.b that requires the submittal of a "Wellfield Completion Report" upon the completion of restoration of each wellfield.

As detailed in the attached information, the A-Wellfield 20-Sand Production Zone was mined using the approved In Situ Leach (ISL) Mining Method from January 1988 until July 1991. The ISL mining method involved the addition of gaseous carbon dioxide and oxygen to the natural ground water contained within the 20-Sand Production Zone, the circulation of this solution (known as the lixiviant) through the ore to dissolve the uranium, and the capture of the dissolved uranium at the ion exchange (IX) facility located at Satellite No. 1.

After mining was completed in the A-Wellfield, PRI completed ground water restoration from July 1991 to October 1998 in accordance with the statutes contained in the Wyoming Environmental Quality Act, the Wyoming Department of Environmental Quality (WDEQ), Land Quality Division (LQD) Chapter XI Regulations (Non-Coal-In Situ Mining), and commitments contained in the WDEQ-LQD Mine Permit No. 603 and the NRC License No. SUA-1548 (previously No. SUA-1511).

As your staff is aware, a considerable amount of information concerning the restoration of the A-Wellfield was submitted by PRI to the WDEQ to satisfy numerous requests for additional information. Therefore, in accordance with directives from Mr. John Lusher, NRC Project Manager, the most pertinent information and ground water quality data are included herein for

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the NRC's review. The various information submitted in the attachments is also included in the "Summary of Attached Information". Of particular importance are Attachment A (Ground Water Restoration Report, A-Wellfield, Highland Uranium Project), Attachment C (A-Wellfield Ground Water Stabilization Report), Attachment E (Updated Restoration Well Data) and Attachment H which includes the approval from the WDEQ that the restoration of the A-Wellfield meets all Wyoming statutory and regulatory requirements.

It should be noted that although the WDEQ Mine Permit and NRC License requires the collection of "stability data" for a six month period after the completion of ground water restoration activities, PRI submitted to the WDEQ "stability data" for the ground water quality that spanned a period of approximately 14 months (February 1999 to April 2000). Attachments C and D contain this information. Additionally, PRI has included as Attachment E, an updated graph of the restoration well data that shows ground water quality conditions from the start of ground water restoration (July 1991) through November 2003 for chloride, bicarbonate, conductivity and uranium.

This information effectively expands the "stability" period from February 1999 to November 2003, or a period of approximately 51 months (4 ¼ years). This "long term" data shows that no significant adverse increasing trends are occurring that could negatively impact the ground water quality of the production zone or adjacent areas that naturally contain elevated levels of radium-226, radon-222 and uranium as a result of the uranium mineralization in the mine area and adjacent areas.

As recently discussed with Mr. Lusher, PRI intends to discontinue routine monitoring of the A-Wellfield monitor wells concurrent with the submittal of this information. PRI is hopeful that the NRC can review this information in a timely manner and concur with the WDEQ's November 2003 decision that ground water restoration at the A-Wellfield meets regulatory requirements, and decommissioning of the wellfield can commence.

If you have any questions or need additional information, please don't hesitate to call me.

Sincerely,

W.F. Kearney
Manager-Health, Safety
& Environmental Affairs

WFK/ksj

cc: F.T. Newton w/atta
S.P. Collings w/o atta
R. Knode w/o atta
L.A. Huffman w/o atta
File 4.6.4.1 w/atta

Summary of Attached Information

Attachment A: Report entitled "Ground Water Restoration Report, A-Wellfield, Highland Uranium Project" submitted to the WDEQ in correspondence dated April 23, 1999

This report provides the operational information and ground water quality data that shows that ground water restoration was completed in accordance with permit and license requirements and requests concurrence that the "stability period" can commence.

Attachment B: WDEQ Response Dated August 10, 1999 that reviewed the above report

The response stated that the WDEQ concurred that restoration met regulatory requirements and permit commitments and that stabilization had begun in December of 1998. Final approval of restoration would be forth coming after the stability period was completed. This correspondence also requested additional information on the movement of the 20-Sand restored ground water.

Attachment C: Report entitled "A-Wellfield Ground Water Stability Report" submitted to the WDEQ in correspondence dated March 31, 2000

This report contained the full suite (Guideline No. 8) ground water quality data for the stability period and additional water quality and water level data. This report also addressed the movement of the 20-Sand restored ground water.

Attachment D: Graphs of Restored Ground Water at the Restoration (MP) Wells during the stability period (February through October 1999) including additional data collected on April 26, 2000

These graphs showed that the ground water chemistry is relatively stable. Three parameters that showed increasing trends were TDS, pH and iron. These insignificant increases occur because as the pH increases, any carbon dioxide remaining in the ground water will be converted to bicarbonate and this will cause an increase in TDS. Also, under reducing conditions, the iron concentration will increase with the dissolution of iron oxides. Eventually, the iron concentration will begin to drop as the iron precipitates as sulfide minerals.

Attachment E: Graph of the average chloride, bicarbonate, conductivity and uranium from July 1991 (start of restoration) through November 2003 at the five Restoration Wells (Wells MP-1 through MP-5)

It should be noted that data for Well MP-2 was not included after May 30, 2001 because the well became unusable. As a result of the loss of Well MP-2, there is a slight increase in the average conductivity and the average uranium concentration, which should not be construed as an increasing trend. This graph effectively shows a "stability period" of 51 months.

Attachment F: Graphs of the chloride, bicarbonate, conductivity and uranium from July 1991 (start of restoration) through November 2003 at the five individual Restoration Wells (Wells MP-1 through MP-5)

These graphs show the same information as Attachment E for **each** well.

Attachment G: Additional selenium and uranium ground water quality data collected at three additional wells submitted to the WDEQ in correspondence dated May 23, 2003

This additional ground water quality data was obtained at three wells located in the restored A-Wellfield which were not Restoration (MP) Wells. This data was included with data previously obtained from the Restoration (MP) Wells to show that the average concentration of these parameters met applicable WDEQ "Use Suitability" standards.

Attachment H: WDEQ correspondence dated November 23, 2003

This correspondence conveyed to PRI that the WDEQ had determined that the A-Wellfield had been restored in accordance with statutory and regulatory requirements and restoration of the A-Wellfield was approved.

Attachment A

Report entitled "Ground Water Restoration Report, A-Wellfield, Highland Uranium Project" submitted to the WDEQ in correspondence dated April 23, 1999

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POWER RESOURCES

Operations Office
800 Werner Ct.
Suite 352
Casper, Wyoming USA 82601
Tel: 307-472-2035
Fax: 307-234-2147

April 23,1999

Ms. Georgia Cash, District I Supervisor
Land Quality Division
Wyoming Department of Environmental Quality
Herschler Building
122 West 25th Street
Cheyenne, WY 82002

RE: Permit 603-A2
A-Wellfield Ground Water Restoration Report
Request for Concurrence to Commence Stability Monitoring

Dear Ms. Cash:

Attached please find two copies of a report detailing the history and status of ground water restoration in the A-Wellfield at Power Resources, Inc.'s (PRI) Highland Uranium Project. The A-Wellfield has been in ground water restoration since July 1991 and is now considered to be restored. With this letter, PRI requests concurrence from WDEQ\ LQD that the restoration requirement has been met and that stability monitoring can commence. A copy of this report and a request for concurrence to begin stability monitoring has also been submitted to the US NRC.

PRI has expended a substantial level of effort and has applied Best Practicable Technology (BPT) to restore the A-Wellfield ground water, and has returned the affected ground water to a quality of use equal to, and consistent with, uses for which the water was suitable prior to the commencement of insitu leach mining (ISL) pursuant to WDEQ/LQD R & R Chapter XI, Section 3 (d) (i)(B). All A-Wellfield ground water parameters, with the exception of iron, manganese, selenium and radium, have been restored to baseline, or at least to within the WDEQ/WQD Class I water classification (ie: Domestic Use Suitability). Because the pre-ISL mining average baseline concentration of dissolved radium was at least 100 times the WDEQ/WQD upper limit for domestic or agricultural use and 30 times higher than the EPA treatability limit, the A-Wellfield pre-ISL mining ground water quality was not suitable for any potable or agricultural use, with its only use being for uranium extraction (ie: WDEQ/WQD Class V - Commercial - Mineral).

The additional effort that would be required to further reduce the remaining four parameters to baseline would not be cost-effective nor would it provide any additional protection to the environment or the public. PRI therefore requests concurrence from WDEQ\LQD that the restoration requirement has been met for the A-Wellfield, and that the stability monitoring period can commence.

A member of the Cameco group of companies

PRI also requests a meeting with LQD staff in the near future to discuss the restoration results presented in the attached report and to address any concerns your staff may have. Either Mark Wittrup or I will be contacting you shortly to determine a mutually convenient time and place for the meeting.

Please call should you have any questions related to the report, our request for concurrence or to discuss a mutually convenient meeting time.

Sincerely,

Paul R. Hildenbrand
Manager of Environmental
and Regulatory Affairs

PRH/pbs

cc: M.B. Wittrup w/o atta
S.P. Collings w/o atta
File 4.3.3.1 w/atta
File HL-9 w/o atta
W.F. Kearney w/o atta
J. Hunter w/o atta
File HL-7 w/atta
R. H. Knode w/o atta
N.K. Stablein, USNRC w/o atta
File 4.6.6.1 w/o atta

Ground Water Restoration Report, A-Wellfield, Highland Uranium Project

Summary

Uranium mineralization contained in the 20-Sand aquifer at the Highland Uranium Project was mined in the A-Wellfield using the in-situ leach (ISL) method from January 1988 until July 1991. The wellfield was developed and initially operated by Everest Minerals Corporation, under Permit No. 603. Power Resources, Inc. (PRI), assumed operatorship of the Highland Uranium Project in July 1989. After the end of mining, restoration of ground water in the A-Wellfield was conducted by PRI from July 1991 to October 1998, in accordance with the general directions of the Reclamation Plan contained in Permit No. 603 and the requirements of Chapter XI of the WDEQ Land Quality Division Rules and Regulations (Non Coal - In Situ Mining). To accomplish ground water restoration, PRI employed Best Practicable Technology (BPT) by using a combination of recognized techniques, including ground water sweep, reverse osmosis treatment and the addition of chemical reductant.

A review of the current average concentrations of the 35 WDEQ Guideline No.8 chemical parameters from the MP Wells shows that ground water restoration in the A-Wellfield has succeeded in reducing the majority of these to baseline or to concentrations substantially below the allowable upper limits for WDEQ/WQD Class 1 (Domestic Use Suitability) water. Although the concentration of certain parameters, including uranium, may exceed these limits at individual wells, only four parameters (Fe, Mn, Se and Ra) have wellfield average concentrations which exceed both the baseline and Class 1 limits. It should be noted, however, that the average baseline concentration of radium within the A-Wellfield naturally exceeded the Class 1 limits by two orders of magnitude. This parameter, together with its decay product, radon, renders the natural ground water in the A-Wellfield virtually unusable prior to any in-situ leach activities. According to the US Environmental Protection Agency (EPA), existing technology for the safe treatment of potable water containing radium concentrations in excess of the proposed EPA maximum contaminant level (MCL) of 20 pCi/L is impracticable for population sizes smaller than 10,000 persons. The WDEQ has recognized this fact by classifying the ground water at other Highland wellfields as Class 4 (Industrial Use Suitability).

The limited extent and discontinuity of the 20-Sand aquifer, and the continuation of unmined 30-Sand uranium mineralization in the path of any future water migration, means that no usable waters of the State will be impacted by the residual concentrations of U, Fe, Mn, Se, and Ra. In the process of migrating, via the 30-sand, towards the abandoned Exxon open pit, ground water from the A-Wellfield will pass through zones where the existing ground water is already unusable because of dissolved radium and radon associated with the uranium mineralization. Absorption, precipitation and dispersion will reduce, or remove, the elevated concentrations of these parameters before this water reaches the pit, where any remaining traces will be indistinguishable from the background concentration in the lake. For these reasons, there are no identifiable social or economic impacts and there is no opportunity for the water to inflict injury upon livestock, wildlife, aquatic life or plant life, either now or in the future. There are shallower and more easily accessible ground water resources in the area, for which radium and radon treatment, with its associated risks, is not necessary.

PRI, after a substantial level of effort, and the application of the BPT, contends that restoration of the A-Wellfield is complete in that the affected ground water has been returned to a quality of use equal to, and consistent with, the uses for which the water was suitable prior to ISL mining as required by WDEQ/LQD Rules and Regulations, Chapter XI, Section 3(d)(i)(B). Expending the economic resources that would be required to further "polish" this naturally unusable water cannot be justified from either a technical or a cost effective basis. Consequently, PRI requests concurrence from the WDEQ that restoration of the A-Wellfield has been achieved and that the six month stability period can begin.

Introduction

Location of the A-Wellfield

A detailed description of the location of the A-Wellfield can be found in the original Permit Application submitted by Everest Minerals Corporation in December 1985. Figure 1 of this restoration report is a map showing the position of the A-Wellfield, surrounded geographically by the B-Wellfield, and its proximity to the nearby Exxon open pit and underground mines. Figure 2 shows the configuration of the injection and production wells which comprise the A-Wellfield patterns, as well as the external monitor wells. Also shown are the "MP-" monitoring wells, which were approved for use in determining the baseline water quality and subsequent restoration progress.

Geology of the 20-Sand within the A-Wellfield

The A-Wellfield was installed in a lens of 20-Sand surrounding an isolated uranium roll-front which had infiltrated downwards from the 30-Sand. At an average depth of 530 feet, the wellfield is deeper than the typical aquifers used for domestic and livestock supply in this area. A summary of the A-Wellfield geology is provided in section 2.4.1. of the December 1985 Permit Application, where it is called the Section 21 mine area. Appendix 6.1 - 6.5 of the application contains a geologic cross section and several isopach maps showing the thickness of the overlying and underlying aquitards. A review of the resistivity character of the 20-Sand on logs used to construct the northeast-southwest cross-section (Drawing A6.1) shows that this unit becomes thin and silty in a southwest direction away from the "20-Sand Monitor Well Ring" (A-Wellfield). The 20-Sand is also known, from the study of other logs, to be discontinuous, with a clearly defined boundary to the west (see 20-Sand isopach map included with correspondence to the WDEQ dated May 13, 1996). This boundary lies close to the A-Wellfield monitor well ring near Well M-8, where the pilot hole did not intersect any sandy formation and had to be offset and redrilled as Well M-8A. These geologic features, when considered together with the small aerial distribution of the 20-Sand redox boundary (uranium roll front), are evidence of the limited opportunity for ground water to migrate away from the A-Wellfield.

A review of the isopach map of the 25-Shale aquitard separating the 20-Sand and 30-Sand aquifers (Drawing A6.4 of the December 1985 Permit Application) shows an elongated, northeast to southwest trending zone which is labeled as "less than 2 feet thick". The A-Wellfield monitor well ring was installed in a location which partially enclosed this zone of thinned aquitard and intersected it between monitor wells M-10A and M-11. The two aquifers are, in fact, interconnected in this area. This situation would have been of little consequence to the A-Wellfield if 30-Sand wells had not been subsequently installed at the B4 and B17 pattern groups in close proximity to these monitor wells and the zone of interconnection. The mining of these 30-Sand patterns created a reservoir of impacted ground water above this aquifer interconnection, or aquitard hole, which was eventually drawn into the 20-Sand during ground water restoration of the A-Wellfield. This event has been described in more detail in correspondence to the WDEQ dated May 13, 1996.

Pre-Mining Ground Water Quality Baseline

The baseline ground water quality for the A-Wellfield prior to the start of mining (1987) is summarized on Table 1 using averaged concentrations for Guideline No.8 parameters for wells MP-1 to MP-5. The ground water quality does not meet any Class of Use except Class 5 (Commercial-Mineral) because of the elevated concentrations of dissolved radium. Dissolved radon gas, a decay product of radium, is not included in the Guideline No.8 parameter list, yet it is present in large enough concentrations (100,000's pCi/L) to also preclude the use of this water for any domestic purposes. According to the EPA (Radionuclides in Drinking Water, December 1997), water containing >20 pCi/L radium is not practically treatable, particularly in a home water softener, as the equipment will become a significant radiation hazard and the spent cartridges present a solid waste disposal problem. Such equipment is also of no value in removing the dissolved radon gas, which will vent to the atmosphere as soon as the water is used. For these reasons, and in order to protect the public, this water should be correctly considered as "unusable", both before, and after, in situ leach mining.

A-Wellfield Production History

Uranium production began in the A-Wellfield in January 1988, and continued until July 1991, using dissolved O_2 and CO_2 gases as the lixiviant (Note; this, and other specialized terminology is defined in a short glossary as Appendix 4). The 31 patterns were divided into three groups, labeled A1, A2 and A3. The number of operating patterns in these groups was gradually reduced during the production period, with only 12 production wells pumping at the end. Many of the patterns were shut off due to diminished flow rates, rather than declining uranium concentration, which left partially leached ore in the formation and significant quantities of dissolved uranium in the ground water when restoration started. Problems were experienced with an excursion at Monitor Well M-11 as soon as production began from the 30-Sand B4 pattern group in February 1988 (Figure 3). The excursion was controlled by stopping injection of lixiviant in the B4 patterns closest to the aquitard hole. Excursion problems reoccurred at Monitor Well M-11 when restoration began. This situation is explained in more detail below.

Post-Mining Ground Water Quality

The ground water quality in the A-Wellfield at the end of mining in July 1991 is also summarized on Table 1 using averaged concentrations of Guideline No.8 parameters for wells MP-1 to MP-5. The concentration of all major cations and anions were elevated at the end of mining, but only uranium, radium, selenium and manganese were significantly increased from their baseline concentrations. Mathematically, the increases in concentration of these trace metals are several orders of magnitude because of the extremely low original baseline concentrations.

The pH value and bicarbonate concentration shown on Table 1 were measured in the laboratory and are affected by the unavoidable degassing of the water during sampling. The results for these parameters are different from the actual values in the aquifer, which would have been closer to pH 6.0 and 1200 mg/L HCO_3. The average uranium concentration of 40 mg/L is unusually high, at least two to three times higher than would be expected for a wellfield at the end of mining, and would have been a factor in lengthening the restoration time.

Wellfield Restoration Activity

Ground Water Restoration Plan

The Ground Water Restoration Plan in Permit No. 603 (Section 4 of the Reclamation Plan) was based upon techniques employed and knowledge acquired during restoration of the Exxon Expanded R&D Pilot wellfield, which was located in the southern part of the Section 21 (B-Wellfield) mine unit area. Restoration of this pilot wellfield was completed in 1986 and succeeded in returning the affected ground water to a baseline condition.

The Ground Water Restoration Plan states that the primary goal of the ground water restoration effort will be to return the ground water quality of the production zone, on a mine unit average, to the pre-injection baseline condition. The plan also states that, in the event that baseline conditions are not achieved after diligent application of the Best Practicable Technology (BPT) available, PRI is committed to a secondary goal of returning the ground water to a quality consistent with the use, or uses, for which the water was suitable prior to in-situ leach mining.

The approved plan includes three techniques to accomplish ground water restoration, the approximate volumes of ground water to be treated during each phase, and a general schedule for completion of the activities. The three restoration techniques are:

- Ground water sweep (3-4 pore volumes).
- Ground water treatment and reinjection, using reverse osmosis (RO) or a similar treatment technology (2-3 pore volumes).
- Addition of a chemical reductant to specific wells which remain elevated in certain redox sensitive parameters, such as iron, manganese, selenium and uranium.

The proposed schedule estimated that restoration of a wellfield would last from four to seven years, although it was also stated that there was insufficient storage capacity in the purge storage reservoir (PSR-1) to allow continuous removal of water from an aquifer and that active restoration would be confined to the warmer spring and summer months (April to October).

The term "pore volume" was not clearly defined in the Ground Water Restoration Plan. The pore volume for the A-Wellfield was determined to be 12.5 acre-feet (1992-1994 Annual

Reports to WDEQ), and was apparently calculated using an average pattern area of 4900 ft^2 and an average screen thickness of 10 ft, with no adjustment for impacted fluid located outside of the patterns (flare factor). In 1995, the A-Wellfield pore volume was changed to 14.3 AF by including a 1.4 flare factor (1995 Annual Report to WDEQ). In August 1996, following further discussions with the WDEQ, the unit pore volume for all wellfields was increased again using an interim compromise flare factor of 2.94. This flare factor, which was agreed for bonding purposes, enlarged the estimated A-Wellfield pore volume to 30 AF. The actual impacted pore volume for this mine unit cannot be reliably determined due to its complex production and restoration history.

Phase 1, Ground Water Sweep

Ground water sweep pumping began in the both the A- and B-Wellfields in July 1991 and continued until June 1994. The volume of water which could be pumped from the A-Wellfield was restricted by having to share the capacity of the purge storage reservoir with the ground water sweep fluids from the B-Wellfield and the production purge fluids from the C-Wellfield. No seasonal reduction in pumping rate was necessary during the relatively mild winter of 1991-1992, but the flow rate was reduced during the next two winters. Pond storage capacity was improved when the second reservoir (PSR-2) was permitted and began to accept production purge fluids in May 1994.

There were typically two pumping wells in operation during the ground water sweep phase of restoration in the A-Wellfield, removing water at an average combined rate of 10 gpm. From May to November 1992, a third pumping well was added as part of the mitigation effort to control the developing excursion at Monitor Well M-11. At other times, and during winter months, only one well was pumped to reduce the flow rate to PSR-1. The monthly cumulative flow totals for the three years of ground water sweep pumping are listed on Table 2, where it can be seen that a cumulative water volume of 40.06 AF had been withdrawn from the 20-Sand by the end of this phase of restoration. Using the original 12.5 AF pore volume definition in effect at the time, this represents 3.2 PV's of ground water sweep, consistent with the timeline provided in the Ground Water Restoration Plan.

The quality of the ground water at the end of the ground water sweep phase, based upon averaged concentrations of Guideline No.8 parameters for wells MP-1 to MP-5, showed no significant improvement from the situation which existed at the end of mining in 1991 (see Appendix 3, and Figure 4). This was not unexpected, as the MP Wells are located in the middle of the pattern groups and the invasion by unaffected ground water would only have been detectable at the edges of the patterns. What had not been anticipated, however, and was not evident at the time, was the migration of impacted water from the 30-Sand B4 pattern group, through the aquitard hole, to form a plume which merged with the 20-Sand flare zone.

Phase 2, Treatment With Reverse Osmosis

The first reverse osmosis (RO) unit was constructed in early 1994 and made operational in June of that year. Its design capacity was 125 gpm gross feed, of which 100 gpm was supplied from the wellfield and 25 gpm was recycled concentrate. It was operated to produce 75 gpm of permeate, which was blended with 25 gpm of fresh water to make up the volume before being reinjected back into the wellfield. A small bleed stream was removed for wellfield control.

The individual wells in the A-Wellfield pattern groups were reconfigured into larger arrays, called "megapatterns", for RO treatment. These often consisted of four original mining patterns in a block, with permeate injected into a central well and feed water pumped from the peripheral wells, in an opposite manner to the flow arrangement during mining. In this way, any residual lateral flare lying just outside of the patterns would be drawn inwards. Not all wells are needed for RO treatment of megapatterns, and some of the inactive wells, including MP Wells, were used for sampling to observe the progressive change in water quality. A dramatic illustration of the effect of RO treatment on water quality is given by the time-concentration plot of Well MP-3, situated inside one of the first megapatterns, and to a lesser degree, Well MP-4 (both shown on Figure 4). In both of these cases, the circulating permeate quickly displaced and diluted the residual mining fluids.

In August 1994, an excursion occurred at Monitor Well M-10A, located on the south side of the aquitard hole, presumably caused by the expansion of migrating 30-Sand fluids. An attempt was made to control this excursion, as well as the continuing excursion at Well M-11, by resuming ground water sweep pumping of selected pattern wells simultaneously with RO treatment in the megapatterns. This activity continued into 1995, when it was evident that the excursions could not be reversed without installing new wells specifically located for that purpose. These wells, labeled AR-1 to AR-3, were installed in September 1995 and began pumping ground water sweep fluids a month later. The Well M-10A excursion was soon reversed, however, there was no significant improvement at Well M-11. A ground water sweep component continued to be pumped from various wells in the A-Wellfield while the RO treatment was moved between megapatterns during the next three years.

A number of additional restoration wells (AR Wells) were installed to assist with remediation of the extended flare zone caused by migration of the 30-Sand fluids into the 20-Sand. The progressive restoration of the flare zone and of the mining patterns using RO treatment has been described in annual reports to the WDEQ in years 1995 through 1998. RO treatment ceased in the A-Wellfield in November 1997.

Table 3 lists the monthly cumulative flow totals for the period of operation of the RO unit in the A-Wellfield, together with the totals for additional ground water sweep pumping conducted to control the monitor well excursions. It can be seen that a total of 373.4 AF of RO feed water was pumped from the wellfield, with 352.2 AF of permeate reinjected. This represents almost 30 PV of treatment, as originally defined, and 12.4 PV as currently defined. A proportion of this, however, can be discounted as experimental, as experience was gained in the operation of the RO treatment process. Another significant percentage was devoted to the remediation of the flare zone. Treatment of this area was discontinued after it was realized that the chloride concentration had returned to baseline and the injected permeate was probably dissolving calcite and generating more bicarbonate than was being removed. In addition to these volumes of RO feed, a further 58.7 AF of ground water sweep was pumped as part of the monitor well excursion control effort, although in hindsight, this may have merely continued to draw 30-Sand fluids into the flare area.

The quality of the ground water at the end of the RO treatment phase, based upon averaged concentrations of Guideline No.8 parameters for Wells MP-1 to MP-5, showed a definite improvement from the situation which existed at the end of the ground water sweep phase in 1994 (see Table 1). Of the 35 Guideline No.8 parameters analyzed in 1997 (see Appendix 3), 25 were at or below baseline concentration, 5 were slightly above baseline concentration and 4 were moderately elevated above baseline concentration. The latter group includes manganese (0.37 mg/L), uranium (3.03 mg/L), radium (1057 pCi/L) and selenium (0.36 mg/L).

Phase 3, Treatment With Chemical Reductant

Hydrogen sulfide (H_2S) gas was selected as the reductant to be used for Phase 3 of ground water restoration because of its strong reducing capacity and its utilization during restoration of the R&D pilot wellfield. However, it required special storage and handling, and several months of work were needed to develop reliable and safe gas addition equipment. H_2S began to be added experimentally to the RO permeate stream in the Spring of 1997. In October 1997, the gas was injected into the wellfield via a closed-loop recirculation system after it became evident, from a review of the chloride and bicarbonate data, that there was no further benefit to be gained in the A-Wellfield from RO treatment. The H_2S recirculation system operated intermittently during the winter of 1997-1998, as its use was limited to daytime for safety reasons, and problems were experienced with freezing of condensation in the gas lines. Full time recirculation started in May 1998 and continued until October 1998, when approximately 26,000 lbs of H_2S gas had been injected into all three pattern groups in the A-Wellfield.

Table 4 lists the monthly cumulative flow totals for the period of operation of the H_2S recirculation system in the A-Wellfield, together with the totals for continuing ground water sweep pumping. It can be seen that 56.3 AF of ground water was recirculated for purposes of reductant addition, and 5.9 AF of ground water sweep was removed during this period. This represents 4.5 and 0.5 PV, respectively, using the original definition, and 1.9 and 0.2 PV using the current definition.

Breakthough of dissolved H_2S gas was detected at several of the pumping wells while the gas was being added to the recirculating ground water stream, suggesting that the aquifer had been thoroughly contacted by the reductant. The ground water at the end of the H_2S recirculation phase showed slight increases in the concentration of several parameters when compared to the situation which existed at the end of the RO treatment phase in 1997. Three parameters increased sufficiently in concentration to exceed their baseline values; TDS, conductivity and chloride. The increase in the first two parameters is due to elevated sulfate concentrations resulting from the oxidation of the injected H_2S, although sulfate itself remains below baseline. A plausible explanation for the increase, or "rebound" of chloride, is less certain, but is most likely due to diffusion and mixing of chloride ions retained in restricted (less permeable) pore spaces during recirculation of the ground water.

Only limited ground water sweep pumping has been conducted in the A-Wellfield since the end of this phase of ground water restoration. All wellfield activity stopped during November and December, 1998, to enable the 10-year anniversary MIT survey to be completed. During this work, it was noticed that the water quality at Monitor Well M-11 showed signs of improvement, which supported the concept that 30-sand fluids were drawn downwards by pumping from the 20-Sand. Consequently, no more ground water has been pumped from the A-Wellfield since that time.

Determination of Restoration Success

Ground Water Quality After Restoration

Table 1 lists the ground water quality beneath the A-Wellfield pattern group at the end of active restoration, based upon averaged concentrations of Guideline No.8 parameters for Wells MP-1 to MP-5. Copies of these February 1999 Guideline No.8 analyses for each MP-Well are attached to this report as Appendix 1. Ignoring occasional higher values at individual wells, the averaged parameters can be considered in three groups, listed in Table 5.

Those parameters in the first group are restored to baseline or better water quality and require no further comment. Five of the eleven parameters in the second group (calcium, magnesium, TDS, conductivity and alkalinity), in addition to being below the concentration limits for any Class of Use, are also below the average baseline concentrations for all the monitor wells in the seven wellfields at Highland (nearly 400 wells). The third group, which remains elevated above the limits for domestic or related uses, includes iron (1.30 mg/L), manganese (0.49 mg/L), radium (1153 pCi/L) and selenium (0.07 mg/L).

A-Wellfield Ground Water Quality versus Restoration Goals

The significant level of effort which has been expended upon this restoration has succeeded in returning 31 of these 35 parameters to concentrations below the limits for any Class of Use. Two of the remaining four parameters, iron and manganese, have been elevated by the H_2S treatment but pose no risk of toxicity. The Class of Use limits for these parameters are based upon aesthetic objectives of taste and staining, and they will be buffered by the formation when the Eh and pH stabilize. The average concentration of selenium has decreased as a result of the H_2S treatment and recirculation and may be expected to decrease further due to formation buffering, as will the residual concentration of uranium. The fourth parameter, radium, occurs naturally in high concentrations in ground water beneath and adjacent to the A-Wellfield pattern group.

When reviewing these criteria, the following observations should demonstrate that any future impact to the environment will be minimal:

- The A-Wellfield is geographically remote from inhabited areas. It lies between, and in close proximity to two pre-existing abandoned conventional uranium mining operations, one of which is an open pit, and the other, an underground mine.
- It lies at a depth of 530 feet, well below the typical depth limit for installation of domestic and livestock watering wells. There are alternate, shallower and more suitable aquifers available in this area which do not contain uranium mineralization and the associated dissolved radium and radon.

- The ground water gradient prior to all conventional and in-situ mining activities was probably to the northeast, as suggested by the direction of the 20-Sand and 30-Sand uranium roll fronts. However, the post-mining ground water gradient will be in a southwesterly direction, towards the Exxon open pit, which will become the regional "sink" (Figure 1). As stated earlier, the 20-Sand is thin and discontinuous in that direction, and any future migration of water from the 20-Sand towards the pit will probably occur via connections with the 30-Sand.
- The average pre-injection baseline concentration of dissolved radium in the A-Wellfield is at least two orders of magnitude above the limit for all domestic or related uses and 30 times higher than the treatability limit determined by the EPA. This effectively renders the water unfit for potable use, as it is classified as Commercial-Mineral (Class 5). It is unusable, except for uranium mining, where sufficient radiological safeguards will be employed to monitor and control the toxicity hazards associated with radium, the emission of gamma radiation and the escape of radon gas into buildings. Any other attempted use for this water should be discouraged.
- Dissolved radium in ground water is present at Highland everywhere where there is uranium mineralization in the host formations. The concentration of dissolved radium does not appear to correlate directly to ore grade, but is probably related to the dispersion and surface area of the uranium mineral grains. Thus, dissolved radium in ground water can be found associated with the diffuse and extensive zones of low grade or uneconomic mineralization scattered across the Highland property. From monitor well sample data collected to date, it is evident that radium does not migrate any significant distance from these source areas, as there are no observed dispersion zones down-gradient from the uranium mineralized trends.
- Uranium mineralization in the 30-Sand is continuous in a southwesterly direction from the southern end of the B-Wellfield to the northern end of the Exxon open pit. Thus, all down-gradient water from the A- and B-Wellfields will be impacted by naturally elevated concentrations of dissolved radium and radon, and therefore no additional risk is posed to this already unusable water.

Status of M-11 and M-10A Monitor Wells

Continuous effort has been expended to mitigate the limited impact excursions at Monitor Wells M-11 and M-10A since 1991 and 1994 respectively. This effort involved the removal of several additional pore volumes of ground water from the aquifer and succeeded in bringing the concentration of excursion parameters at Well M-10A below the UCL's. At Well M-11, however, it has only been possible to achieve stable, but moderately elevated concentrations of excursion parameters. The proximity of both of these wells to the complex aquifer geometry associated with the interconnection between the 20- and 30-Sands appears to prevent the flushing of either well screen with native ground water without drawing any residual wellfield fluid component from the 30-Sand. PRI has demonstrated in recent months that the removal of a pumped bleed stream from the A-Wellfield for the purpose of improving the water quality at Well M-11 actually results in the opposite effect, as 30-Sand fluids are drawn past the well (see Monthly Excursion Reports to WDEQ, November 1998 - March 1999).

Both of these wells were sampled on February 3, 1999, with the samples analyzed for Guideline No.8 parameters. A review of these results, which are attached to this report as Appendix 2, shows that the water at the location of these wells is impacted by moderate increases in the concentrations of calcium, magnesium and bicarbonate, with minor changes in a few other parameters. Consistent with the baseline condition at Wells M-10A and M-11, this water meets Class 1 Domestic Use Suitability standards for all parameters except radium (5.3 and 452 pCi/L, respectively). The baseline concentration of radium at Well M-10A ranged from 78.5 to 95.1 pCi/L, with a mean of 85.4 pCi/L. At Well M-11 the baseline radium concentration ranged from 114.1 to 556 pCi/L with a mean of 418.7 pCi/L. Additional restoration is not necessary for these wells as the radium concentrations are within or less than the range of baseline concentrations. Also, for the same reasons discussed above concerning restoration of the wellfield pattern area, the existing ground water quality poses no threat to any down-gradient water resource.

Stability Monitoring Period and Reclamation

Active ground water restoration has now ceased in the A-Wellfield. With the concurrence of the WDEQ, a six-month period of stability monitoring could begin immediately. In accordance with the Ground Water Restoration Plan, the M- and MP-Wells will continue to be sampled every two months. Samples from the former will be analyzed for the UCL parameters, while it is proposed that the latter be analyzed for all of the Guideline No.8 parameters. PRI proposes that the samples collected from Wells MP-1 through MP-5 on February 3, 1999, which were analyzed for Guideline No.8 parameters, be regarded as the first of the required samples for the six month stability period. The WDEQ can be notified of future sampling dates to provide opportunities for the collection of split samples.

If, at the end of the stability monitoring period, restoration of the wellfield is approved by the WDEQ, many of the wells will be plugged and abandoned, while a request will be made for some wells to be recompleted in the 30-Sand to be used to assist with restoration of the B-Wellfield. Surface reclamation of the A-Wellfield will be deferred until the final reclamation of the B-Wellfield, inside which it is located.

Discussion and Conclusions

A significant level of effort has been expended by PRI from July 1991 until November 1998 to complete the restoration of ground water in the A-Wellfield. The volumes of ground water which were pumped and treated were much greater than originally estimated due to the inadvertent enlargement of the zone of impacted water by a quantity of fluid migrating through an interconnection between the 20-Sand and 30-Sand aquifers. The edges of this migrated fluid also caused prolonged, but limited impact, excursions at two monitor wells which necessitated additional pumping as part of an action plan to mitigate the excursions. The time taken to complete the restoration was also extended by the low yield of the 20-Sand aquifer and constraints with the capacity of the treated water storage and disposal system.

The goal of restoring to a pre-mining baseline condition was successful for 20 of the 35 Guideline No.8 parameters. The concentrations of a further 11 parameters are slightly elevated above baseline but are within the limits for Class 1 (Domestic) water use. Four parameters, iron, manganese, selenium and radium, remain above both baseline and the limits for Class 1 (Domestic) water use. As discussed above, naturally high concentrations of dissolved radium and radon effectively condemn as unusable the ground water both inside the A-Wellfield and along any future potential migration route towards the abandoned Exxon open pit. When classified as unusable because of high radium and radon concentrations, moderately elevated concentrations of the other three parameters in this water are not of any consequence. These three, being redox and pH sensitive, will be naturally attenuated by precipitation and adsorption as the water slowly migrates towards the pit.

PRI considers the A-Wellfield to be restored, with all of the affected ground water being returned to a quality of use equal to, and consistent with, the use for which the water was suitable prior to ISL mining, following a significant level of effort using BPT. Further effort will only achieve incremental improvements and is not justified by the original unusable condition of the water. As such, PRI requests concurrence from the WDEQ that the restoration goal has been met and the six month stability phase can begin.

References

Everest Minerals Corp., December 1985, Application for Mining Permit etc.

Everest Minerals Corp., February 27, 1987, Highland Expanded R&D Pilot, Final Ground Water Restoration Report.

WDEQ, October 15, 1991, Highland Uranium Project, Permit to Mine No. 603-A2

PRI., May 13, 1996, Correspondence to WDEQ Concerning M-10A and M-11 Excursions.

PRI, August 1996, Correspondence to WDEQ on Interim Compromise Flare Factor.

WDEQ, March 1997, Correspondence to PRI (classification of Wellfield water as Class 4)

PRI., 1992 Annual Report to WDEQ

PRI., 1993 Annual Report to WDEQ

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PRI, Nov. 1998 - Feb. 1999, Monthly Reports to WDEQ

EPA, Dec. 11-12, 1997, Radionuclides in Drinking Water (discussion paper at Washington, DC conference on radium in drinking water).

Table 1. A-Wellfield, Average Water Quality at Wells MP-1 Through MP-5.

(All values in mg/L, except pH, conductivity in μmhos/cm, and Ra, in pCi/L)

	BASELINE (Aug. 1987)	END MINING (July 1991)	PRE-H2S (May 1998)	END REST (Feb. 1999)	CLASS 1 (* see below)
Ca	44.1	313.4	68.6	73.4	
Mg	9.0	59.5	12.4	13.5	
Na	55.0	80.8	37.4	42.2	
K	8.0	13.4	4.7	4.4	
CO3	0.0	0.0	0.0	0.0	
HCO3	215.0	720.2	242.2	256.6	
SO4	91.0	380.6	83.9	127.2	250.0
Cl	4.7	212.6	14.4	18.0	250.0
NH4	0.1	0.7	0.2	0.29	
NO2	0.0	0.1	0.1	0.1	
NO3	0.0	0.2	0.1	0.1	
F	0.2	0.2	0.1	0.15	
SiO2	16.0	20.5	12.6	11.9	
TDS	330	1507	342	410	500
COND	525	2390	579	647	
ALK	177	591	199	211	
pH	8.00	6.78	7.25	7.31	
Al	0.1	0.1	0.1	0.1	
As	0.001	0.001	0.010	0.030	0.050
Ba	0.1	0.1	0.1	0.1	
B	0.1	0.1	0.1	0.1	
Cd	0.01	0.03	0.005	0.005	
Cr	0.05	0.05	0.05	0.05	
Cu	0.01	0.02	0.03	0.01	
Fe	0.05	0.05	1.32	1.30	0.30
Pb	0.05	0.05	0.05	0.05	
Mn	0.03	0.66	0.41	0.49	0.05
Hg	0.001	0.001	0.001	0.001	
Mo	0.10	0.10	0.10	0.10	
Ni	0.05	0.08	0.05	0.05	
Se	0.001	0.990	0.160	0.070	
V	0.10	0.19	0.10	0.10	
Zn	0.01	0.04	0.01	0.01	
U	0.05	40.19	3.00	3.53	5.00
Ra	675	3286	1056	1153	5

* Class 1 Domestic Use Suitability Standard, Chapter VIII of the WDEQ, Water Quality Division Rules and Regulations.

Table 2. Monthly Water Volume Pumped From the A-Wellfield During Phase 1 Restoration (Ground Water Sweep).

Date	GWS (gals)	RO Feed (gals)	Injection (gals)	Recircul-ation (gals)	Total Bleed (gals)	GWS (Acre ft)	Cumulative (Acre ft)
1991/07/31	126147	0	0	0	126147	0.39	0.39
1991/08/31	388074	0	0	0	388074	1.19	1.58
1991/09/30	539156	0	0	0	539156	1.65	3.23
1991/10/31	554121	0	0	0	554121	1.70	4.93
1991/11/30	511396	0	0	0	511396	1.57	6.50
1991/12/31	546944	0	0	0	546944	1.68	8.18
1992/01/31	593150	0	0	0	593150	1.82	10.00
1992/02/29	452409	0	0	0	452409	1.39	11.39
1992/03/31	240568	0	0	0	240568	0.74	12.13
1992/04/30	254312	0	0	0	254312	0.78	12.91
1992/05/31	424688	0	0	0	424688	1.30	14.21
1992/06/30	523988	0	0	0	523988	1.61	15.82
1992/07/31	540008	0	0	0	540008	1.66	17.48
1992/08/31	538095	0	0	0	538095	1.65	19.13
1992/09/30	519050	0	0	0	519050	1.59	20.72
1992/10/31	534204	0	0	0	534204	1.64	22.36
1992/11/30	483858	0	0	0	483858	1.48	23.84
1992/12/31	331527	0	0	0	331527	1.02	24.86
1993/01/31	351089	0	0	0	351089	1.08	25.94
1993/02/28	322406	0	0	0	322406	0.99	26.93
1993/03/31	359350	0	0	0	359350	1.10	28.03
1993/04/30	213576	0	0	0	213576	0.66	28.69
1993/05/31	315126	0	0	0	315126	0.97	29.66
1993/06/30	372277	0	0	0	372277	1.14	30.80
1993/07/31	381003	0	0	0	381003	1.17	31.97
1993/08/31	389164	0	0	0	389164	1.19	33.16
1993/09/30	376652	0	0	0	376652	1.16	34.32
1993/10/31	185998	0	0	0	185998	0.57	34.89
1993/11/30	176116	0	0	0	176116	0.54	35.43
1993/12/31	274918	0	0	0	274918	0.84	36.27
1994/01/31	369841	0	0	0	369841	1.13	37.40
1994/02/28	329093	0	0	0	329093	1.01	38.41
1994/03/31	177093	0	0	0	177093	0.54	38.95
1994/04/30	214291	0	0	0	214291	0.66	39.61
1994/05/31	146497	0	0	0	146497	0.45	40.06

Table 2. Monthly Water Volume Pumped From the A-Wellfield During Phase 1 Restoration (Ground Water Sweep).

Date	GWS (gals)	RO Feed (gals)	Injection (gals)	Recircul-ation (gals)	Total Bleed (gals)	GWS (Acre ft)	Cumulative (Acre ft)
1991/07/31	126147	0	0	0	126147	0.39	0.39
1991/08/31	388074	0	0	0	388074	1.19	1.58
1991/09/30	539156	0	0	0	539156	1.65	3.23
1991/10/31	554121	0	0	0	554121	1.70	4.93
1991/11/30	511396	0	0	0	511396	1.57	6.50
1991/12/31	546944	0	0	0	546944	1.68	8.18
1992/01/31	593150	0	0	0	593150	1.82	10.00
1992/02/29	452409	0	0	0	452409	1.39	11.39
1992/03/31	240568	0	0	0	240568	0.74	12.13
1992/04/30	254312	0	0	0	254312	0.78	12.91
1992/05/31	424688	0	0	0	424688	1.30	14.21
1992/06/30	523988	0	0	0	523988	1.61	15.82
1992/07/31	540008	0	0	0	540008	1.66	17.48
1992/08/31	538095	0	0	0	538095	1.65	19.13
1992/09/30	519050	0	0	0	519050	1.59	20.72
1992/10/31	534204	0	0	0	534204	1.64	22.36
1992/11/30	483858	0	0	0	483858	1.48	23.84
1992/12/31	331527	0	0	0	331527	1.02	24.86
1993/01/31	351089	0	0	0	351089	1.08	25.94
1993/02/28	322406	0	0	0	322406	0.99	26.93
1993/03/31	359350	0	0	0	359350	1.10	28.03
1993/04/30	213576	0	0	0	213576	0.66	28.69
1993/05/31	315126	0	0	0	315126	0.97	29.66
1993/06/30	372277	0	0	0	372277	1.14	30.80
1993/07/31	381003	0	0	0	381003	1.17	31.97
1993/08/31	389164	0	0	0	389164	1.19	33.16
1993/09/30	376652	0	0	0	376652	1.16	34.32
1993/10/31	185998	0	0	0	185998	0.57	34.89
1993/11/30	176116	0	0	0	176116	0.54	35.43
1993/12/31	274918	0	0	0	274918	0.84	36.27
1994/01/31	369841	0	0	0	369841	1.13	37.40
1994/02/28	329093	0	0	0	329093	1.01	38.41
1994/03/31	177093	0	0	0	177093	0.54	38.95
1994/04/30	214291	0	0	0	214291	0.66	39.61
1994/05/31	146497	0	0	0	146497	0.45	40.06

Table 3. Monthly Water Volume Pumped From the A-Wellfield During Phase 2 Restoration (Reverse Osmosis Treatment).

Date	GWS (gals)	RO Feed (gals)	Injection (gals)	Recircul-ation (gals)	Bleed (gals)	GWS (AF)*	RO (AF)*	Cumul. (AF)*
1994/06/30	10084	3148312	2435522	0	795824	0.03	9.66	9.66
1994/07/31	0	3823797	2879316	0	944481	0.00	11.73	21.39
1994/08/31	0	3627565	2720969	0	906596	0.00	11.13	32.52
1994/09/30	250353	1457621	1057781	0	650193	0.77	4.47	36.99
1994/10/31	797225	27136	19593	0	804768	2.45	0.08	37.07
1994/11/30	643122	0	0	0	643122	1.97	0.00	37.07
1994/12/31	722414	0	0	0	722414	2.22	0.00	37.07
1995/01/31	937591	6881	2017	0	942455	2.88	0.02	37.09
1995/02/28	446467	1159238	871378	0	734327	1.37	3.56	40.65
1995/03/31	22979	4093112	3713810	0	402281	0.07	12.56	53.21
1995/04/30	0	3910010	3780903	0	129107	0.00	12.00	65.21
1995/05/31	0	4484270	4312296	0	171974	0.00	13.76	78.97
1995/06/30	0	3223339	3066381	0	156958	0.00	9.89	88.86
1995/07/31	0	4450319	4326131	0	124188	0.00	13.66	102.52
1995/08/31	0	2487546	2492871	0	-5325	0.00	7.63	110.15
1995/09/30	0	4029132	3991039	0	38093	0.00	12.36	122.51
1995/10/31	586120	4504144	4339523	0	750741	1.80	13.82	136.33
1995/11/30	837459	4388909	4267662	0	958706	2.57	13.47	149.80
1995/12/31	725331	4452353	4348680	0	829004	2.23	13.66	163.46
1996/01/31	646438	3316579	3242995	0	720022	1.98	10.18	173.64
1996/02/29	1147575	3777060	3561154	0	1169481	3.52	11.59	185.23
1996/03/31	504427	1905498	1826920	0	583005	1.55	5.85	191.08
1996/04/30	756569	3358979	3299251	0	816297	2.32	10.31	201.39
1996/05/31	825739	3537155	3481226	0	881668	2.53	10.85	212.24
1996/06/30	939219	2535064	2513395	0	960888	2.88	7.78	220.02
1996/07/31	927248	3465610	3364912	0	1027946	2.85	10.63	230.65
1996/08/31	593283	3631026	3550495	0	673814	1.82	11.14	241.79
1996/09/30	608588	3364002	3194096	0	778494	1.87	10.32	252.11
1996/10/31	656156	3912506	3721507	0	847155	2.01	12.01	264.12
1996/11/30	612979	3468136	3291045	0	790070	1.88	10.64	274.76
1996/12/31	580079	3303095	3203193	0	679981	1.78	10.14	284.90
1997/01/31	251690	2432037	2349120	0	334607	0.77	7.46	292.36
1997/02/28	381776	2836447	2691297	0	526926	1.17	8.70	301.06
1997/03/31	385008	4356176	4162148	0	579036	1.18	13.37	314.43
1997/04/30	263241	2793215	2691842	0	364614	0.81	8.57	323.00
1997/05/31	252583	3549167	3458234	0	343516	0.78	10.89	333.89
1997/06/30	250965	4052747	3979145	0	324567	0.77	12.44	346.33
1997/07/31	664376	4123672	4100384	0	687664	2.04	12.65	358.98
1997/08/31	368380	2707474	2648905	0	426949	1.13	8.31	367.29
1997/09/30	357212	931710	866760	0	422162	1.10	2.86	370.15
1997/10/31	668876	895739	829461	723037	735154	2.05	2.75	372.90
1997/11/30	490563	159477	148054	503232	501986	1.51	0.49	373.39

* GWS = Ground Water Sweep,
RO = Reverse Osmosis
AF = Acre Feet
Cumul = Cumulative

Table 4. Monthly Water Volumes Pumped From the A-Wellfield During Phase 3 Restoration. (Recirculation with Reductant Addition).

Date	GWS (gals)	RO Feed (gals)	Injection (gals)	Recircul-ation (gals)	Bleed (gals)	GWS (AF)	Recirc (AF)*	Cumul. (AF)
1997/10/31	668876	895739	829461	723037	735154	2.05	2.22	2.22
1997/11/30	490563	159477	148054	503232	501986	1.51	1.54	3.76
1997/12/31	316726	0	0	0	316726	0.97	0.00	3.76
1998/01/31	194725	0	0	95973	194725	0.60	0.29	4.05
1998/02/28	203127	0	0	833586	203127	0.62	2.56	6.61
1998/03/31	176468	0	0	921132	176468	0.54	2.83	9.44
1998/04/30	160467	0	0	1518326	160467	0.49	4.66	14.10
1998/05/31	136985	0	0	2629206	136985	0.42	8.07	22.17
1998/06/30	158025	0	0	2702426	158025	0.48	8.29	30.46
1998/07/31	97554	0	0	2424458	97554	0.30	7.44	37.90
1998/08/31	153050	0	0	2614825	153050	0.47	8.02	45.92
1998/09/30	163864	0	0	2844277	163864	0.50	8.73	54.65
1998/10/31	16729	0	0	523260	16729	0.05	1.61	56.26
1998/11/30	82193	0	0	0	82193	0.25	0.00	56.26
1998/12/31	76930	0	0	0	76930	0.24	0.00	56.26
1999/01/31	0	0	0	0	0	0.00	0.00	56.26
1999/02/28	0	0	0	0	0	0.00	0.00	56.26
1999/03/31	0	0	0	0	0	0.00	0.00	56.26
1999/04/30	0	0	0	0	0	0.00	0.00	56.26

* GWS = Ground Water Sweep,
RO = Reverse Osmosis
Recirc = Recirculation
AF = Acre Feet
Cumul = Cumulative

Table 5. Three Groups of Post-Restoration Water Quality Parameters Based Upon Averaged Guideline No.8 Analyses from Wells MP-1 Through MP-5.

At or Below Baseline	Above Baseline, but Below Limits for Any Class of Use	Above Baseline and Above Limits For Classes 1 - 3
Na	Ca	Fe
K	Mg	Mn
CO3	HCO3	Se
NH4	Cl	Ra
NO2	TDS	
NO3	COND	
F	ALK	
SiO2	pH	
Al	U	
Ba	SO4	
B	As	
Cd		
Cr		
Cu		
Pb		
Hg		
Mo		
Ni		
Zn		
V		

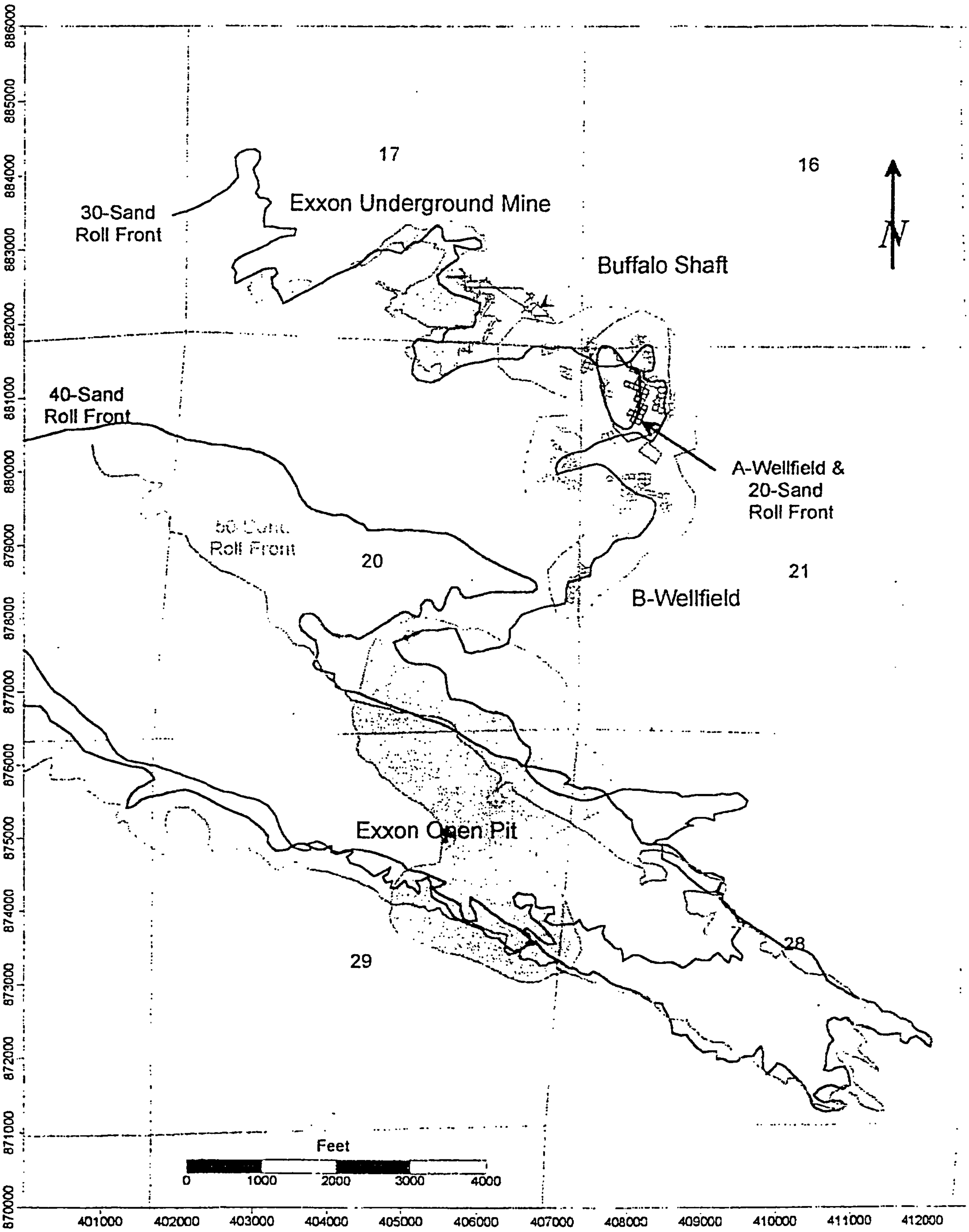


Figure 1., Location Map of the A-Wellfield in Relation to Mineral Trends and Adjacent Mine Workings

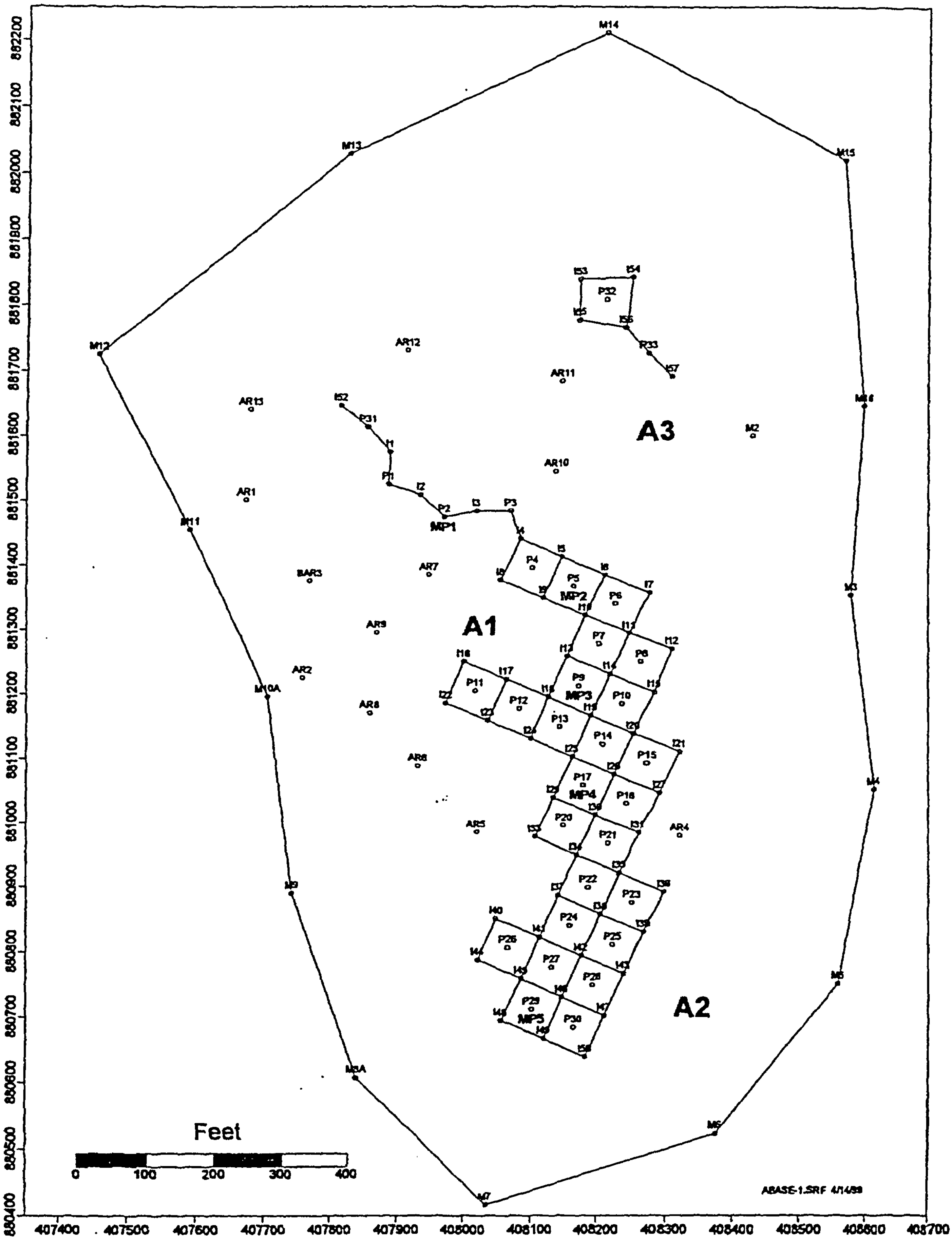
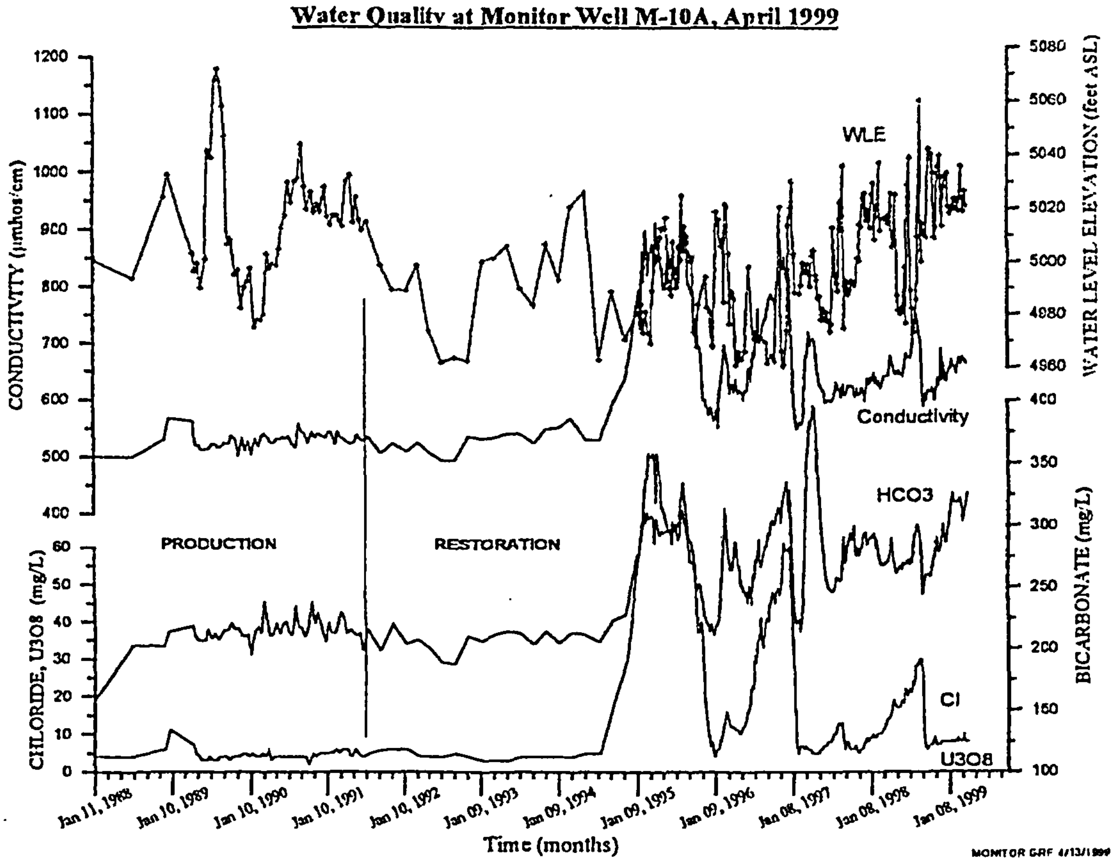


Figure 2., A-Wellfield Base Map, Showing Monitor Wells and Patterns



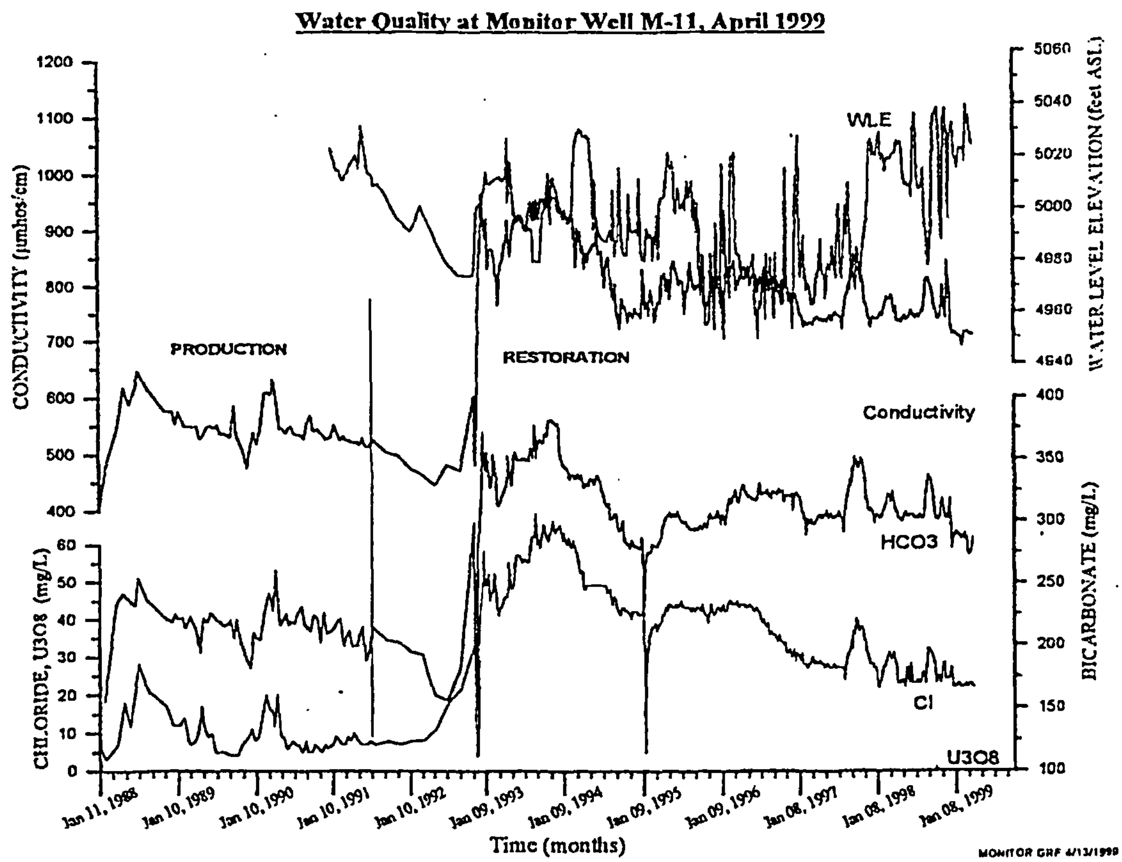


Figure 3, Time-Concentration Plots of Monitor Wells M-10A and M11, April 1999

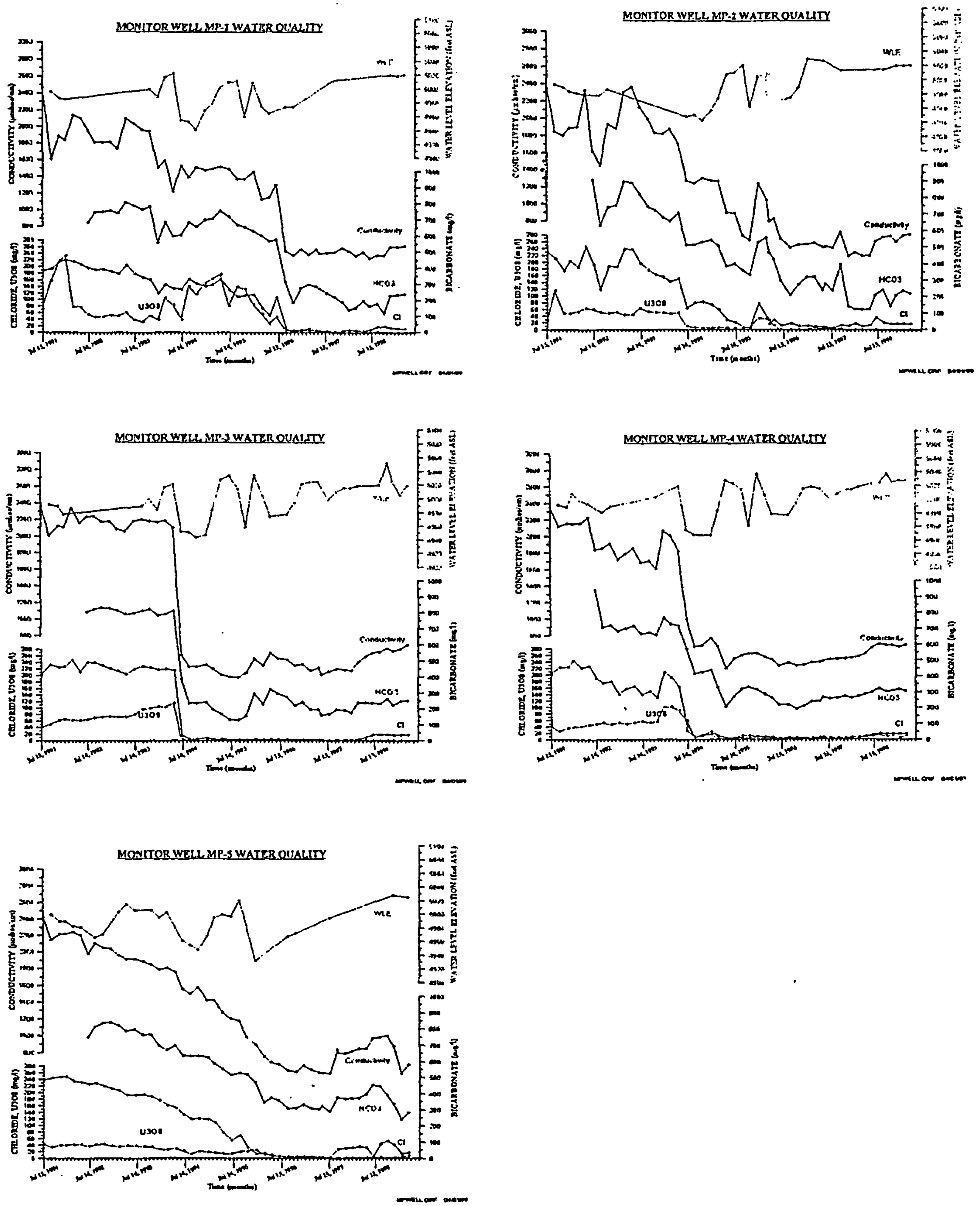


Figure 4, Time-Concentration Plots of Monitor Wells MP-1 to MP-5, April 1999

Appendix 1, Guideline 8 Analyses for Monitor Wells MP-1 Through MP-5, February 1999.

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP1
Laboratory ID:	99-19462
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	71.2
Magnesium	Mg	mg/L	1.0	7.8
Sodium	Na	mg/L	1.0	57.0
Potassium	K	mg/L	1.0	3.3
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	234
Sulfate	SO_4	mg/L	1.0	159
Chloride	Cl	mg/L	1.0	15.0
Ammonium as N	NH_4	mg/L	0.05	0.54
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.13
Silica	SiO_2	mg/L	1.0	9.9
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	366
Conductivity		µmho/cm	1.0	582
Alkalinity	$CaCO_3$	mg/L	1.0	192
pH		std. units	0.10	7.27
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	< 0.001
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.48
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.60
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.258
Radium 226	^{226}Ra	pCi/L	0.2	293
Radium Error Estimate ±				6.1

Quality Assurance Data		Target Range	
Anion	meq		7.59
Cation	meq		6.88
WYDEQ A/C Balance	%	-5 - +5	-4.89
Calc TDS	mg/L		442
TDS A/C Balance	dec. %	0.80 - 1.20	0.83

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Sample ID:	MP2
Laboratory ID:	99-19463
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	64.0
Magnesium	Mg	mg/L	1.0	15.1
Sodium	Na	mg/L	1.0	42.0
Potassium	K	mg/L	1.0	4.1
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	211
Sulfate	SO_4	mg/L	1.0	155
Chloride	Cl	mg/L	1.0	19.0
Ammonium as N	NH_4	mg/L	0.05	0.30
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.15
Silica	SiO_2	mg/L	1.0	13.5

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	392
Conductivity		µmho/cm	1.0	639
Alkalinity	$CaCO_3$	mg/L	1.0	173
pH		std. units	0.10	7.09

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.002
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	2.20
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.30
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.174
Radium 226	^{226}Ra	pCi/L	0.2	934
Radium Error Estimate ±				10.4

Quality Assurance Data		Target Range	
Anion	meq		7.24
Cation	meq		6.56
WYDEQ A/C Balance	%	-5 - +5	-4.95
Calc TDS	mg/L		421
TDS A/C Balance	dec. %	0.80 - 1.20	0.93

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP3
Laboratory ID:	99-19464
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	74.0
Magnesium	Mg	mg/L	1.0	12.3
Sodium	Na	mg/L	1.0	38.0
Potassium	K	mg/L	1.0	4.0
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	237
Sulfate	SO_4	mg/L	1.0	133
Chloride	Cl	mg/L	1.0	19.0
Ammonium as N	NH_4	mg/L	0.05	0.12
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.11
Silica	SiO_2	mg/L	1.0	15.7
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	420
Conductivity		µmho/cm	1.0	659
Alkalinity	$CaCO_3$	mg/L	1.0	194
pH		std. units	0.10	7.31
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.052
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	1.90
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.80
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.006
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.685
Radium 226	^{226}Ra	pCi/L	0.2	784
Radium Error Estimate ±				9.5

Quality Assurance Data		Target Range	
Anion	meq		7.20
Cation	meq		6.65
WYDEQ A/C Balance	%	-5 - +5	-4.00
Calc TDS	mg/L		418
TDS A/C Balance	dec. %	0.80 - 1.20	1.01

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP4
Laboratory ID:	99-19465
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	83.0
Magnesium	Mg	mg/L	1.0	16.2
Sodium	Na	mg/L	1.0	35.1
Potassium	K	mg/L	1.0	5.9
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	314
Sulfate	SO_4	mg/L	1.0	95.0
Chloride	Cl	mg/L	1.0	20.0
Ammonium as N	NH_4	mg/L	0.05	0.16
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.18
Silica	SiO_2	mg/L	1.0	13.0

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	443
Conductivity		µmho/cm	1.0	697
Alkalinity	$CaCO_3$	mg/L	1.0	258
pH		std. units	0.10	7.53

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.092
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.44
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.47
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.343
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	8.20
Radium 226	^{226}Ra	pCi/L	0.2	3220
Radium Error Estimate ±				19.0

Quality Assurance Data		Target Range	
Anion	meq		7.72
Cation	meq		7.25
WYDEQ A/C Balance	%	-5 - +5	-3.14
Calc TDS	mg/L		427
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP5
Laboratory ID:	99-19466
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	75.0
Magnesium	Mg	mg/L	1.0	16.0
Sodium	Na	mg/L	1.0	39.0
Potassium	K	mg/L	1.0	4.5
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	287
Sulfate	SO_4	mg/L	1.0	94.0
Chloride	Cl	mg/L	1.0	17.0
Ammonium as N	NH_4	mg/L	0.05	0.33
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.18
Silica	SiO_2	mg/L	1.0	7.2
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	431
Conductivity		µmho/cm	1.0	656
Alkalinity	$CaCO_3$	mg/L	1.0	236
pH		std. units	0.10	7.33
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.010
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	1.50
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.30
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.008
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	8.35
Radium 226	^{226}Ra	pCi/L	0.2	532
Radium Error Estimate ±				7.8

Quality Assurance Data		Target Range	
Anion	meq		7.17
Cation	meq		7.03
WYDEQ A/C Balance	%	-5 - +5	-1.04
Calc TDS	mg/L		399
TDS A/C Balance	dec. %	0.80 - 1.20	1.08

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Appendix 2. Guideline 8 Analyses for Monitor Wells M-10A and M-11, February 1999.

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	M-10-A
Laboratory ID:	99-15851
Sample Matrix:	Water
Sample Date:	02-15-99
Report Date:	March 8, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	65.6
Magnesium	Mg	mg/L	1.0	14.1
Sodium	Na	mg/L	1.0	59.0
Potassium	K	mg/L	1.0	6.2
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	330
Sulfate	SO_4	mg/L	1.0	80.9
Chloride	Cl	mg/L	1.0	6.0
Ammonium as N	NH_4	mg/L	0.05	0.13
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.21
Silica	SiO_2	mg/L	1.0	17.0

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	363
Conductivity		µmho/cm	1.0	663
Alkalinity	$CaCO_3$	mg/L	1.0	271
pH		std. units	0.10	7.95

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.001
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.05
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.05
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.0740
Radium 226	^{226}Ra	pCi/L	0.2	5.3
Radium Error Estimate ±				0.4

Quality Assurance Data		Target Range	
Anion	meq		7.29
Cation	meq		7.21
WYDEQ A/C Balance	%	-5 - +5	-0.60
Calc TDS	mg/L		415
TDS A/C Balance	dec. %	0.80 - 1.20	0.87

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	M-11
Laboratory ID:	99-15852
Sample Matrix:	Water
Sample Date:	02-15-99
Report Date:	March 8, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	71.5
Magnesium	Mg	mg/L	1.0	15.6
Sodium	Na	mg/L	1.0	58.6
Potassium	K	mg/L	1.0	6.7
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	299
Sulfate	SO_4	mg/L	1.0	110
Chloride	Cl	mg/L	1.0	20.2
Ammonium as N	NH_4	mg/L	0.05	0.12
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.19
Silica	SiO_2	mg/L	1.0	16.8
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	425
Conductivity		µmho/cm	1.0	690
Alkalinity	$CaCO_3$	mg/L	1.0	245
pH		std. units	0.10	7.97
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	< 0.001
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.16
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.06
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.297
Radium 226	^{226}Ra	pCi/L	0.2	452
Radium Error Estimate ±				6.2

Quality Assurance Data		Target Range	
Anion	meq		7.78
Cation	meq		7.63
WYDEQ A/C Balance	%	-5 - +5	-0.98
Calc TDS	mg/L		450
TDS A/C Balance	dec. %	0.80 - 1.20	0.95

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COMPLETE ANALYTICAL SERVICES

Appendix 3. Compiled Guideline 8 Analyses for Monitor Wells MP-1 Through MP-5, 1987 - 1999.

Well	Date	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NH_4	NO_2
MP1	1987/08/24	43.9	9.8	52.9	12.1	0.0	220.0	91.6	4.2	0.13	0.01
MP1	1991/07/15	301.0	61.8	83.8	13.1	0.0	810.0	364.0	188.0	0.08	0.10
MP1	1992/07/08	304.0	69.9	96.9	16.1	0.0	680.0	313.0	196.0	0.18	0.10
MP1	1993/07/07	270.0	53.7	83.2	12.9	0.0	787.0	258.0	171.0	0.05	0.10
MP1	1994/07/20	205.0	38.7	79.4	10.7	0.0	634.0	146.0	143.0	0.16	0.10
MP1	1995/07/05	206.0	41.0	81.0	10.8	0.0	715.0	141.0	130.0	0.05	0.10
MP1	1996/06/25	184.0	38.0	72.7	9.6	0.0	573.0	153.0	107.0	1.32	0.10
MP1	1997/05/27	63.6	12.4	26.4	5.0	0.0	272.0	39.0	2.8	0.11	0.25
MP1	1998/05/07	48.6	6.1	36.0	3.0	0.0	159.0	108.0	4.0	0.46	0.10
MP1	1999/02/23	71.2	7.8	57.0	3.3	0.0	234.0	159.0	15.0	0.54	0.10
MP2	1987/08/20	44.4	8.6	55.6	9.6	0.0	217.0	94.5	4.7	0.14	0.01
MP2	1991/07/18	315.0	60.8	77.9	13.4	0.0	697.0	365.0	228.0	1.97	0.10
MP2	1992/07/09	313.0	71.3	97.6	14.7	0.0	906.0	308.0	193.0	0.21	0.10
MP2	1993/07/06	301.0	70.5	77.1	13.4	0.0	832.0	301.0	196.0	0.19	0.10
MP2	1994/07/20	143.0	28.3	48.1	8.5	0.0	445.0	152.0	45.5	0.08	0.10
MP2	1995/07/05	105.0	24.0	51.0	8.0	0.0	399.0	112.0	22.0	0.05	0.10
MP2	1996/06/25	62.2	18.9	35.7	6.0	0.0	298.0	53.7	12.2	0.13	0.10
MP2	1997/05/27	66.4	13.8	25.2	5.4	0.0	275.0	41.7	5.0	0.10	0.20
MP2	1998/05/07	35.2	7.2	34.4	3.4	0.0	122.0	88.1	13.1	0.29	0.10
MP2	1999/02/23	64.0	15.1	42.0	4.1	0.0	211.0	155.0	19.0	0.30	0.10
MP3	1987/08/25	43.8	9.7	53.1	6.1	0.0	209.0	93.6	4.4	0.15	0.01
MP3	1991/07/15	312.0	53.5	78.0	13.2	0.0	690.0	383.0	204.0	0.18	0.10
MP3	1992/07/08	380.0	84.9	102.0	17.5	0.0	805.0	418.0	241.0	0.22	0.10
MP3	1993/07/07	322.0	64.2	85.2	14.0	0.0	825.0	335.0	218.0	0.13	0.10
MP3	1994/07/20	73.9	13.8	13.1	6.2	0.0	304.0	12.3	5.1	0.05	0.10
MP3	1995/07/05	34.5	4.0	21.0	2.6	0.0	134.0	35.8	2.6	0.05	0.10
MP3	1996/06/25	67.0	12.9	28.8	4.9	0.0	298.0	40.1	5.4	0.08	0.10
MP3	1997/05/27	40.7	6.7	21.9	3.3	0.0	161.0	38.5	2.2	0.10	0.18
MP3	1998/05/07	66.9	12.1	32.8	4.5	0.0	240.0	61.6	10.2	0.06	0.10
MP3	1999/02/23	74.0	12.3	38.0	4.0	0.0	237.0	133.0	19.0	0.12	0.10
MP4	1987/08/24	43.8	9.0	52.5	6.5	0.0	207.0	89.6	4.9	0.13	0.01
MP4	1991/07/15	296.0	57.8	82.6	13.4	0.0	690.0	378.0	204.0	0.13	0.10
MP4	1992/07/09	325.0	72.7	97.9	14.7	0.0	944.0	340.0	190.0	0.19	0.10
MP4	1993/07/07	220.0	43.3	72.6	11.6	0.0	671.0	222.0	138.0	0.05	0.10
MP4	1994/07/20	125.0	24.1	15.9	8.8	0.0	464.0	22.2	10.4	0.05	0.10
MP4	1995/07/05	70.0	11.7	22.0	3.5	0.0	271.0	40.3	5.1	0.05	0.10
MP4	1996/06/25	54.2	11.5	20.8	5.3	0.0	223.0	41.9	4.5	0.08	0.10
MP4	1997/05/27	64.7	11.8	29.3	4.8	0.0	264.0	47.1	5.7	0.10	0.11
MP4	1998/05/07	75.4	15.2	32.4	5.7	0.0	289.0	62.0	10.0	0.10	0.10
MP4	1999/02/23	83.0	16.2	35.1	5.9	0.0	314.0	95.0	20.0	0.16	0.10
MP5	1987/08/19	44.4	10.2	55.6	6.4	0.0	223.0	89.4	5.1	0.11	0.01
MP5	1991/07/18	343.0	63.6	81.5	14.1	0.0	714.0	413.0	239.0	0.94	0.10
MP5	1992/07/09	328.0	76.8	104.0	15.5	0.0	750.0	327.0	226.0	0.47	0.10
MP5	1993/07/07	245.0	52.6	86.2	12.5	0.0	794.0	208.0	185.0	0.30	0.10
MP5	1994/07/21	202.0	41.7	66.2	10.5	0.0	588.0	167.0	120.0	0.26	0.10
MP5	1995/07/05	143.0	32.0	68.0	9.3	0.0	516.0	133.0	55.0	0.05	0.10
MP5	1996/06/25	80.0	19.3	39.2	6.9	0.0	361.0	63.3	6.5	0.15	0.10
MP5	1997/05/27	85.6	11.7	24.9	2.6	0.0	322.0	37.5	2.9	0.11	0.10
MP5	1998/05/07	117.0	21.6	51.6	6.8	0.0	401.0	99.8	34.9	0.11	0.10
MP5	1999/02/23	75.0	16.0	39.0	4.5	0.0	287.0	94.0	17.0	0.33	0.10

Well	Date	NO_3	F	SiO_2	TDS	Cond	Alk	pH	Al	As	Ba
MP1	1987/08/24	0.01	0.16	15.40	312	562	180	8.12	0.1	0.001	0.10
MP1	1991/07/15	0.41	0.29	22.10	1530	2468	664	6.63	0.1	0.001	0.10
MP1	1992/07/08	1.12	0.30	22.29	1526	1956	557	7.75	0.1	0.001	0.10
MP1	1993/07/07	0.40	0.10	17.90	1402	1978	645	6.87	0.1	0.002	0.10
MP1	1994/07/20	0.10	0.17	19.30	1015	1465	520	7.91	0.1	0.026	0.10
MP1	1995/07/05	0.10	0.20	21.50	1085	1482	586	8.02	0.1	0.021	0.10
MP1	1996/06/25	0.22	0.15	14.40	902	1298	470	7.16	0.1	0.048	0.10
MP1	1997/05/27	0.55	0.13	12.60	329	481	223	7.39	0.1	0.017	0.10
MP1	1998/05/07	0.10	0.11	16.50	268	468	130	6.85	0.1	0.001	0.10
MP1	1999/02/23	0.10	0.13	9.90	366	582	192	7.27	0.1	0.001	0.10
MP2	1987/08/20	0.02	0.10	16.50	352	535	178	8.28	0.1	0.002	0.10
MP2	1991/07/18	0.10	0.13	21.10	1443	2346	572	7.20	0.1	0.001	0.10
MP2	1992/07/09	1.06	0.19	10.20	1539	1615	743	7.75	0.1	0.001	0.10
MP2	1993/07/06	0.18	0.14	14.00	1493	2152	682	6.60	0.1	0.010	0.10
MP2	1994/07/20	0.10	0.18	10.10	669	1088	365	7.87	0.1	0.006	0.10
MP2	1995/07/05	0.10	0.21	9.10	545	891	327	7.93	0.1	0.003	0.10
MP2	1996/06/25	0.10	0.10	11.50	381	595	244	6.88	0.1	0.007	0.10
MP2	1997/05/27	0.51	0.12	11.40	331	499	225	7.49	0.1	0.014	0.10
MP2	1998/05/07	0.10	0.12	13.60	227	396	100	6.71	0.1	0.002	0.10
MP2	1999/02/23	0.10	0.15	13.50	392	639	173	7.09	0.1	0.002	0.10
MP3	1987/08/25	0.01	0.17	15.60	316	553	172	7.65	0.1	0.001	0.10
MP3	1991/07/15	0.10	0.23	17.40	1550	2361	566	6.59	0.1	0.001	0.10
MP3	1992/07/08	0.54	0.20	20.65	1682	2240	660	7.05	0.1	0.001	0.10
MP3	1993/07/07	0.27	0.15	16.80	1641	2244	676	6.71	0.1	0.013	0.10
MP3	1994/07/20	0.10	0.13	13.00	304	531	249	7.67	0.1	0.023	0.10
MP3	1995/07/05	0.10	0.10	8.00	177	308	110	7.04	0.1	0.007	0.10
MP3	1996/06/25	0.14	0.12	9.00	348	531	244	6.88	0.1	0.009	0.10
MP3	1997/05/27	0.63	0.10	12.40	233	334	132	7.13	0.1	0.016	0.10
MP3	1998/05/07	0.10	0.14	9.50	321	549	197	7.63	0.1	0.013	0.10
MP3	1999/02/23	0.10	0.11	15.70	420	659	194	7.31	0.1	0.052	0.10
MP4	1987/08/24	0.01	0.17	15.20	316	551	170	7.70	0.1	0.001	0.10
MP4	1991/07/15	0.10	0.22	20.10	1420	2350	566	6.54	0.1	0.002	0.10
MP4	1992/07/09	0.36	0.11	8.61	1467	1839	774	7.66	0.1	0.002	0.10
MP4	1993/07/07	0.31	0.16	15.60	1155	1670	550	6.66	0.1	0.030	0.10
MP4	1994/07/20	0.10	0.16	14.90	460	773	380	7.64	0.1	0.320	0.10
MP4	1995/07/05	0.10	0.11	13.20	309	516	222	7.46	0.1	0.030	0.10
MP4	1996/06/25	0.10	0.17	14.90	288	437	183	6.88	0.1	0.038	0.10
MP4	1997/05/27	2.25	0.16	11.30	336	489	216	7.26	0.1	0.059	0.10
MP4	1998/05/07	0.10	0.20	11.60	360	581	237	7.31	0.1	0.049	0.10
MP4	1999/02/23	0.10	0.18	13.00	443	697	258	7.53	0.1	0.092	0.10
MP5	1987/08/19	0.01	0.11	15.40	342	506	183	8.01	0.1	0.001	0.10
MP5	1991/07/18	0.10	0.13	21.70	1593	2426	586	6.96	0.1	0.001	0.10
MP5	1992/07/09	0.47	0.10	7.99	1605	1978	615	7.70	0.1	0.001	0.10
MP5	1993/07/07	0.28	0.15	13.70	1305	1942	651	6.89	0.1	0.012	0.10
MP5	1994/07/21	0.10	0.17	10.10	989	1527	482	7.67	0.1	0.370	0.10
MP5	1995/07/05	0.10	0.17	8.60	737	1200	423	7.68	0.1	0.007	0.10
MP5	1996/06/25	1.78	0.18	8.70	416	661	296	7.22	0.1	0.014	0.10
MP5	1997/05/27	0.49	0.10	9.30	370	551	264	7.64	0.1	0.006	0.10
MP5	1998/05/07	0.10	0.13	11.90	532	901	329	7.73	0.1	0.003	0.10
MP5	1999/02/23	0.10	0.18	7.20	431	656	236	7.33	0.1	0.010	0.10

Well	Date	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se
MP1	1987/08/24	0.10	0.010	0.05	0.02	0.05	0.05	0.02	0.001	0.1	0.05	0.004
MP1	1991/07/15	0.10	0.100	0.05	0.02	0.05	0.05	0.61	0.001	0.1	0.05	1.320
MP1	1992/07/08	0.10	0.010	0.05	0.02	0.05	0.09	0.66	0.001	0.1	0.05	1.126
MP1	1993/07/07	0.10	0.010	0.05	0.01	0.08	0.05	0.54	0.001	0.1	0.05	0.653
MP1	1994/07/20	0.10	0.010	0.05	0.01	1.09	0.05	0.38	0.001	0.1	0.05	0.632
MP1	1995/07/05	0.10	0.010	0.05	0.01	0.05	0.05	0.54	0.001	0.1	0.05	1.900
MP1	1996/06/25	0.10	0.010	0.05	0.01	5.09	0.05	0.69	0.001	0.1	0.05	0.020
MP1	1997/05/27	0.10	0.010	0.05	0.10	0.06	0.05	0.31	0.001	0.1	0.05	0.360
MP1	1998/05/07	0.10	0.005	0.05	0.10	3.55	0.05	0.44	0.001	0.1	0.05	0.001
MP1	1999/02/23	0.10	0.005	0.05	0.01	0.48	0.05	0.60	0.001	0.1	0.05	0.001
MP2	1987/08/20	0.10	0.010	0.05	0.01	0.05	0.05	0.01	0.001	0.1	0.05	0.001
MP2	1991/07/18	0.14	0.010	0.05	0.01	0.05	0.05	0.07	0.001	0.1	0.09	0.313
MP2	1992/07/09	0.14	0.010	0.05	0.07	0.05	0.05	0.73	0.001	0.1	0.06	1.291
MP2	1993/07/06	0.10	0.010	0.05	0.01	0.11	0.05	0.99	0.001	0.1	0.06	0.612
MP2	1994/07/20	0.10	0.010	0.05	0.01	0.05	0.05	0.41	0.001	0.1	0.05	0.316
MP2	1995/07/05	0.10	0.010	0.05	0.01	0.05	0.05	0.29	0.001	0.1	0.05	0.095
MP2	1996/06/25	0.10	0.010	0.05	0.01	0.53	0.05	0.27	0.001	0.1	0.05	0.112
MP2	1997/05/27	0.10	0.010	0.05	0.01	0.05	0.05	0.24	0.001	0.1	0.05	0.640
MP2	1998/05/07	0.10	0.005	0.05	0.01	2.41	0.05	0.14	0.001	0.1	0.05	0.001
MP2	1999/02/23	0.10	0.005	0.05	0.01	2.20	0.05	0.30	0.001	0.1	0.05	0.001
MP3	1987/08/25	0.10	0.010	0.05	0.01	0.05	0.05	0.03	0.001	0.1	0.05	0.001
MP3	1991/07/15	0.10	0.010	0.05	0.01	0.05	0.05	0.70	0.001	0.1	0.05	0.900
MP3	1992/07/08	0.10	0.010	0.05	0.02	0.05	0.05	1.14	0.001	0.1	0.08	0.867
MP3	1993/07/07	0.10	0.010	0.05	0.02	0.09	0.05	1.12	0.001	0.1	0.09	0.708
MP3	1994/07/20	0.10	0.010	0.05	0.01	0.32	0.05	0.48	0.001	0.1	0.05	0.399
MP3	1995/07/05	0.10	0.010	0.05	0.01	0.06	0.05	0.48	0.001	0.1	0.05	0.107
MP3	1996/06/25	0.10	0.010	0.05	0.01	0.31	0.05	0.57	0.001	0.1	0.05	0.203
MP3	1997/05/27	0.10	0.010	0.05	0.01	0.27	0.05	0.35	0.001	0.1	0.05	0.215
MP3	1998/0507	0.10	0.005	0.05	0.01	0.32	0.05	0.53	0.001	0.1	0.05	0.213
MP3	1999/02/23	0.10	0.005	0.05	0.01	1.90	0.05	0.80	0.001	0.1	0.05	0.006
MP4	1987/08/24	0.10	0.010	0.05	0.01	0.05	0.05	0.02	0.001	0.1	0.05	0.001
MP4	1991/07/15	0.12	0.010	0.05	0.02	0.05	0.05	0.82	0.001	0.1	0.05	0.826
MP4	1992/07/09	0.10	0.010	0.05	0.04	0.81	0.05	1.00	0.001	0.1	0.05	0.475
MP4	1993/07/07	0.10	0.010	0.05	0.02	0.19	0.05	0.80	0.010	0.1	0.07	0.655
MP4	1994/07/20	0.10	0.010	0.05	0.01	0.15	0.05	0.41	0.001	0.1	0.05	0.635
MP4	1995/07/05	0.10	0.010	0.05	0.01	0.43	0.05	0.48	0.001	0.1	0.05	0.255
MP4	1996/06/25	0.10	0.010	0.05	0.01	0.26	0.05	0.30	0.001	0.1	0.05	0.744
MP4	1997/05/27	0.10	0.010	0.05	0.01	0.26	0.05	0.38	0.001	0.1	0.05	0.502
MP4	1998/05/07	0.10	0.005	0.05	0.01	0.25	0.05	0.40	0.001	0.1	0.05	0.504
MP4	1999/02/23	0.10	0.005	0.05	0.01	0.44	0.05	0.47	0.001	0.1	0.05	0.343
MP5	1987/08/19	0.10	0.010	0.05	0.01	0.05	0.05	0.03	0.001	0.1	0.05	0.001
MP5	1991/07/18	0.14	0.010	0.05	0.04	0.05	0.05	1.08	0.001	0.1	0.14	1.590
MP5	1992/07/09	0.12	0.010	0.05	0.03	4.94	0.05	1.17	0.001	0.1	0.09	0.419
MP5	1993/07/07	0.11	0.010	0.05	0.01	0.20	0.05	1.04	0.001	0.1	0.09	0.673
MP5	1994/07/21	0.10	0.010	0.05	0.01	1.00	0.05	0.63	0.001	0.1	0.05	0.304
MP5	1995/07/05	0.10	0.010	0.05	0.01	0.05	0.05	0.50	0.001	0.1	0.05	0.210
MP5	1996/06/25	0.10	0.010	0.05	0.01	0.09	0.05	0.31	0.001	0.1	0.05	0.244
MP5	1997/05/27	0.10	0.010	0.05	0.01	0.36	0.05	0.57	0.001	0.1	0.05	0.069
MP5	1998/05/07	0.10	0.005	0.05	0.01	0.05	0.05	0.54	0.001	0.1	0.05	0.077
MP5	1999/02/23	0.10	0.005	0.05	0.01	1.50	0.05	0.30	0.001	0.1	0.05	0.008

Well	Date	V	Zn	U_3O_8	Ra	Calc TDS
MP1	1987/08/24	0.10	0.01	0.07	407	339.758
MP1	1991/07/15	0.10	0.03	62.50	2648	1505.192
MP1	1992/07/08	0.10	0.01	46.55	2380	1411.457
MP1	1993/07/07	0.10	0.13	31.14	1482	1294.182
MP1	1994/07/20	0.10	0.06	75.78	1874	961.977
MP1	1995/07/05	0.10	0.02	80.60	2392	990.405
MP1	1996/06/25	0.10	0.02	47.22	2172	874.000
MP1	1997/05/27	0.10	0.01	4.16	928	301.000
MP1	1998/05/07	0.10	0.01	0.08	284	306.000
MP1	1999/02/23	0.10	0.01	0.26	293	442.000
MP2	1987/08/20	0.10	0.01	0.07	977	341.959
MP2	1991/07/18	0.24	0.01	24.40	3568	1458.095
MP2	1992/07/09	0.10	0.02	50.63	1304	1518.378
MP2	1993/07/06	0.10	0.02	49.45	3343	1441.646
MP2	1994/07/20	0.10	0.05	6.22	2279	659.714
MP2	1995/07/05	0.10	0.01	4.76	1591	531.965
MP2	1996/06/25	0.10	0.01	1.45	930	351.000
MP2	1997/05/27	0.10	0.01	4.07	721	309.000
MP2	1998/05/07	0.10	0.01	0.21	738	259.000
MP2	1999/02/23	0.10	0.01	0.17	934	421.000
MP3	1987/08/25	0.10	0.02	0.02	67	330.608
MP3	1991/07/15	0.24	0.02	34.82	2258	1443.619
MP3	1992/07/08	0.10	0.01	55.53	2352	1726.706
MP3	1993/07/07	0.10	0.01	56.86	2322	1528.232
MP3	1994/07/20	0.10	0.09	2.23	970	291.095
MP3	1995/07/05	0.10	0.01	0.53	462	177.085
MP3	1996/06/25	0.10	0.01	3.22	980	319.000
MP3	1997/05/27	0.10	0.02	0.66	566	210.000
MP3	1998/05/07	0.10	0.01	2.54	901	319.000
MP3	1999/02/23	0.10	0.01	0.69	784	418.000
MP4	1987/08/24	0.10	0.01	0.04	897	324.750
MP4	1991/07/15	0.29	0.03	40.18	5984	1439.919
MP4	1992/07/09	0.10	0.02	40.83	4217	1566.431
MP4	1993/07/07	0.10	0.04	45.42	4697	1107.572
MP4	1994/07/20	0.10	0.05	11.88	4931	454.377
MP4	1995/07/05	0.10	0.01	5.37	2026	303.085
MP4	1996/06/25	0.10	0.01	4.79	2117	266.000
MP4	1997/05/27	0.10	0.01	5.80	2474	317.000
MP4	1998/05/07	0.10	0.01	9.86	3030	358.000
MP4	1999/02/23	0.10	0.01	8.20	3220	427.000
MP5	1987/08/19	0.10	0.01	0.06	916	337.730
MP5	1991/07/18	0.10	0.12	39.04	1974	1575.661
MP5	1992/07/09	0.10	0.09	31.03	2495	1501.241
MP5	1993/07/07	0.10	0.08	26.21	2543	1230.232
MP5	1994/07/21	0.10	0.03	11.55	1120	914.456
MP5	1995/07/05	0.10	0.01	13.34	1918	708.495
MP5	1996/06/25	0.10	0.01	6.52	1729	413.000
MP5	1997/05/27	0.10	0.01	0.46	597	339.000
MP5	1998/05/07	0.10	0.01	2.32	329	545.000
MP5	1999/02/23	0.10	0.01	8.35	532	399.000

(All values in mg/L, except pH, conductivity in µmhos/cm, and Ra, in PCi/L)

Appendix 4. Glossary of Selected ISL Mining Terms.

Baseline	Ground water quality prior to mining, as determined by Guideline 8 sampling, with duplicates.
BPT	"Best Practicable Technology". For ground water restoration, this technology consists of a combination of ground water sweep, reverse osmosis treatment and injection of chemical reductant. Its application should be for a reasonable period of time, sufficient to minimize any adverse impacts to the environment, but after which only incremental improvements are possible.
Class of Use:	Classification of ground water into several types for various uses (domestic, agricultural, livestock, industrial etc.) based upon the concentration of various dissolved solids and trace elements.
Concentrate:	The rejected brine stream generated by a reverse osmosis unit while producing permeate.
Excursion:	The detection of unauthorized production fluid movement beyond the patterns into the vicinity of a monitor well.
Flare:	The volume of ground water affected by ISL mining which extends, in a lateral sense, beyond the peripheral wells in a wellfield, and, in a vertical sense, beyond the screened zone. A certain amount of flare is unavoidable due to circulating flow lines and diffusion.
Lixiviant:	Fluid injected into a wellfield to leach the uranium mineralization from the rock formation. It consists of native ground water fortified with CO_2 and O_2 dissolved under pressure. As mining progresses, the concentrations of common solutes gradually increase as these ions are dissolved from various rock-forming and accessory minerals. The TDS of lixiviant is typically 2000 mg/L.
Pattern:	A polygonal array of wells, usually consisting of a single pumping well surrounded by a varying number of injection wells. The commonest array is a "five spot", which is square or trapezoidal in shape and contains four injection wells with a central production well. Adjacent patterns share injection wells.
Permeate:	Fluid which is the usable "product" from a reverse osmosis unit. It has been "cleaned" by passing through the semi-permeable membranes. The TDS of permeate is typically 30-50 mg/L.
Pore Volume (PV):	The volume of ground water (in gals) contained within an aquifer which is affected by the ISL mining process. It is a standard volume, expressed in multiples, which is used to describe the total volume of water circulated in a wellfield, either during mining, or restoration. Its calculation is usually based upon the horizontal wellfield pattern area and the average screen height, and may be adjusted to incorporate a component of lateral and vertical flare. A typical pore for a single pattern ranges from 150,000 - 300,000 gals.
Production Fluid:	The fluid produced by pumping wells in a wellfield. Its chemistry is similar to that of lixiviant, except that it contains higher concentrations of dissolved uranium complexes and less dissolved O_2.

Reverse Osmosis:	A process for removing dissolved solids from water by reversing the natural osmotic force between two fluids of different ionic strength separated by a semi-permeable membrane using high fluid pressure. It generates two streams: permeate and concentrate.
UCL:	Upper Control Limit. Threshold concentrations for selected analytes used to determine an excursion of production fluids at a monitor well.

Attachment B

WDEQ Response Dated August 10, 1999 that reviewed the above report

The State of Wyoming

Department of Environmental Quality

Jim Geringer, Governor

Herschler Building • 122 West 25th Street • Cheyenne, Wyoming 82002

ADMIN/OUTREACH	ABANDONED MINES	AIR QUALITY	INDUSTRIAL SITING	LAND QUALITY	SOLID & HAZ. WASTE	WATER QUALITY
307-777-7758	307-777-6145	307-777-7391	307-777-7369	307-777-7756	307-777-7752	307-777-7781
FAX 777-3610	FAX 777-6462	FAX 777-5616	FAX 777-6937	FAX 777-5864	FAX 777-5973	FAX 777-5973

August 10, 1999

Mr. Paul Hildenbrand
Power Resources, Inc.
800 Werner Ct., Suite 352
Casper, Wyoming 82601

RE: TFN 3 4/261, Review of the A-Wellfield Groundwater Restoration Report, Power Resources Inc., Permit No. 603

Dear Mr. Hildenbrand:

Power Resources Inc. (PRI) submitted the above referenced report in a letter dated April 23, 1999. This information has been reviewed by the Land Quality Division (LQD). PRI has requested concurrence from the LQD that the restoration requirement has been met for the A-Wellfield, and that the stability monitoring period can commence.

I apologize for the delay in the review of this material and I appreciate your offer to meet to discuss the results. The report was found to contain an adequate discussion of the technology used to restore the A-Wellfield and the current status of the production wells. The LQD recognizes the effort put forth by PRI to restore the A-Wellfield.

At this time, however, the LQD cannot determine if the restoration requirement has been achieved. The LQD feels that stability began in December 1998 and agrees that stability monitoring should begin. The LQD will determine if restoration has been successful upon review of the stability monitoring data.

The report implies that the water quality of the production zone may not return to baseline or Class of Use for all parameters. In general, the LQD is concerned that, potentially, restoration goals committed to in the permit may not be met, that waters of the State may be degraded, that degraded water from the production zone may migrate into areas of higher quality water, and that water rights in the area of concern may be affected.

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POWER RESOURCES, INC.

For these reasons, additional information in regard to the migration of the 20-Sand groundwater and the status of monitoring wells has been requested. Please refer to the enclosed review for more detail.

If you have any questions, please contact Paula Cutillo or me at (307) 777-7756.

Sincerely,

Georgia A. Cash
District I Supervisor
Land Quality Division

GAC/pc

Enclosure

cc: Mark Moxley, LQD (w/enclosure)

MEMORANDUM

TO: Georgia A. Cash, District I Supervisor

FROM: Paula Cutillo, District I Groundwater Hydrologist PC GAC

DATE: August 3, 1999

SUBJECT: TFN 3 4/261, A-Wellfield Restoration, Power Resources Inc., Permit No. 603

INTRODUCTION

Power Resources Inc. (PRI) submitted the A-Wellfield Groundwater Restoration Report in a letter dated April 23, 1999. The report requests concurrence from the Land Quality Division (LQD) that restoration goals have been met, using Best Practicable Technology, and that stability monitoring can now begin.

BACKGROUND

The production zone in the A-Wellfield is referred to as the 20-Sand. The A-Wellfield was originally referred to as the Section 21 Mine Area in Permit No. 603. The 20-Sand averages 530ft in depth. According to Appendix D-6 of the permit, the average transmissivity was determined to be 120 gpd/ft.

The A-Wellfield was in production from 1988 to 1991. Restoration began in 1991. Many unanticipated conditions complicated and ultimately lengthened the restoration of the A-Wellfield. PRI ceased active restoration of the A-Wellfield in December 1998.

REVIEW

The report submitted by PRI provides a complete description of the technology used to restore the A-Wellfield and of restoration activity. PRI has provided the bleed stream volume and the volume of water pumped, injected and recirculated, during each phase of restoration, on a monthly basis. Also discussed are the unexpected problems which complicated groundwater restoration and the knowledge gained from their investigation.

The following review states LQD's existing concerns and outlines areas where additional information and/or discussion is required.

Radon

PRI has stated that due to large concentrations of radon in the 20-Sand, it is not practically useable for any domestic purposes. For this reason, and in addition to high background levels of radium, PRI believes that the 20-Sand met only Class V standards prior to mining.

PRI's position is noted, however, it is the LQD's understanding that neither the U.S. Environmental Protection Agency nor the Water Quality Division (WQD) has developed maximum contaminant levels for radon. In addition, radon is not considered in the WQD's aquifer classifications nor is it included on LQD's Guideline No. 8 parameter list. Therefore, radon was also not analyzed to determine baseline water quality. The LQD does not have the authority to consider radon in determining the quality of use for which the 20-Sand groundwater was suitable prior to in situ mining or after groundwater restoration.

As stated in Wyoming Department of Environmental Quality letter to Marion Loomis, Executive Director of the Wyoming Mining Association, dated June 27, 1997, for the WQD to establish a Class I limit and

State Engineer Office's records indicate that there are at least 6 stock wells completed below 500ft in Sections 16, 17, 20 and 21, Township 36N, Range 76W.

Therefore, there is concern over the potential for the restoration goal committed to in the approved permit to not be met, for waters of the State to be degraded, for degraded water to migrate into areas of higher quality water; and for water rights in the area of concern to be affected.

Monitoring Wells

During production and restoration, several monitor ring wells went on excursion. PRI has discussed the impact of the excursions at Wells M-10A and M-11 on restoration and has provided February 1999 water quality analyses of these wells.

The effect of the excursion at Well M-8A in 1995 on restoration, if any, was not discussed. The stability or water quality of the monitor ring, overlying, or underlying wells is also not discussed.
Quarterly excursion monitoring data has been reviewed and it was found that all monitoring wells (excluding production wells) remain below the Upper Control Limits (UCLs), except for Wells M-10A and M-11. However, Wells M-12, M-13 and MU-2 either exceed or have recently exceeded the UCL for chloride.

The restoration goal for monitoring wells will be evaluated on a well-by-well basis. However, other than UCLs and water level data, the status of the monitoring wells is not known. Therefore, the LQD cannot determine if mining has impacted these wells.

COMMENTS

Stability

1. PRI has requested to sample production wells for all Guideline No. 8 parameters every two months during stability. This request is acceptable.

2. PRI has requested that the water quality data collected in February 1999 be considered the first round of the required samples for the stability period. This request is acceptable.

3. Please provide a list of all wells, and their monitoring schedule, that will be sampled to determine stability and restoration success.

4. Please provide an end of stability potentiometric surface map and at least six months of water level data, when obtained, to determine if the groundwater flow pattern is stable.

5. Please provide at least six months of water quality data, when obtained, to determine if the aquifer geochemistry is stable.

Attachment C

Report entitled "A-Wellfield Ground Water Stability Report" submitted to the WDEQ in correspondence dated March 31, 2000

POWER RESOURCES

Highland Uranium Project
P. O. Box 1210
Glenrock, Wyoming USA 82637
Casper: 307-235-1628
Douglas: 307-358-6541
Fax: 307-358-4533

March 31, 2000

Ms. Georgia Cash, District I Supervisor
Land Quality Division
Wyoming Department of Environmental Quality
Herschler Building
122 W. 25th Street
Cheyenne, WY 82002

RE: Permit to Mine No. 603-A2
A-Wellfield Ground Water Stability Monitoring Data and Responses to LQD Comments

Dear Ms. Cash:

In correspondence dated April 23, 1999 Power Resources, Inc. (PRI) submitted the A-Wellfield Ground Water Restoration Report and a request to commence ground water stability monitoring at the monitoring wells. In that report, PRI demonstrated that the ground water restoration activities had been effective in restoring almost all of the ground water quality parameters to baseline conditions and that the overall ground water quality had been returned to a quality of use equal to, and consistent with uses for which the water was suitable prior to the commencement of in situ leach (ISL) mining.

The Land Quality Division (LQD) correspondence dated August 10, 1999 concurred with PRI's request to begin stability monitoring. The correspondence also conveyed that LQD would determine if ground water restoration had been successful after review of the stability monitoring data. The August 10, 1999 correspondence also included Ms. Paula Cutillo's August 3, 1999 Memorandum which details her review and comments on the A-Wellfield Ground Water Restoration Report.

In accordance with permit commitments and guidance from LQD, PRI has completed the stability monitoring phase of the ground water restoration program. Therefore, please find the A-Wellfield Ground Water Quality Stabilization Report included for LQD review. The report includes the stability data for the ground water quality and water levels of the production zone (20-Sand), and the overlying and underlying zones. Also included, please find Attachment A which addresses the nine comments included in Ms. Cutillo's August 3, 1999 Memorandum. Where appropriate, Attachment A references those sections of the report which pertain to a particular comment.

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In summary, the report shows that the ground water quality conditions and water levels of the production zone and overlying and underlying zones are sufficiently stable that no significant adverse changes in the future are expected. Information contained in this, and the previous report, show in accordance with mine permit requirements and applicable regulations, that the overall ground water quality of the production zone has been returned very close to baseline conditions and to a quality of use equal to, and consistent with uses for which the water was suitable prior to ISL mining. Additionally, this information shows that the restored ground water quality, in combination with existing natural geochemical attenuation processes within the production zone, will preserve potential uses of ground water outside the wellfield area, thereby addressing LQD concerns with existing ground water rights and the Highland Reservoir.

PRI hopes that upon review of the information, LQD can determine that ground water restoration has been successful, the wells can be plugged and abandoned, and the decommissioning of surface facilities, such as headerhouses and pipelines, can commence. Please call if you have any questions or desire to meet with PRI staff on the report.

Sincerely,

Bill Kearney

W.F. Kearney
Environmental Superintendent/RSO

WFK/ksj

cc:	F.T. Newton w/o atta	S.P. Collings w/atta	S.D. Magnuson w/o atta
	R. Knode w/o atta	P.R. Hildenbrand w/atta	L.A. Huffman w/atta
	File 4.3.3.1 w/atta	File HL-7 w/atta	

A-Wellfield Ground Water Quality Stabilization Report

Highland Uranium Project

March 31, 2000

Permit to Mine No. 603-A2

Submitted To: State of Wyoming Department of Environmental Quality
Land Quality Division
Herschler Building
122 W. 25th Street
Cheyenne, WY 82002

Prepared By: Power Resources, Inc.
P.O. Box 1210
Glenrock, WY 82637

Table of Contents

Tables

Figures

1. Executive Summary

In correspondence dated April 23, 1999, Power Resources Inc. (PRI) submitted the A-Wellfield Ground Water Restoration Report. The report detailed the restoration methodology used to restore the A-Wellfield and requested concurrence from the Land Quality Division (LQD) that restoration was complete and that stability monitoring could begin. In correspondence dated August 10, 1999, the LQD concurred that the April 23, 1999 report contained an adequate discussion of the technology used to restore the ground water and that ground water quality was restored in the A-Wellfield to a sufficient quality to allow stability monitoring. The LQD correspondence also included Ms. Paula Cutillo's August 3, 1999 memorandum which contains nine comments relevant to PRIs April 23 1999 report or the stability monitoring activities.

Therefore, this report includes the stability data for the ground water quality and water levels of the A-Wellfield production zone (20-Sand), and the overlying and underlying zones. Also, recommendations contained in Ms. Cutillo's comments are addressed in the report. In summary, this report shows that the ground water quality conditions and water levels of the production zone and overlying and underlying zones are sufficiently stable that no significant adverse changes in the future are expected. Information contained in this, and the previous report, show in accordance with mine permit requirements and applicable regulations, that the overall ground water quality of the production zone has been returned very close to baseline conditions and to a quality of use equal to, and consistent with uses for which the water was suitable prior to ISL mining.

Additionally, information presented in the report shows that potential uses of ground water outside the wellfield area will not be adversely affected due to the quality of the restored ground water, natural geochemical attenuation processes which will occur within the production zone, and the relatively long travel time (at least 50-150 years) for restored ground water to potentially reach limits of the wellfield area (monitor well ring). Given these conditions, and the fact that the A-Wellfield area is contained within a uranium mining district where past uranium surface and underground mining has occurred directly adjacent to the area, PRI believes that restoration of ground water at the A-Wellfield meets mine permit requirements and applicable regulations.

2. Ground Water Quality Data during Stability

2.1 Stabilization Period

The LQD conveyed in the August 10, 1999 correspondence that the beginning date for stabilization was December 1998. Also, LQD agreed the water quality data collected in February 1999 and submitted with the A-Wellfield Ground Water Restoration Report should be considered the first round of samples for the stability period. The final set of water quality data used to determine the success of restoration was collected on October 20, 1999. This sampling event effectively defines the end of the Stabilization Phase of Restoration. However, water level data and water quality data were collected from the monitor wells beyond this date. Therefore, the data presented in Appendix 5.2 includes all of 1999.

2.2 Water Level and Ground Water Quality Data

2.2.1 Potentiometric Surface Map

On January 27, 2000, water levels were measured in all of the monitor ring wells and in the five mineralized production zone monitor wells (MP-Wells). From this data, a potentiometric surface contour map of the A-Wellfield (Figure 1) was produced. It is considered to be representative of the potentiometric surface during the stability period since all pumping activity in the A-Wellfield was stopped in December of 1998. As discussed in the 1999 Annual Report, the stability of the A-Wellfield is affected to a limited degree by the pumping activity in the B-Wellfield through areas of pressure communication. This is evident from the slight cone of depression centered near Wells M-10A and M-11. On the south end of the A-Wellfield, the water level gradient is showing the influence caused by the Highland Reservoir (Exxon Pit).

Another method for determining the stability of water levels in the A-Wellfield is to assess the data of individual wells. If the water level of each well has not changed significantly during the stability period, then this indicates stability. The water level data collected during the stabilization period of the five MP-Wells and of the fourteen perimeter monitor ring wells has been graphed in Figures 2-9. This data indicates that water levels and the ground water flow pattern are stable.

2.2.2 A-Wellfield Ground Water Quality

Included in Table 1 is the Guideline No. 8 water quality data obtained from Wells MP-1 through MP-5 sampled during the stabilization period. Figures 2-6 contain graphs of the data collected from the bi-monthly sampling events from 1999. The chloride, bicarbonate, conductivity, and uranium data from the Guideline No. 8 samples are also included in these graphs. The Guideline No. 8 data covers an eight-month period, with the final two samples taken two months apart. Also listed in Table 2, is the average of each parameter from the five MP-Wells for each sampling event. Figure 10 is a chart which shows the trend of the data. The percent restoration values are calculated using both baseline and the Wyoming Department of Environmental Quality Class I Domestic Use Suitability Standard where applicable. If a parameter was determined to have been returned to its baseline value, then the baseline value was used to calculate the percent restoration value (e.g. sodium). If a parameter was returned to its Class I Domestic Use Suitability Standard value, then that value was used to determine the percent restoration value (e.g. chloride). The percent restoration values for iron, manganese and selenium were calculated based on the applicable Class I Domestic Use Suitability Standards. The radium-226 percent restoration value was calculated based on its baseline value. A review of this chart shows, with the exception of iron, that all other constituents remained constant through the sampling period. This indicates the ground water quality is stable. As discussed in the response to LQD Comment 7 in Attachment A, this indicates that the aquifer geochemistry has also stabilized.

Table 1 A-Wellfield, Water Quality at Wells MP-1 Through MP-5

(All values in mg/l, except pH, conductivity in µmbos/cm, and Ra-226, in pCi/L)

WELL ID	DATE	CA	MG	NA	K	CO3	HCO3	SO4	CL	NH4	NO2
MP1	1999-02-23	71.2	7.8	57.0	3.3	0.0	234.0	159.0	15.0	0.54	0.1
MP1	1999-08-18	82.3	9.8	59.1	4.2	1.0	251.0	156.0	12.7	0.79	0.1
MP1	1999-10-20	74.0	9.0	58.0	4.0	1.0	251.0	160.0	6.0	0.53	0.1
MP2	1999-02-23	64.0	15.1	42.0	4.1	0.0	211.0	155.0	19.0	0.3	0.1
MP2	1999-08-18	73.2	18.4	45.7	5.0	1.0	211.0	154.0	18.6	0.43	0.1
MP2	1999-10-20	73.0	18.0	43.0	4.9	1.0	239.0	182.0	11.0	0.35	0.1
MP3	1999-02-23	74.0	12.3	38.0	4.0	0.0	237.0	133.0	19.0	0.12	0.1
MP3	1999-08-18	59.9	11.0	30.2	4.6	1.0	176.0	88.4	12.8	0.15	0.1
MP3	1999-10-20	77.0	14.0	38.0	4.9	1.0	237.0	122.0	11.0	0.16	0.1
MP4	1999-02-23	83.0	16.2	35.1	5.9	0.0	314.0	95.0	20.0	0.16	0.1
MP4	1999-08-18	95.7	20.3	38.9	7.0	1.0	310.0	117.0	20.8	0.15	0.1
MP4	1999-10-20	86.0	19.0	36.0	7.0	1.0	311.0	98.0	13.0	0.11	0.1
MP5	1999-02-23	75.0	16.0	39.0	4.5	0.0	287.0	94.0	17.0	0.33	0.1
MP5	1999-08-18	81.1	18.4	42.1	5.4	1.0	280.0	110.0	19.1	0.41	0.1
MP5	1999-10-20	78.0	18.0	42.0	5.4	1.0	284.0	109.0	10.0	0.35	0.1

WELL ID	DATE	NO3	F	SI02	TDS	COND	ALK	PH	AL	AS	BA
MP1	1999-02-23	0.1	0.13	9.9	366.0	582.0	192.0	7.27	0.1	0.001	0.1
MP1	1999-08-18	0.1	0.17	10.4	384.0	615.0	206.0	7.22	0.1	0.001	0.1
MP1	1999-10-20	0.1	0.15	9.0	356.0	614.0	206.0	7.18	0.1	0.001	0.1
MP2	1999-02-23	0.1	0.15	13.5	392.0	639.0	173.0	7.09	0.1	0.002	0.1
MP2	1999-08-18	0.1	0.18	14.3	438.0	685.0	173.0	6.84	0.1	0.003	0.1
MP2	1999-10-20	0.1	0.17	13.3	455.0	686.0	197.0	7.24	0.1	0.001	0.1
MP3	1999-02-23	0.1	0.11	15.7	420.0	659.0	194.0	7.31	0.1	0.052	0.1
MP3	1999-08-18	0.1	0.14	15.1	309.0	510.0	144.0	6.71	0.1	0.032	0.1
MP3	1999-10-20	0.1	0.12	14.0	413.0	691.0	194.0	7.18	0.1	0.001	0.1
MP4	1999-02-23	0.1	0.18	13.0	443.0	697.0	258.0	7.53	0.1	0.092	0.1
MP4	1999-08-18	0.1	0.22	13.3	488.0	755.0	254.0	7.01	0.1	0.061	0.1
MP4	1999-10-20	0.1	0.2	12.0	441.0	729.0	255.0	7.47	0.1	0.061	0.1
MP5	1999-02-23	0.1	0.18	7.2	431.0	656.0	236.0	7.33	0.1	0.01	0.1
MP5	1999-08-18	0.1	0.2	7.85	447.0	705.0	230.0	6.72	0.1	0.012	0.1
MP5	1999-10-20	0.1	0.18	7.3	425.0	711.0	233.0	7.31	0.1	0.009	0.1

Table 1. A-Wellfield. Water Quality at Wells MP-1 Through MP-5 (cont.)
(All values in mg/l, except pH, conductivity in µmhos/cm, and Ra-226, in pCi/L)

WELL ID	DATE	B	CD	CR	CU	FE	PB	MN	HG	MO	NI	SE
MP1	1999-02-23	0.1	0.005	0.05	0.01	0.48	0.05	0.6	0.001	0.1	0.05	0.001
MP1	1999-08-18	0.1	0.005	0.05	0.01	0.54	0.05	0.62	0.001	0.1	0.05	0.012
MP1	1999-10-20	0.1	0.005	0.05	0.01	0.34	0.05	0.68	0.001	0.1	0.05	0.001
MP2	1999-02-23	0.1	0.005	0.05	0.01	2.2	0.05	0.3	0.001	0.1	0.05	0.001
MP2	1999-08-18	0.1	0.005	0.05	0.01	1.68	0.05	0.25	0.001	0.1	0.05	0.001
MP2	1999-10-20	0.1	0.005	0.05	0.01	2.43	0.05	0.26	0.001	0.1	0.05	0.001
MP3	1999-02-23	0.1	0.005	0.05	0.01	1.9	0.05	0.8	0.001	0.1	0.05	0.006
MP3	1999-08-18	0.1	0.005	0.05	0.01	2.88	0.05	0.66	0.001	0.1	0.05	0.008
MP3	1999-10-20	0.1	0.005	0.05	0.01	2.83	0.05	0.94	0.001	0.1	0.05	0.007
MP4	1999-02-23	0.1	0.005	0.05	0.01	0.44	0.05	0.47	0.001	0.1	0.05	0.343
MP4	1999-08-18	0.1	0.005	0.05	0.01	0.46	0.05	0.52	0.001	0.1	0.05	0.348
MP4	1999-10-20	0.1	0.005	0.05	0.01	0.37	0.05	0.54	0.001	0.1	0.05	0.32
MP5	1999-02-23	0.1	0.005	0.05	0.01	1.5	0.05	0.3	0.001	0.1	0.05	0.008
MP5	1999-08-18	0.1	0.005	0.05	0.01	2.12	0.05	0.34	0.001	0.1	0.05	0.006
MP5	1999-10-20	0.1	0.005	0.05	0.01	2.45	0.05	0.35	0.001	0.1	0.05	0.003

WELL ID	DATE	V	ZN	U	RA-226
MP1	1999-02-23	0.1	0.01	0.26	293.0
MP1	1999-08-18	0.1	0.01	0.19	300.0
MP1	1999-10-20	0.1	0.01	0.29	359.0
MP2	1999-02-23	0.1	0.01	0.17	934.0
MP2	1999-08-18	0.1	0.01	0.17	996.0
MP2	1999-10-20	0.1	0.01	0.12	990.0
MP3	1999-02-23	0.1	0.01	0.69	784.0
MP3	1999-08-18	0.1	0.01	0.46	665.0
MP3	1999-10-20	0.1	0.01	0.65	749.0
MP4	1999-02-23	0.1	0.01	8.2	3220.0
MP4	1999-08-18	0.1	0.01	8.75	3687.0
MP4	1999-10-20	0.1	0.01	9.9	3360.0
MP5	1999-02-23	0.1	0.01	8.35	532.0
MP5	1999-08-18	0.1	0.01	9.17	585.0
MP5	1999-10-20	0.1	0.01	9.3	382.0

Table 2 A-Wellfield, Average Water Quality at Wells MP-1 Through MP-5

(All values in mg/l, except pH, conductivity in μmhos/cm, and Ra-226, in pCi/L)

DATE	CA	MG	NA	K	CO3	HCO3
02/23/1999	73.4	13.5	42.2	4.4	0	257
08/18/1999	78.4	15.6	43.2	5.2	1	246
10/20/1999	77.6	15.6	43.4	5.2	1	264
DATE	SO4	CL	NH4	NO2	NO3	F
02/23/1999	127.2	18.0	0.29	0.1	0.1	0.15
08/18/1999	125.1	16.8	0.39	0.1	0.1	0.18
10/20/1999	134.2	10.2	0.30	0.1	0.1	0.16
DATE	SI02	TDS	COND	ALK	pH	AL
02/23/1999	11.9	410	647	211	7.3	0.10
08/18/1999	12.2	413	654	201	6.9	0.10
10/20/1999	11.1	418	686	217	7.3	0.10
DATE	AS	BA	B	CD	CR	CU
02/23/1999	0.031	0.10	0.1	0.005	0.05	0.01
08/18/1999	0.022	0.10	0.1	0.005	0.05	0.01
10/20/1999	0.015	0.10	0.1	0.005	0.05	0.01
DATE	FE	PB	MN	HG	MO	NI
02/23/1999	1.30	0.05	0.49	0.001	0.1	0.05
08/18/1999	1.54	0.05	0.48	0.001	0.1	0.05
10/20/1999	1.68	0.05	0.55	0.001	0.1	0.05
DATE	SE	V	ZN	U	RA-226	
02/23/1999	0.072	0.1	0.01	3.5	1153	
08/18/1999	0.075	0.1	0.01	3.7	1247	
10/20/1999	0.066	0.1	0.01	4.1	1168	

2.2.3 Ra-226, Se, Fe, and Mn

In the August 10, 1999 correspondence, LQD expressed concern over the elevated levels of radium-226, selenium, iron and manganese that remain in the 20-Sand ground water in the A-Wellfield area. Specifically, the LQD is concerned that the water will migrate from the A-Wellfield into areas of higher quality water with the result that these waters will become degraded. Therefore, LQD is requesting that the 20-Sand ground water quality be estimated as it moves to the monitor well ring, to the 30-Sand, and potentially to the Highland Reservoir. Also, LQD is requesting an estimate of the volume of water which is expected to reach the reservoir from the A-Wellfield 20-Sand.

Before it can be determined what impact the A-Wellfield ground water will have on down gradient waters, the flow path of this water must be determined. In the A-Wellfield Restoration Report, PRI stated that the likely flow path will be in a southwesterly direction towards the Highland Reservoir through interconnections with the 30-Sand, since the reservoir will act as a local sink. This is a valid statement until the water level in the reservoir exceeds the hydrostatic head pressures in the 20 and 30-Sands. Once this occurs, the reservoir would potentially recharge these sands under constant pressure. Also, the probable reason the A-Wellfield ground water will flow up into the B-Wellfield 30-Sand is due to the restoration currently taking place in the B-Wellfield. The bleed, which is being taken from the B-Wellfield, is lessening its hydrostatic head which allows the A-Wellfield ground water to flow into the B-Wellfield. Once restoration has ceased in the B-Wellfield, the A-Wellfield ground water will no longer flow into the B-Wellfield since the hydrostatic head in the 30-Sand will be higher than the 20-Sand. Once this occurs, the 20-Sand ground water in the A-Wellfield will return to its approximate pre ISL mining flow direction.

The length of time for these changes in hydrostatic head pressures to occur is on the order of years (five to ten years). This is supported by the fact that the water level in the Highland Reservoir is already greater than the hydrostatic head in the 20-Sand within the A-Wellfield. Even so, some of the A-Wellfield ground water may still migrate along the path described in the A-Wellfield Restoration Report. Even if this is the case, the length of time for the affected A-Wellfield ground water to reach the reservoir would be on the order of hundreds of years. The hydrostatic head in the reservoir will be greater than the hydrostatic head of both the A and B wellfields long before the A-Wellfield ground water could approach the reservoir. Therefore, none of the A-Wellfield ground water will ever reach the reservoir.

In the A-Wellfield Restoration Report, PRI stated that radium-226, selenium, iron and manganese will be attenuated through the various processes of adsorption, precipitation and dispersion. By applying these natural geochemical processes to the ground water in the A-Wellfield, an estimated water chemistry can be developed as the water moves towards the monitor well ring and the 30-Sand. These geochemical processes and the constituents they are most likely to affect are discussed below.

Dispersion

Dispersion is the process of mixing, which occurs as a fluid flows through a porous medium. Due to the different flow paths and flow velocities established by the pore diameters and the pore configurations in the host rock, constituents in a fluid will be diluted with the natural ground water. For a case such as the A-Wellfield ground water, dispersion will be the process which will be most important to reducing the concentrations of macro anions such as bicarbonate, sulfate and chloride. Since these constituents have been returned to Class I Domestic Use Suitability Standards through active restoration techniques, the concentrations of these anions do not pose a threat to water down gradient of the restored area. However, dispersion is not limited to reducing just these anions, but will affect all constituents equally.

Adsorption

Adsorption is the process where ions are removed from solution through the attraction of the solid material through which the ground water is in contact. Adsorption is important to the removal of redox-sensitive elements such as vanadium, chromium, arsenic, selenium, molybdenum and uranium. In the case of the A-Wellfield ground water, only selenium is of concern since the other elements have been returned to baseline or the Class I Domestic Use Suitability Standard. As the A-Wellfield ground water moves toward the monitor well ring, the selenium concentration will be lowered by adsorption and also by dispersion. Currently, the concentration of selenium in the A-Wellfield averages 0.066 mg/l. The Class I Domestic Use Suitability Standard for Wyoming is 0.01 mg/l. However, the Environmental Protection Agency's (EPA) drinking water Maximum Contaminant Level (MCL) for selenium is 0.05 mg/l.

Using data gathered from the original pump test, the travel time for the A-Wellfield ground water to reach the monitor ring wells has been calculated to be at least 50 to 150 years. It can be reasonably assumed that the amount of attenuation that will take place over a distance of approximately 300 feet and over a time span of between 50 to 150 years will be such that the selenium concentration will be reduced to at least the primary drinking water standard as set by the EPA and most likely to baseline conditions.

The average radium-226 concentration of the last sample set taken during stabilization was approximately 1.7 times the baseline concentration. Although baseline was not achieved, this radium-226 concentration does not pose any greater threat to the down gradient ground water than did the original baseline concentration of 675 pCi/l. The basis for this assertion is found in the pre-mining baseline data. The concentrations of radium-226 in the MP-Wells ranged from a low average value in Well MP-1 of 466 pCi/l to a high average value of 1012 pCi/l in Well MP-5. The concentrations of radium-226 in the down gradient monitor ring wells (M-4 to M-7) ranged from a low average value of 3.7 pCi/l in Well M-7 to a high average value of 9.3 pCi/l in Well M-4. The relative lack of radium-

226 at wells down gradient of the ore bearing areas illustrates that natural attenuation of radium-226 does occur, otherwise the down gradient baseline values would have been much higher. The most probable attenuation mechanism is adsorption, since radium-226 is strongly adsorbed onto clays. Also, this data suggests the amount of attenuation was by at least two orders of magnitude. Therefore, by the time the A-Wellfield ground water reaches the monitor ring wells, the radium-226 concentration will be similar to the monitor well ring baseline concentrations.

It should be noted that the uranium concentrations will also be naturally reduced through adsorption. Currently, the average uranium concentration is below the Class I Domestic Use Suitability Standard of 5 mg/l. As the A-Wellfield ground water moves through the reducing conditions down gradient of the original uranium roll fronts, the uranium concentrations will be lowered significantly, thereby further protecting the potential use of the down gradient water. It is likely that uranium concentrations at the monitor ring wells will approach baseline levels.

Precipitation

The direction of flow of the A-Wellfield ground water will play an important role in enhancing the precipitation of certain minerals. As stated above, the final direction of flow for the A-Wellfield ground water will be to return to its original direction of flow before mining. This direction of flow was towards the reduced side of the original uranium role fronts. This is significant since certain minerals can be precipitated by the reduction of sulfate to sulfide.

The concentrations of manganese and iron will be reduced through precipitation of sulfide minerals and also by dispersion. By the time the A-Wellfield ground water reaches the monitor ring wells, the concentrations of iron and manganese will be reduced significantly by these geochemical processes.

2.3 Monitoring Wells

2.3.1 Monitor Ring

During the restoration of the A-Wellfield, three of the perimeter monitor ring wells went on excursion. The impact on restoration of the excursions at Wells M-10A and M-11 was discussed in the A-Wellfield Ground Water Restoration Report submitted to the LQD on April 23, 1999. The impact on restoration of the excursion at Well M-8A is discussed below. Except for these three wells, no other excursions occurred in the perimeter monitor ring wells.

Since there were no excursions among the other monitoring wells, Guideline No. 8 analyses are not needed to determine if these wells are stable. A review of the routine monitoring data for chloride, bicarbonate and conductivity and the water level data for these wells (Appendix 5.2) shows they are stable. Graphs of the water quality data and water level data collected during the stabilization period are presented in Figures 7 - 9. As can be seen in the graph of Well M10A, bicarbonate and conductivity have increased slightly during the year. However, towards the end of the year these constituents have stabilized. Also, it is not necessary to determine if these wells have returned to baseline since there is no evidence that the water quality in these wells has been altered from baseline. The basis for this statement comes from a review of the monitor well water quality data. Chloride, bicarbonate and conductivity were grouped as excursion parameters because they are process specific. Together, they represent the best indicators of the presence of mining solution. Since there were no other excursions, these areas do not need to be restored. Also, it should be noted, the approved mine permit does not require Guideline No. 8 analyses be conducted for monitor ring wells which have never been on excursion.

There are two perimeter monitor ring wells that have exceeded their Upper Control Limits (UCLs) for chloride. They are Wells M-12 and M-13. These wells were never on excursion because they have never exceeded their UCLs for bicarbonate or conductivity. A small increase in chloride does not by itself mean that it was related to mining solution, since there are several causes for relatively minor increases in chloride levels in wells. Well M-13, for example, appears to have been related to cement contamination that is characterized by low bicarbonate and high chloride levels. Although the specific reason for the increased chloride levels in these wells is not readily apparent, and since the bicarbonate and conductivity UCLs were not exceeded, it is unlikely that it was caused by mining solutions. The chloride concentration in Well M-13 dropped to it's UCL on June 6, 1998 and has remained below this value to present. Well M-12 continues to equal or exceed its chloride UCL. Since the chloride UCL was exceeded in Well M-12, the maximum chloride concentration has been 27 mg/l. The existing water quality of this well does not threaten other water resources as the chloride concentration is well below the Class I Domestic Use Suitability Standard of 250 mg/l.

There are two overlying and two underlying monitor wells for the A-Wellfield. The overlying wells are labeled MO-1 and MO-2 and the underlying monitor wells are labeled MU-1 and MU-2. Throughout the mining and restoration of the A-Wellfield, none of these wells went on excursion. A review of the routine monitoring data and the water level data for these wells shows they are stable. Graphs of the water quality data and the water level data collected during the stabilization period are presented in Figure 11.

Although Well MU-2 exceeded it's UCL for chloride on April 22,1998 and continues to equal or exceed it at the present time, Well MU-2 has never exceeded it's UCLs for bicarbonate or conductivity. The cause of the higher chloride values is not known. However, since the other parameters remained constant, this indicates that the elevated chloride was not due to the migration of lixiviant into this lower zone. Since the chloride UCL was exceeded, the chloride concentrations in Well MU-2 have ranged from 10 to 15 mg/l. Therefore, the existing water quality of this well does not threaten other water resources as the chloride concentration is well below the Class I Domestic Use Suitability Standard of 250 mg/l.

2.3.2 Impact of Well M-8A on Restoration

Monitor Well M-8A was placed on excursion status on December 18, 1995. To control this excursion, a bleed ranging from 6 to 12 gpm was taken at first from the nearest pattern wells, P-29 (MP-5) and I-49, and later from Well I-48, located at the southern end of the A-Wellfield. This course of action lasted from January of 1996 through March of 1997. The well responded to this mitigative action and was removed from excursion status in March 1996 when the conductivity was lowered below the UCL. The bleed was continued to reduce the chloride concentration.

This excursion did not have a negative impact on the restoration process. It merely was another component of the ground water sweep which was taking place along with the reverse osmosis permeate injection. If anything, it enhanced the clean up of some of the patterns near Well M-8A. This can be seen in the annual Guideline No. 8 data of Well MP-5 collected annually from July 1995 to May of 1997 (Table 3). During the time the excursion was cleaned up, RO Permeate Restoration continued in other areas of the A-Wellfield.

Water quality data collected from Well M-8A on January 6, 2000 is compared to baseline data in Table 4. Also listed are the Class I Domestic Use Standards. This table shows that all constituents have been returned to either baseline or Class I Domestic Use Suitability Standards with the exception of radium-226. It should be noted, that the baseline concentration of radium-226 was above the Class I Domestic Use Suitability Standards for this well. As discussed in Section 2.2.3, the radium-226 will be naturally attenuated so that the radium-226 concentration will be returned to baseline within a short distance from the well. Therefore, based on this data, this area should be considered restored.

Table 3 MP-5 Guideline 8 Analyses

(All values in mg/l, except pH, conductivity in µmhos/cm, and Ra-226, in pCi/L)

MP-5	07/05/1995	06/25/1996	05/27/1997
CA	143.0	80.0	85.6
MG	32.0	19.3	11.7
NA	68.0	39.2	24.9
K	9.3	6.9	2.6
CO3	0.0	0.0	0.0
HCO3	516.0	361.0	322.0
SO4	133.0	63.3	37.5
CL	55.0	6.5	2.9
NH4	0.05	0.15	0.11
NO2	0.10	0.10	0.10
NO3	0.10	1.78	0.49
F	0.17	0.18	0.10
SI02	8.60	8.70	9.30
TDS	737	416	370
COND	1200	661	551
ALK	423	296	264
pH	7.68	7.22	7.64
AL	0.1	0.1	0.1
AS	0.007	0.014	0.006
BA	0.10	0.10	0.10
B	0.10	0.10	0.10
CD	0.010	0.010	0.010
CR	0.05	0.05	0.05
CU	0.01	0.01	0.01
FE	0.05	0.09	0.36
PB	0.05	0.05	0.05
MN	0.50	0.31	0.57
HG	0.001	0.001	0.001
MO	0.1	0.1	0.1
NI	0.05	0.05	0.05
SE	0.210	0.244	0.069
V	0.10	0.10	0.10
ZN	0.01	0.01	0.01
U	13.34	6.52	0.46
RA-226	1918.0	1729.0	597.0

Table 4 M-8A

(All values in mg/l, except pH, conductivity in µmhos/cm, and Ra-226, in pCi/L)

	Baseline Average (Aug. & Sept.)	End Stabilization (Jan 6, 2000)	CLASS 1 (* see below)
CA	40.7	46.8	
MG	10.5	11.1	
NA	59.8	54.6	
K	8.7	6.4	
CO3	1.5	2.66	
HCO3	228	210	
SO4	89	91.3	250
CL	4.1	7.3	250
NH4	0.13	0.2	0.5
NO2	<0.01	<0.10	1.0
NO3	<0.02	<0.10	10
F	0.15	0.17	
SI02	14.4	13.5	
TDS	273	318	500
COND	570	539	
ALK	192	177	
pH	8.25	8.35	6.5-9.0
AL	<0.10	<0.10	
AS	<0.001	<0.001	0.050
BA	<0.10	<0.10	1.0
B	<0.10	<0.10	0.75
CD	<0.01	<0.005	0.01
CR	<0.05	<0.05	0.05
CU	<0.01	<0.01	1.0
FE	<0.05	<0.03	0.30
PB	<0.05	<0.05	0.05
MN	<0.01	0.03	0.05
HG	<0.001	<0.001	0.002
MO	<0.10	<0.10	
NI	<0.05	<0.05	
SE	<0.001	0.003	0.01
V	<0.10	<0.10	
ZN	0.015	<0.01	5.0
U	0.027	0.0087	5.0
RA-226	6.2	16.9	5

* Class 1 Domestic Use Suitability Standard, Chapter VIII of the WDEQ, Water Quality Division Rules and Regulations.

2.4 Evaluation of Stability Data

A review of the data collected during the Stabilization Period shows that PRI has successfully restored the A-Wellfield. The data has been presented on the basis of wellfield averages and has been compared parameter by parameter. Examination of the ground water data during the stabilization period indicates that the aquifer geochemistry is stable. Also, the ground water flow patterns have been shown to be stable. An evaluation of the ground water data indicates that the ground water in the production zone has been returned to a condition such that its quality of use is equal to, or better than, and consistent with the uses for which the water was suitable prior to the beginning of mining operations. Even though four parameters remain above either baseline or Class I Domestic Use Suitability Standards, the water has been returned to a quality similar to its original quality and remains suitable for the same pre-mining uses.

There are only four parameters that do not meet baseline values or Class I Domestic Use Suitability Standards. Therefore, any degradation of higher quality water that the A-Wellfield ground water may contact would come from these four parameters. The mobility of these parameters has been addressed in Section 2.2.3. It was shown that the concentration of selenium will be attenuated to EPA drinking water standards within a relatively short distance down gradient of the wellfield. Therefore, it will not be a source of contamination for higher quality water.

The next two parameters that do not meet baseline values or Class I Domestic Use Suitability Standards are iron and manganese. Although these constituents will be reduced as the water migrates, it should be noted that they are listed under the EPA's National Secondary Drinking Water Regulations. They are listed under these regulations because these contaminants do not cause health problems. Secondary standards have been established for them because they may cause cosmetic effects such as staining the toilet bowl.

The last parameter that does not meet baseline values or Class I Domestic Use Suitability Standards is radium-226. By looking at the original state of the ground water, the effect radium-226 will have on down gradient higher quality waters can be predicted. The original water in the A-Wellfield had areas that contained greater than 1000 pCi/l of radium-226. This is similar to conditions that exist today in the A-Wellfield. The fact that the water down gradient of the original ore zone water, which contained high concentrations of radium-226, had concentrations of radium-226 two orders of magnitude less than the ore zone water indicates that radium-226 is removed from the ground water very efficiently as it migrates. Based on this information, it is reasonable to assume that the radium-226 within the affected ground water in the A-Wellfield will also be attenuated to the same degree. Therefore, the radium-226 concentration in the A-Wellfield ground water will not pose a threat to higher quality waters.

All of the conditions for stability have been met and it has been shown that the migration of the A-Wellfield ground water will not degrade the waters of the State, therefore, PRI considers the A-Wellfield ground water restoration complete.

3. References

1. PRI, April 23, 1999, A-Wellfield Restoration Report

2. Wyoming Department of Environmental Quality, Land Quality Division Review of the A-Wellfield Ground Water Restoration Report

3. Permit No. 603

4. The Geochemistry of Natural Waters, Surface and Ground Water Environments, Third Edition, James I. Drever

5. Aquifer Restoration Techniques for In-Situ Leach Uranium Mines, W. J. Deutsch, N. E. Bell, B. W. Mercer, R. J. Serne, J. W. Shade, D. R. Tweeton, Pacific Northwest Laboratory operated by Battelle Memorial Institute, Prepared for U. S. Nuclear Regulatory Commission

6. Applied Hydrogeology, C. W. Fetter, Jr.

4. Figures

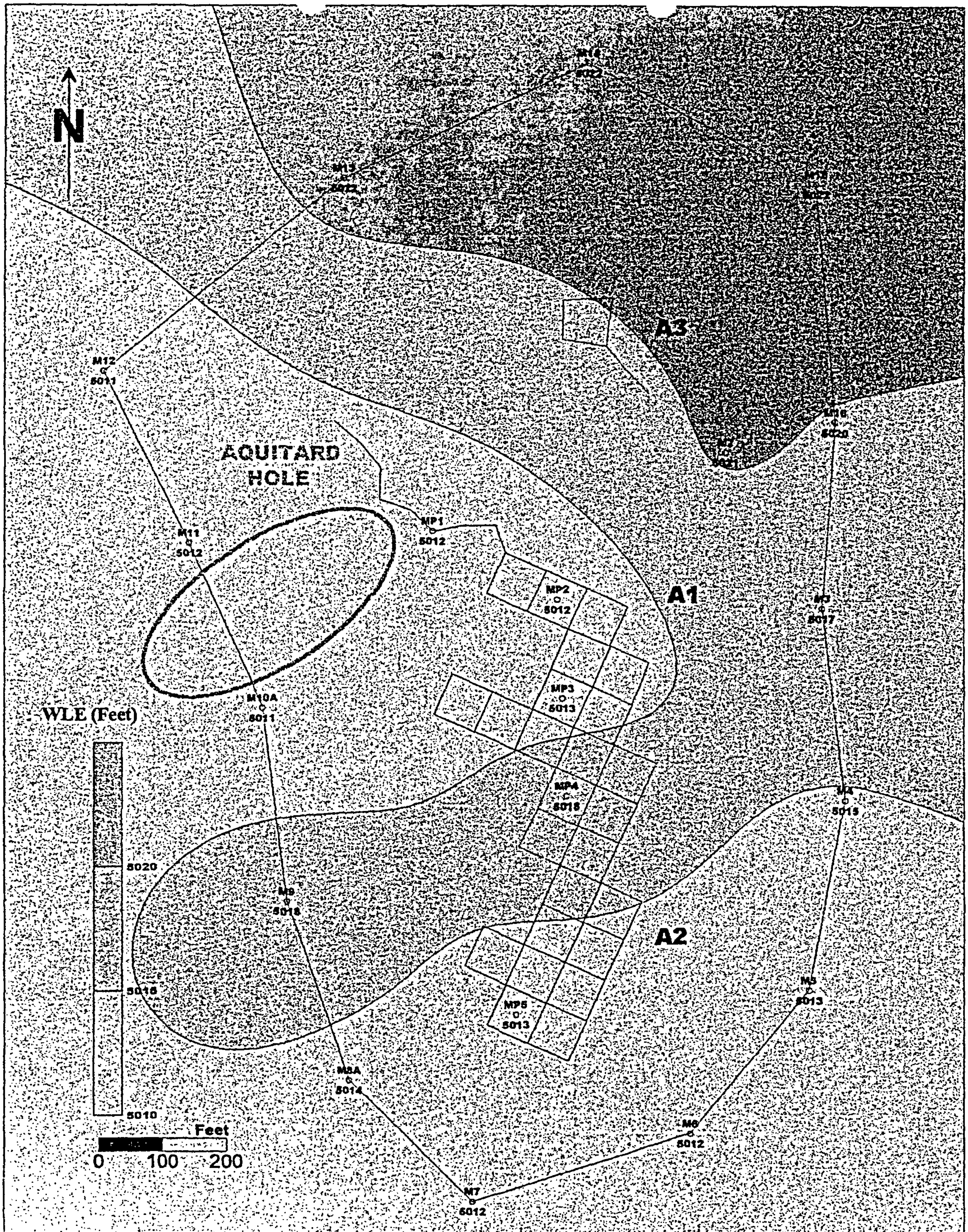


Figure 1., Contoured A-Wellfield Water Level Elevations, 01/27/2000

Figure 2 MP-1 Water Quality and Water Level Data during Stability Period

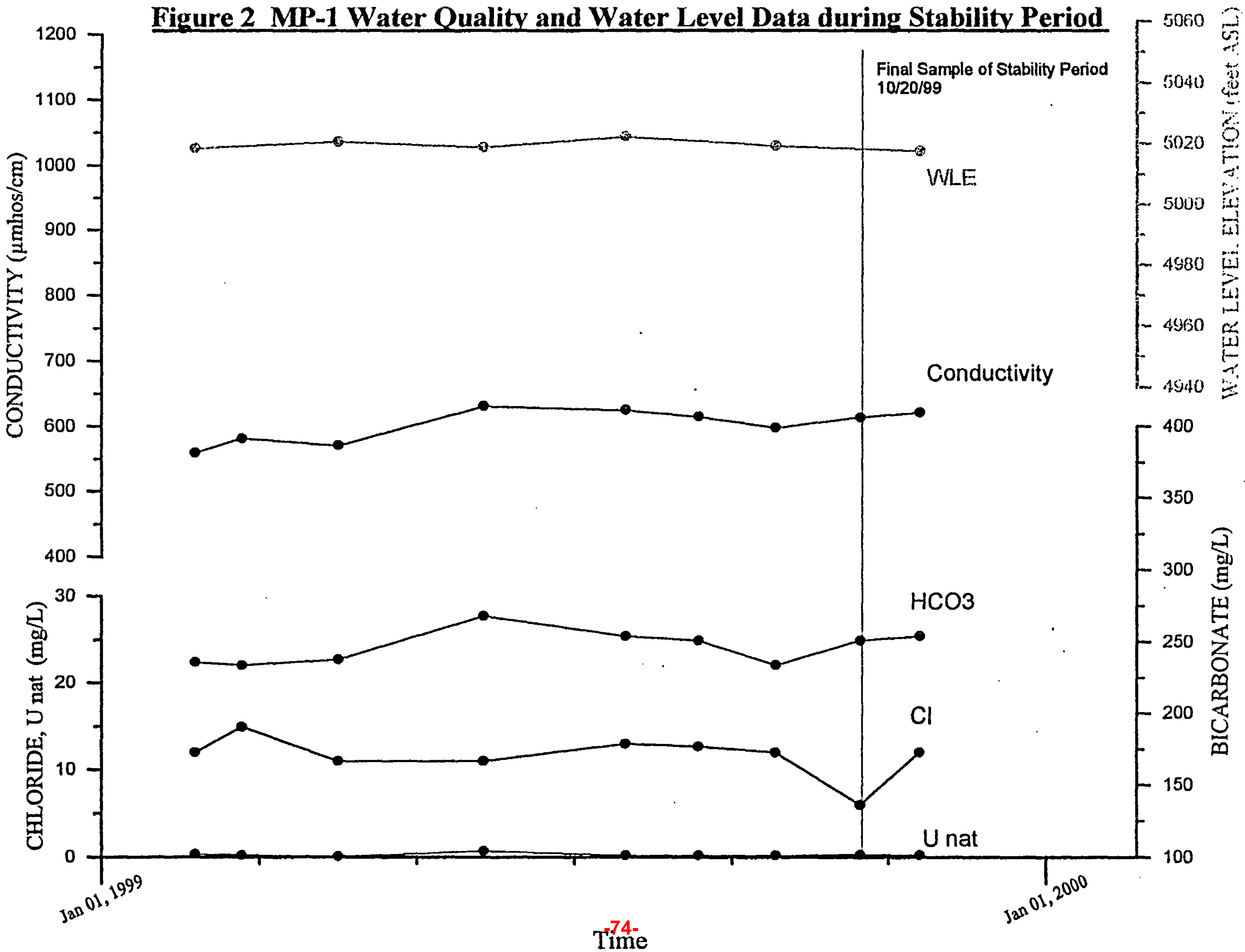


Figure 3 MP-2 Water Quality and Water Level Data during Stability Period

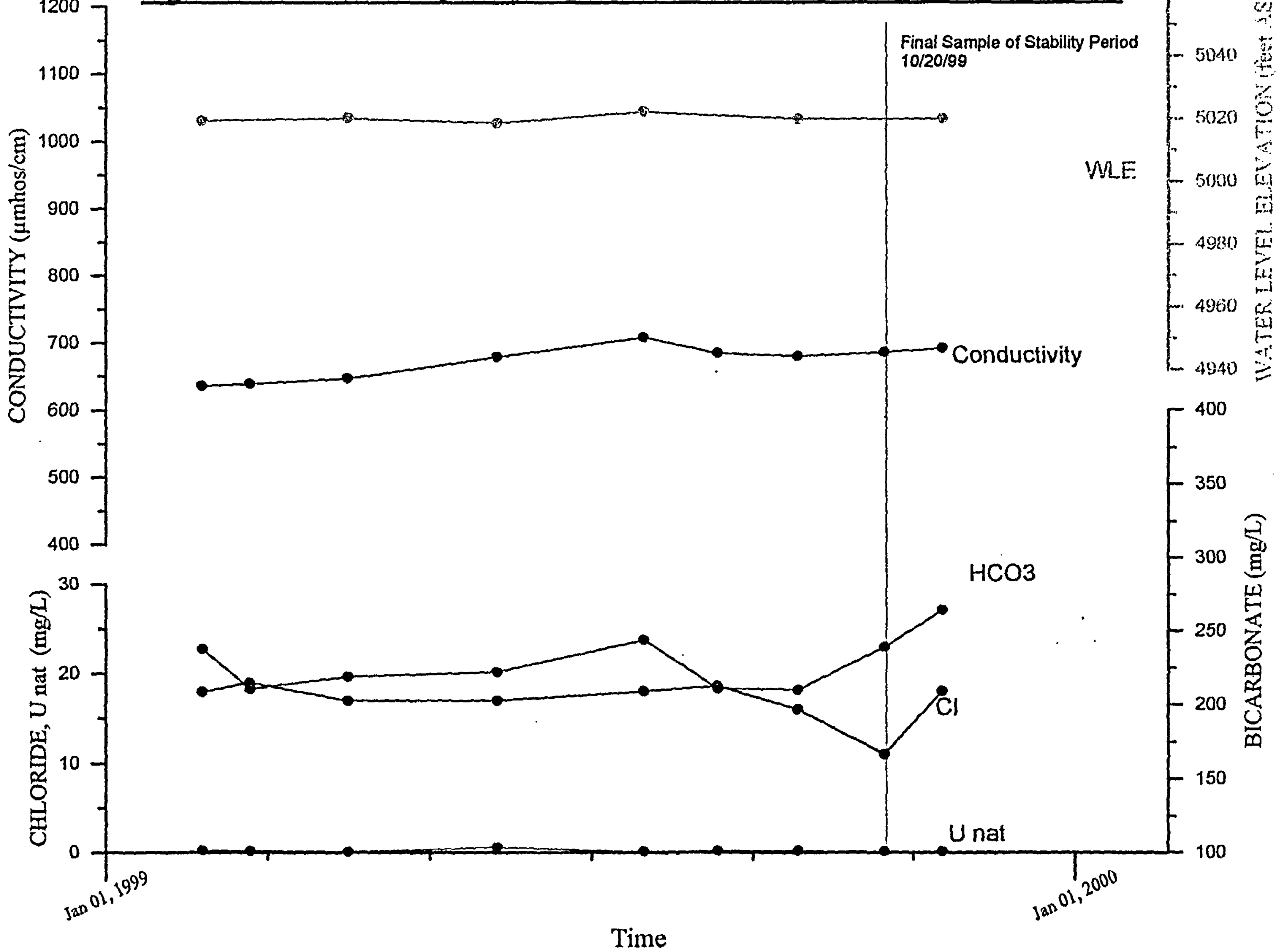


Figure 4 MP-3 Water Quality and Water Level Data during Stability Period

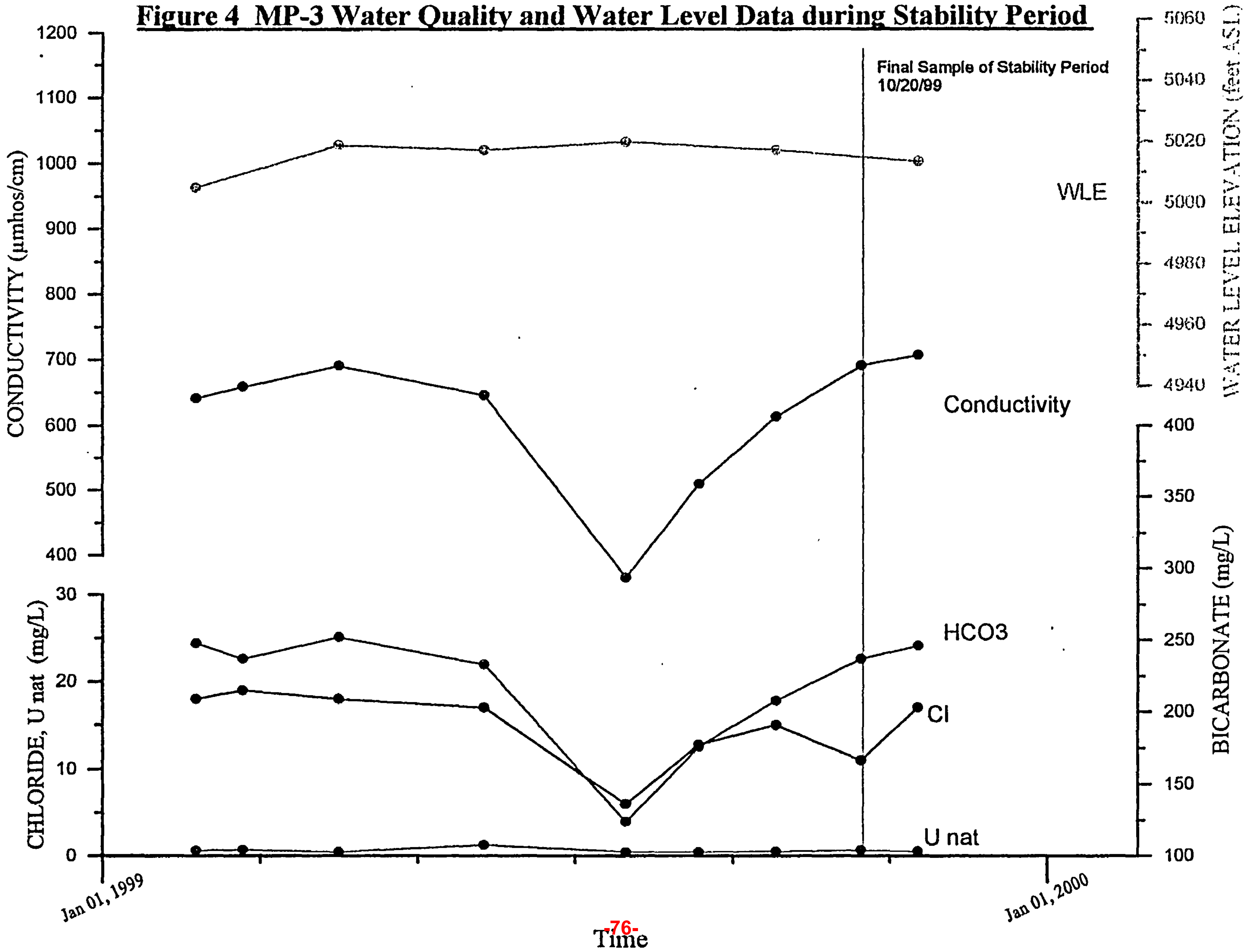


Figure 5 MP-4 Water Quality and Water Level Data during Stability Period

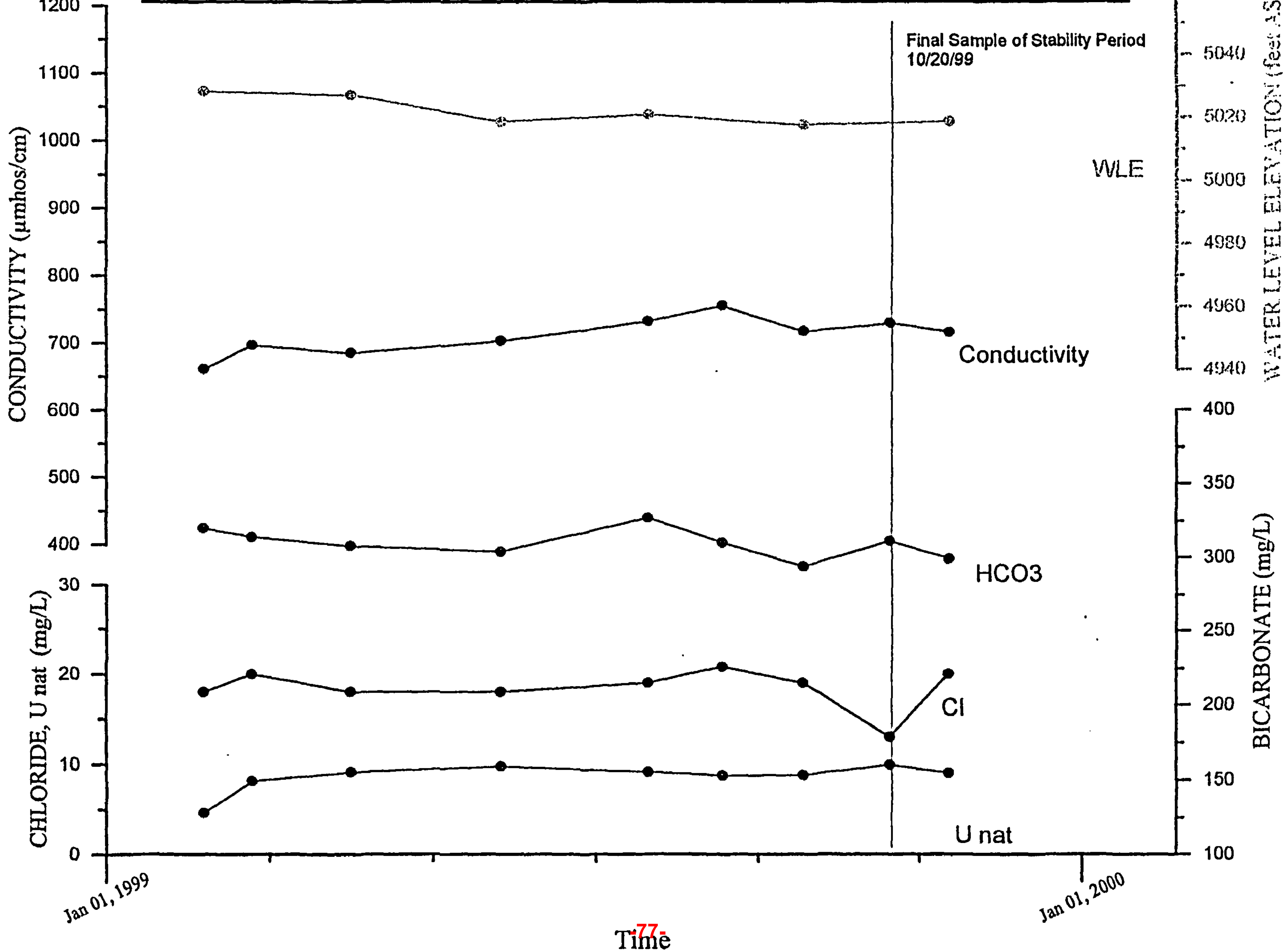
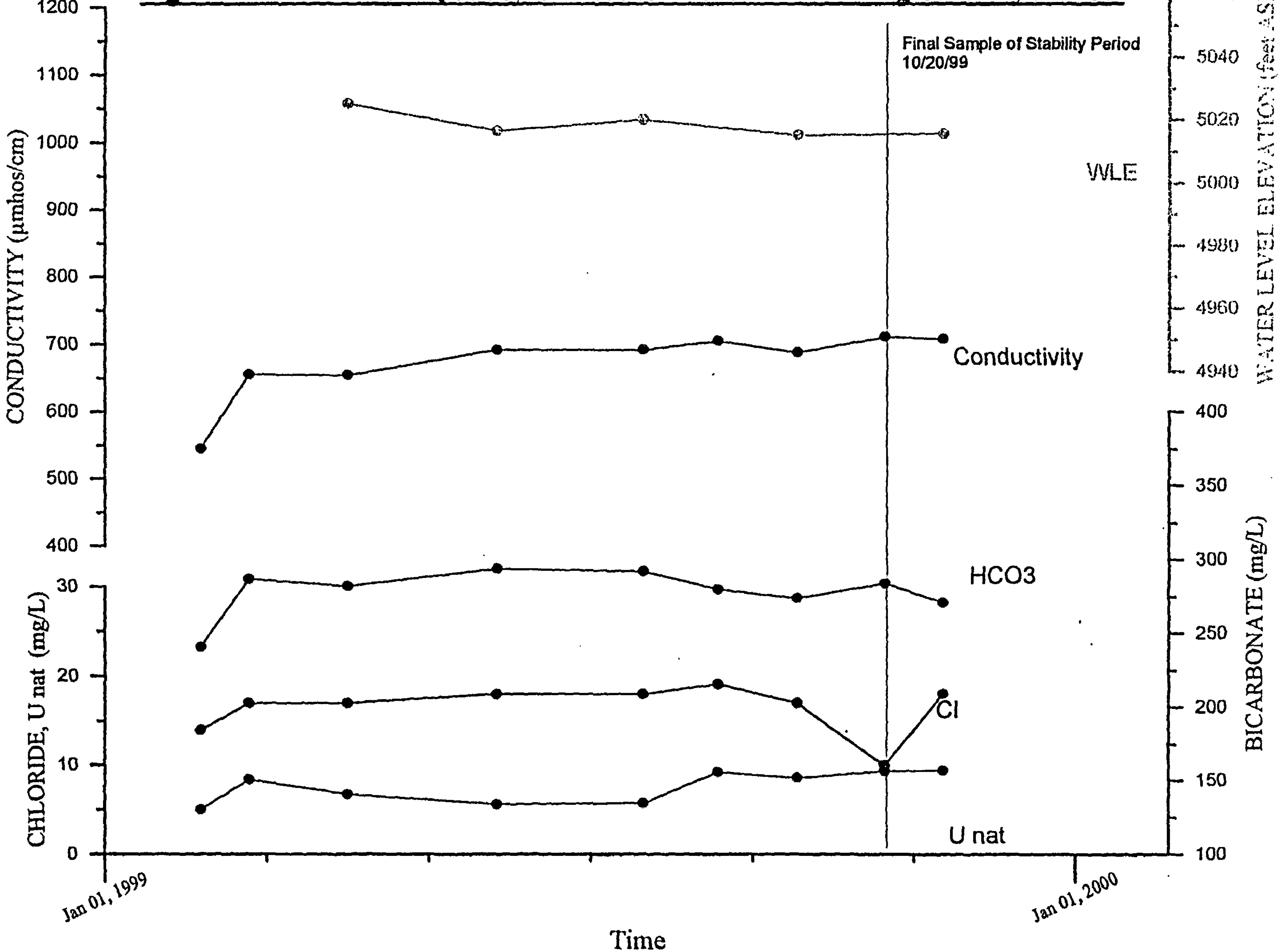


Figure 6 MP-5 Water Quality and Water Level Data during Stability Period



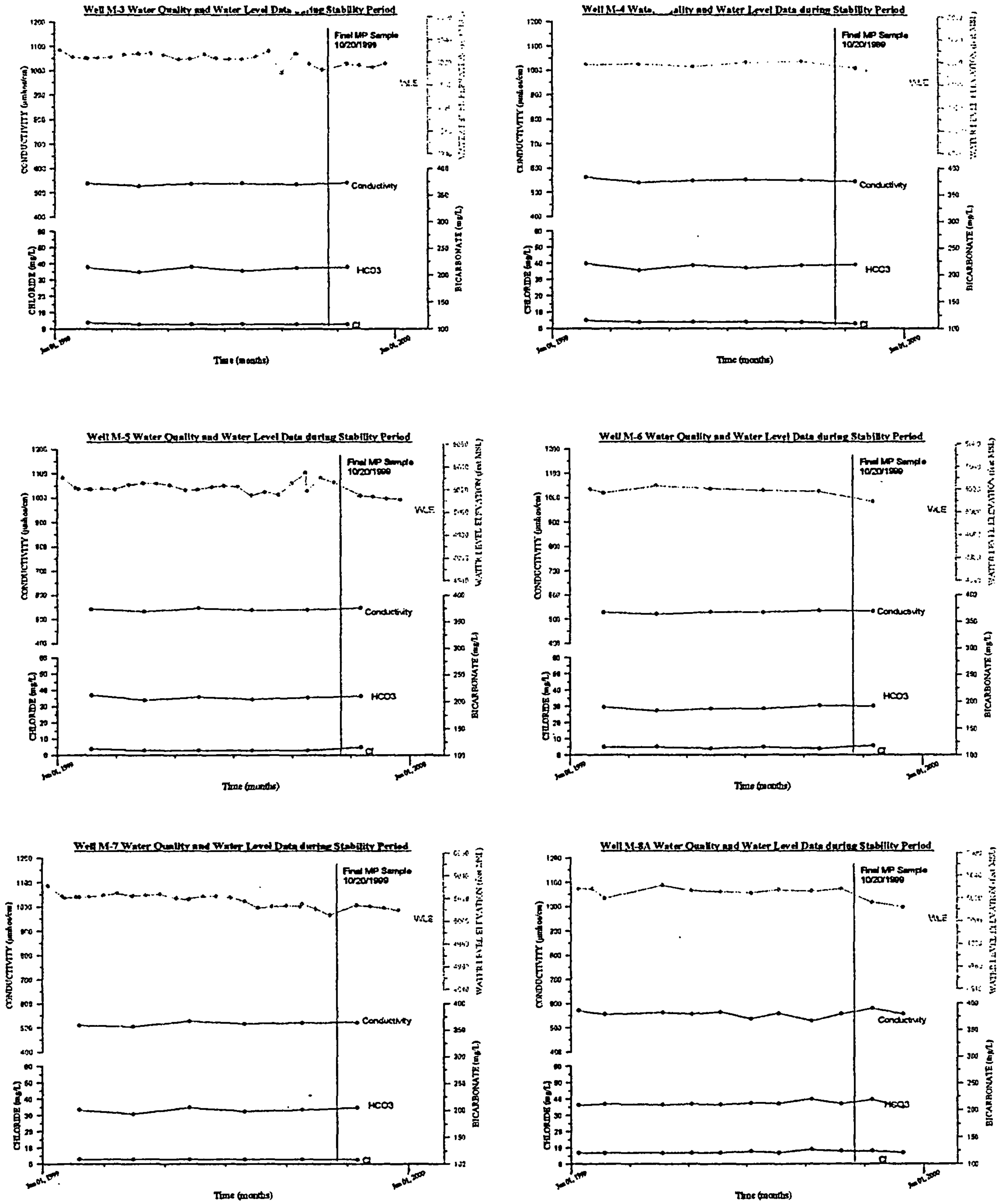


Figure 7 Time-Concentration Plots of Monitor Wells M-3 to M-8

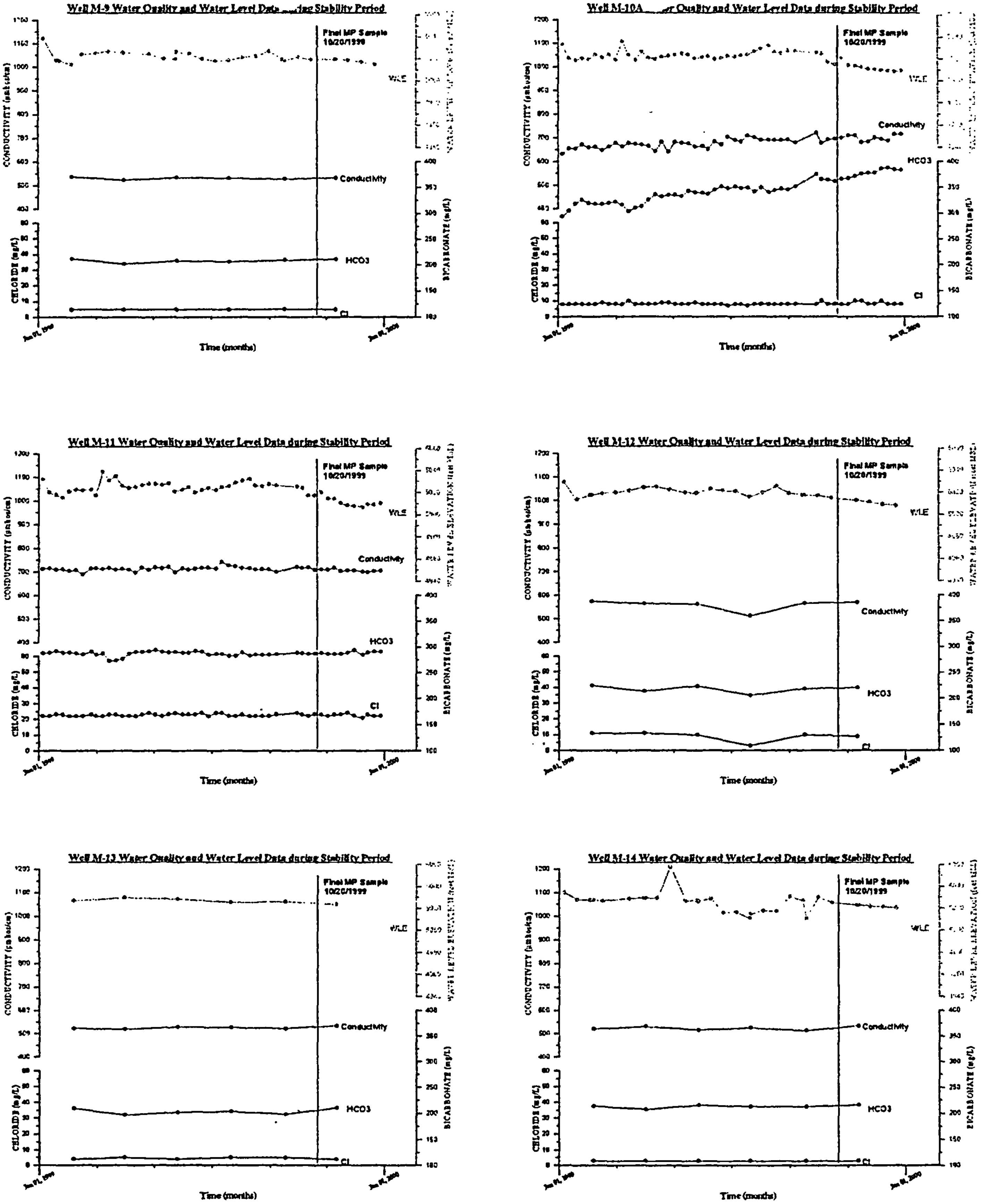
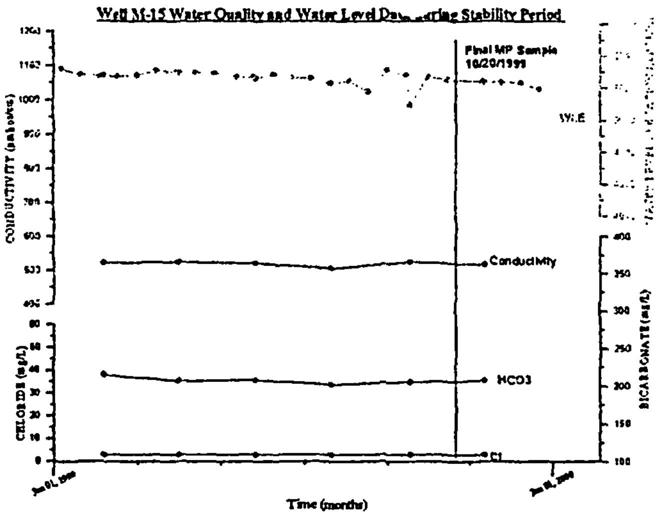


Figure 8 Time-Concentration Plots of Monitor Wells M-9 to M-14



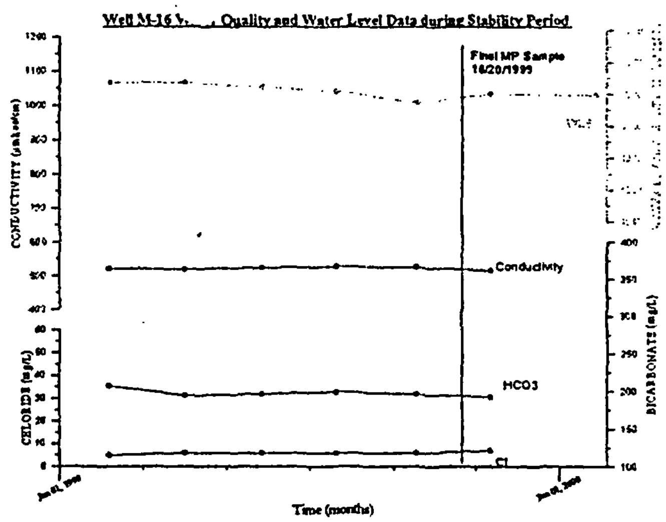
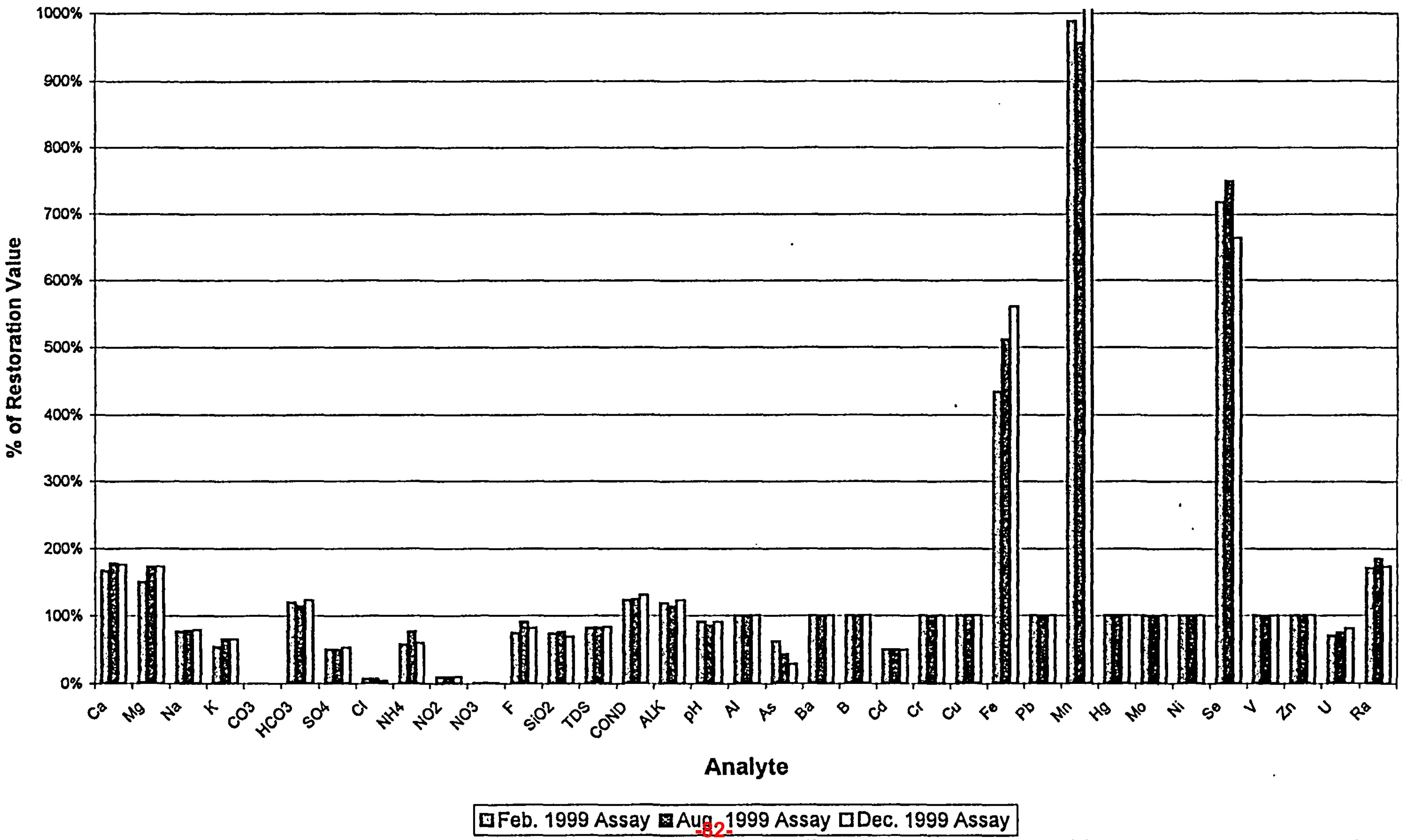


Figure 9 Time-Concentration Plots of Monitor Wells M-15 and M-16

Figure 10
A-Wellfield Stabilization Trends



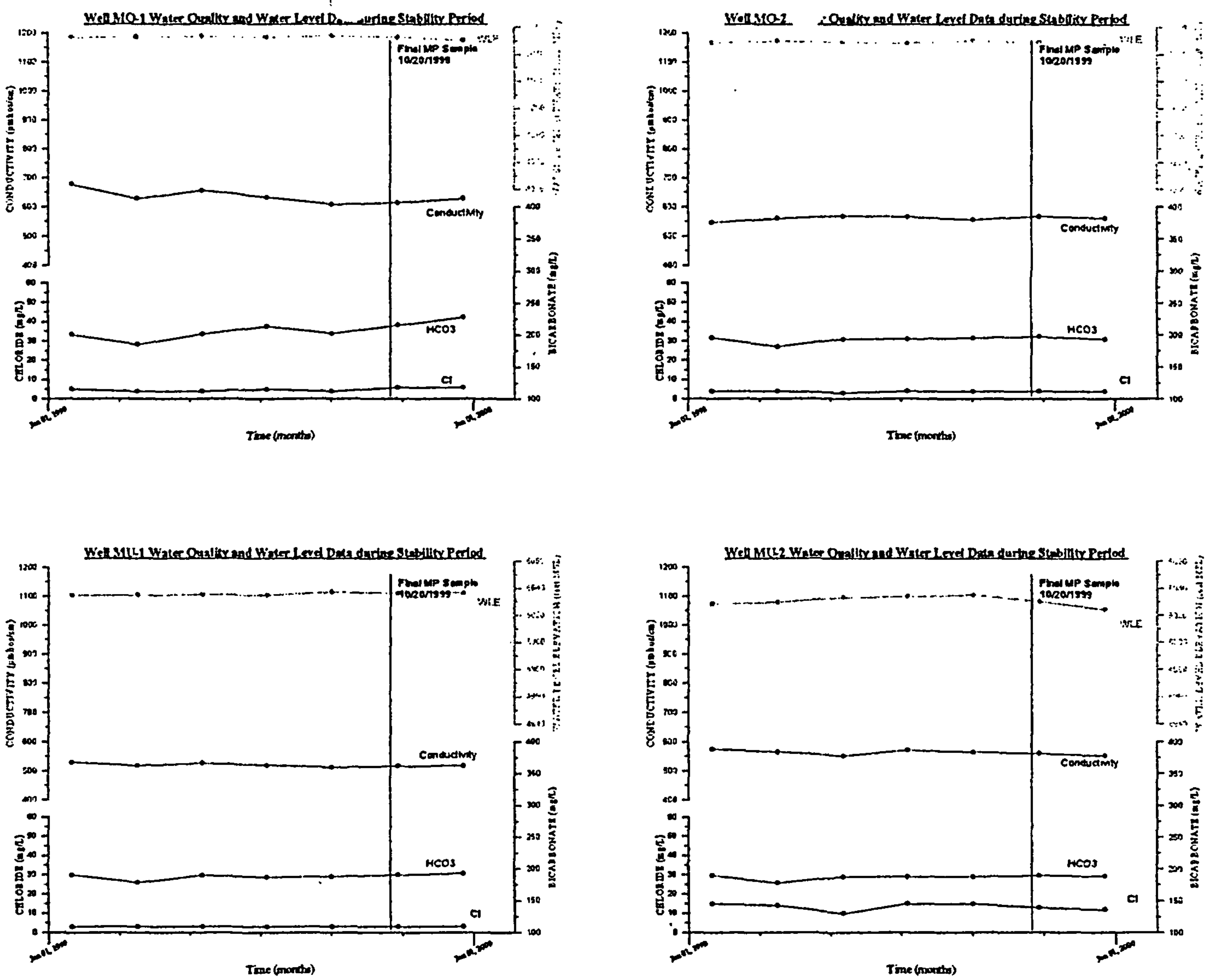


Figure 11 Time-Concentration Plots of MO and MU Monitor Wells

5. Appendix

5.1 Guideline No. 8 Data for the MP-Wells During Stability

5.2 1999 Water Level and Water Quality Data for the A-Wellfield Monitor Wells

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP1
Laboratory ID:	99-19462
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	71.2
Magnesium	Mg	mg/L	1.0	7.8
Sodium	Na	mg/L	1.0	57.0
Potassium	K	mg/L	1.0	3.3
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	234
Sulfate	SO_4	mg/L	1.0	159
Chloride	Cl	mg/L	1.0	15.0
Ammonium as N	NH_4	mg/L	0.05	0.54
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.13
Silica	SiO_2	mg/L	1.0	9.9

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	366
Conductivity		µmho/cm	1.0	582
Alkalinity	$CaCO_3$	mg/L	1.0	192
pH		std. units	0.10	7.27

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	< 0.001
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.48
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.60
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.258
Radium 226	^{226}Ra	pCi/L	0.2	293
Radium Error Estimate ±				6.1

Quality Assurance Data		Target Range	
Anion	meq		7.59
Cation	meq		6.88
WYDEQ A/C Balance	%	-5 - +5	-4.89
Calc TDS	mg/L		442
TDS A/C Balance	dec. %	0.80 - 1.20	0.83

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP2
Laboratory ID:	99-19463
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	64.0
Magnesium	Mg	mg/L	1.0	15.1
Sodium	Na	mg/L	1.0	42.0
Potassium	K	mg/L	1.0	4.1
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	211
Sulfate	SO_4	mg/L	1.0	155
Chloride	Cl	mg/L	1.0	19.0
Ammonium as N	NH_4	mg/L	0.05	0.30
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.15
Silica	SiO_2	mg/L	1.0	13.5
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	392
Conductivity		µmho/cm	1.0	639
Alkalinity	$CaCO_3$	mg/L	1.0	173
pH		std. units	0.10	7.09
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.002
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	2.20
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.30
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.174
Radium 226	^{226}Ra	pCi/L	0.2	934
Radium Error Estimate ±				10.4

Quality Assurance Data		Target Range	
Anion	meq		7.24
Cation	meq		6.56
WYDEQ A/C Balance	%	-5 - +5	-4.95
Calc TDS	mg/L		421
TDS A/C Balance	dec. %	0.80 - 1.20	0.93

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP3
Laboratory ID:	99-19464
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	74.0
Magnesium	Mg	mg/L	1.0	12.3
Sodium	Na	mg/L	1.0	38.0
Potassium	K	mg/L	1.0	4.0
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	237
Sulfate	SO_4	mg/L	1.0	133
Chloride	Cl	mg/L	1.0	19.0
Ammonium as N	NH_4	mg/L	0.05	0.12
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.11
Silica	SiO_2	mg/L	1.0	15.7
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	420
Conductivity		µmho/cm	1.0	659
Alkalinity	$CaCO_3$	mg/L	1.0	194
pH		std. units	0.10	7.31
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.052
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	1.90
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.80
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.006
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.685
Radium 226	^{226}Ra	pCi/L	0.2	784
Radium Error Estimate ±				9.5

Quality Assurance Data		Target Range	
Anion	meq		7.20
Cation	meq		6.65
WYDEQ A/C Balance	%	-5 - +5	-4.00
Calc TDS	mg/L		418
TDS A/C Balance	dec. %	0.80 - 1.20	1.01

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP4
Laboratory ID:	99-19465
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	83.0
Magnesium	Mg	mg/L	1.0	16.2
Sodium	Na	mg/L	1.0	35.1
Potassium	K	mg/L	1.0	5.9
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	314
Sulfate	SO_4	mg/L	1.0	95.0
Chloride	Cl	mg/L	1.0	20.0
Ammonium as N	NH_4	mg/L	0.05	0.16
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.18
Silica	SiO_2	mg/L	1.0	13.0
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	443
Conductivity		μmho/cm	1.0	697
Alkalinity	$CaCO_3$	mg/L	1.0	258
pH		std. units	0.10	7.53
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.092
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.44
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.47
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.343
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	8.20
Radium 226	^{226}Ra	pCi/L	0.2	3220
Radium Error Estimate ±				19.0

Quality Assurance Data		Target Range	
Anion	meq		7.72
Cation	meq		7.25
WYDEQ A/C Balance	%	-5 - +5	-3.14
Calc TDS	mg/L		427
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP5
Laboratory ID:	99-19466
Sample Matrix:	Water
Sample Date:	02-23-99
Report Date:	March 19, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.0	75.0
Magnesium	Mg	mg/L	1.0	16.0
Sodium	Na	mg/L	1.0	39.0
Potassium	K	mg/L	1.0	4.5
Carbonate	CO_3	mg/L	0.10	< 0.10
Bicarbonate	HCO_3	mg/L	0.10	287
Sulfate	SO_4	mg/L	1.0	94.0
Chloride	Cl	mg/L	1.0	17.0
Ammonium as N	NH_4	mg/L	0.05	0.33
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.18
Silica	SiO_2	mg/L	1.0	7.2

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	431
Conductivity		µmho/cm	1.0	656
Alkalinity	$CaCO_3$	mg/L	1.0	236
pH		std. units	0.10	7.33

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.010
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	1.50
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.30
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.008
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	8.35
Radium 226	^{226}Ra	pCi/L	0.2	532
Radium Error Estimate ±				7.8

Quality Assurance Data		Target Range	
Anion	meq		7.17
Cation	meq		7.03
WYDEQ A/C Balance	%	-5 - +5	-1.04
Calc TDS	mg/L		399
TDS A/C Balance	dec. %	0.80 - 1.20	1.08

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP1
Laboratory ID:	32411-001
Sample Matrix:	Water
Sample Date:	08-18-99
Report Date:	September 20, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.00	82.3
Magnesium	Mg	mg/L	1.00	9.80
Sodium	Na	mg/L	1.00	59.1
Potassium	K	mg/L	1.00	4.20
Carbonate	CO_3	mg/L	1.00	< 1.00
Bicarbonate	HCO_3	mg/L	1.00	251
Sulfate	SO_4	mg/L	1.00	156
Chloride	Cl	mg/L	1.00	12.7
Ammonium as N	NH_4	mg/L	0.05	0.79
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.17
Silica	SiO_2	mg/L	1.00	10.4

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	10.0	384
Conductivity		µmho/cm	1.00	615
Alkalinity	$CaCO_3$	mg/L	1.00	206
pH		std. units	0.10	7.22

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	< 0.001
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.54
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.62
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.012
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.194
Radium 226	^{226}Ra	pCi/L	0.2	300
Radium Error Estimate ±				8.3

Quality Assurance Data		Target Range	
Anion	meq		7.74
Cation	meq		7.74
WYDEQ A/C Balance	%	-5 - +5	-0.03
Calc TDS	mg/L		462
TDS A/C Balance	dec. %	0.80 - 1.20	0.83

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP2
Laboratory ID:	32411-002
Sample Matrix:	Water
Sample Date:	08-18-99
Report Date:	September 20, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.00	73.2
Magnesium	Mg	mg/L	1.00	18.4
Sodium	Na	mg/L	1.00	45.7
Potassium	K	mg/L	1.00	5.00
Carbonate	CO_3	mg/L	1.00	< 1.00
Bicarbonate	HCO_3	mg/L	1.00	211
Sulfate	SO_4	mg/L	1.00	154
Chloride	Cl	mg/L	1.00	18.6
Ammonium as N	NH_4	mg/L	0.05	0.43
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.18
Silica	SiO_2	mg/L	1.00	14.3

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	10.0	438
Conductivity		µmho/cm	1.00	685
Alkalinity	$CaCO_3$	mg/L	1.00	173
pH		std. units	0.10	6.84

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.003
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	1.68
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.25
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.166
Radium 226	^{226}Ra	pCi/L	0.2	996
Radium Error Estimate ±				27.6

Quality Assurance Data		Target Range	
Anion	meq		7.21
Cation	meq		7.45
WYDEQ A/C Balance	%	-5 - +5	1.68
Calc TDS	mg/L		437
TDS A/C Balance	dec. %	0.80 - 1.20	1.00

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP3
Laboratory ID:	32411-003
Sample Matrix:	Water
Sample Date:	08-18-99
Report Date:	September 20, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.00	59.9
Magnesium	Mg	mg/L	1.00	11.0
Sodium	Na	mg/L	1.00	30.2
Potassium	K	mg/L	1.00	4.60
Carbonate	CO_3	mg/L	1.00	< 1.00
Bicarbonate	HCO_3	mg/L	1.00	176
Sulfate	SO_4	mg/L	1.00	88.4
Chloride	Cl	mg/L	1.00	12.8
Ammonium as N	NH_4	mg/L	0.05	0.15
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.14
Silica	SiO_2	mg/L	1.00	15.1
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	10.0	309
Conductivity		µmho/cm	1.00	510
Alkalinity	$CaCO_3$	mg/L	1.00	144
pH		std. units	0.10	6.71
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.032
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	2.88
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.66
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.008
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	0.458
Radium 226	^{226}Ra	pCi/L	0.2	665
Radium Error Estimate ±				18.4

Quality Assurance Data		Target Range	
Anion	meq		5.10
Cation	meq		5.56
WYDEQ A/C Balance	%	-5 - +5	4.31
Calc TDS	mg/L		314
TDS A/C Balance	dec. %	0.80 - 1.20	0.98

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP4
Laboratory ID:	32411-004
Sample Matrix:	Water
Sample Date:	08-18-99
Report Date:	September 20, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.00	95.7
Magnesium	Mg	mg/L	1.00	20.3
Sodium	Na	mg/L	1.00	38.9
Potassium	K	mg/L	1.00	7.00
Carbonate	CO_3	mg/L	1.00	< 1.00
Bicarbonate	HCO_3	mg/L	1.00	310
Sulfate	SO_4	mg/L	1.00	117
Chloride	Cl	mg/L	1.00	20.8
Ammonium as N	NH_4	mg/L	0.05	0.15
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.22
Silica	SiO_2	mg/L	1.00	13.3

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	10.0	488
Conductivity		µmho/cm	1.00	755
Alkalinity	$CaCO_3$	mg/L	1.00	254
pH		std. units	0.10	7.01

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.061
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	0.46
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.52
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.348
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01

Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	8.75
Radium 226	^{226}Ra	pCi/L	0.2	3687
Radium Error Estimate ±				102

Quality Assurance Data	Units	Target Range	Results
Anion	meq		8.12
Cation	meq		8.42
WYDEQ A/C Balance	%	-5 - +5	1.82
Calc TDS	mg/L		470
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

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LABORATORY ANALYSIS REPORT - POWER RESOURCES, INC.

Sample ID:	MP5
Laboratory ID:	32411-005
Sample Matrix:	Water
Sample Date:	08-18-99
Report Date:	September 20, 1999

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	1.00	81.1
Magnesium	Mg	mg/L	1.00	18.4
Sodium	Na	mg/L	1.00	42.1
Potassium	K	mg/L	1.00	5.40
Carbonate	CO_3	mg/L	1.00	< 1.00
Bicarbonate	HCO_3	mg/L	1.00	280
Sulfate	SO_4	mg/L	1.00	110
Chloride	Cl	mg/L	1.00	19.1
Ammonium as N	NH_4	mg/L	0.05	0.41
Nitrite as N	NO_2	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	$NO_3 + NO_2$	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	0.20
Silica	SiO_2	mg/L	1.00	7.85
Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	10.0	447
Conductivity		µmho/cm	1.00	705
Alkalinity	$CaCO_3$	mg/L	1.00	230
pH		std. units	0.10	6.72
Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.012
Barium	Ba	mg/L	0.10	< 0.10
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.005	< 0.005
Chromium	Cr	mg/L	0.05	< 0.05
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.05	2.12
Lead	Pb	mg/L	0.05	< 0.05
Manganese	Mn	mg/L	0.01	0.34
Mercury	Hg	mg/L	0.001	< 0.001
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.006
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	< 0.01
Radiometrics				
Uranium	^{Nat}U	mg/L	0.0003	9.17
Radium 226	^{226}Ra	pCi/L	0.2	585
Radium Error Estimate ±				16.2

Quality Assurance Data		Target Range	
Anion	meq		7.45
Cation	meq		7.73
WYDEQ A/C Balance	%	-5 - +5	1.87
Calc TDS	mg/L		427
TDS A/C Balance	dec. %	0.80 - 1.20	1.05

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LABORATORY ANALYSIS REPORT
POWER RESOURCES, INC.

Sample ID:	MP-1
Sample Date:	10-20-99
Sample Matrix:	Water
Laboratory ID:	33889-001
Report Date:	November 11, 1999
Revised Report Date:	November 22, 1999

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	74.0
Magnesium	EPA 200.7	mg/L	1.0	9.0
Sodium	EPA 200.7	mg/L	1.0	58.0
Potassium	EPA 200.7	mg/L	1.0	4.0
Carbonate	SM 2320-B	mg/L	1.0	< 1.0
Bicarbonate	SM 2320-B	mg/L	1.0	251
Sulfate	EPA 200.7	mg/L	1.0	160
Chloride	EPA 200.7	mg/L	1.0	6.0
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.53
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.15
Silica	EPA 200.7	mg/L	1.0	9.0

Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod.	mg/L	10.0	356
Conductivity	EPA 120.1	µmho/cm	1.0	614
Alkalinity	SM 2320-B	mg/L	1.0	206
pH	SM 4500-H-B	std. units	0.10	7.18

Trace Metals				
Aluminum	EPA 200.8	mg/L	0.10	< 0.10
Arsenic	EPA 200.8	mg/L	0.001	0.001
Barium	EPA 200.8	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.8	mg/L	0.05	< 0.05
Copper	EPA 200.8	mg/L	0.01	< 0.01
Iron	EPA 200.7	mg/L	0.03	0.34
Lead	EPA 200.8	mg/L	0.05	< 0.05
Manganese	EPA 200.8	mg/L	0.01	0.68
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.8	mg/L	0.10	< 0.10
Nickel	EPA 200.8	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	< 0.001
Vanadium	EPA 200.8	mg/L	0.10	< 0.10
Zinc	EPA 200.8	mg/L	0.01	< 0.01

Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	0.292
Radium 226	EPA 903.0	pCi/L	0.2	359
Radium Error Estimate ±				12.9

Quality Assurance Data		Target Range	
Anion	meq		7.64
Cation	meq		7.18
WYDEQ A/C Balance	%	-5 - +5	-3.09
Calc TDS	mg/L		447
TDS A/C Balance	dec. %	0.80 - 1.20	0.80

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LABORATORY ANALYSIS REPORT
POWER RESOURCES, INC.

Sample ID:	MP-2
Sample Date:	10-20-99
Sample Matrix:	Water
Laboratory ID:	33889-002
Report Date:	November 11, 1999

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	73.0
Magnesium	EPA 200.7	mg/L	1.0	18.0
Sodium	EPA 200.7	mg/L	1.0	43.0
Potassium	EPA 200.7	mg/L	1.0	4.9
Carbonate	SM 2320-B	mg/L	1.0	< 1.0
Bicarbonate	SM 2320-B	mg/L	1.0	239
Sulfate	EPA 200.7	mg/L	1.0	182
Chloride	EPA 200.7	mg/L	1.0	11.0
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.35
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.17
Silica	EPA 200.7	mg/L	1.0	13.3

Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod	mg/L	10.0	455
Conductivity	EPA 120.1	µmho/cm	1.0	686
Alkalinity	SM 2320-B	mg/L	1.0	197
pH	SM 4500-H-B	std. units	0.10	7.24

Trace Metals				
Aluminum	EPA 200.8	mg/L	0.10	< 0.10
Arsenic	EPA 200.8	mg/L	0.001	0.001
Barium	EPA 200.8	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.8	mg/L	0.05	< 0.05
Copper	EPA 200.8	mg/L	0.01	< 0.01
Iron	EPA 200.7	mg/L	0.03	2.43
Lead	EPA 200.8	mg/L	0.05	< 0.05
Manganese	EPA 200.8	mg/L	0.01	0.26
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.8	mg/L	0.10	< 0.10
Nickel	EPA 200.8	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	< 0.001
Vanadium	EPA 200.8	mg/L	0.10	< 0.10
Zinc	EPA 200.8	mg/L	0.01	< 0.01

Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	0.122
Radium 226	EPA 903.0	pCi/L	0.2	990
Radium Error Estimate ±				35.5

Quality Assurance Data		Target Range	
Anion	meq		8.06
Cation	meq		7.33
WYDEQ A/C Balance	%	-5 - +5	-4.75
Calc TDS	mg/L		469
TDS A/C Balance	dec. %	0.80 - 1.20	0.97

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LABORATORY ANALYSIS REPORT
POWER RESOURCES, INC.

Sample ID:	MP-3
Sample Date:	10-20-99
Sample Matrix:	Water
Laboratory ID:	33889-003
Report Date:	November 11, 1999

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	77.0
Magnesium	EPA 200.7	mg/L	1.0	14.0
Sodium	EPA 200.7	mg/L	1.0	38.0
Potassium	EPA 200.7	mg/L	1.0	4.9
Carbonate	SM 2320-B	mg/L	1.0	< 1.0
Bicarbonate	SM 2320-B	mg/L	1.0	237
Sulfate	EPA 200.7	mg/L	1.0	122
Chloride	EPA 200.7	mg/L	1.0	11.0
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.16
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.12
Silica	EPA 200.7	mg/L	1.0	14.0

Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod.	mg/L	10.0	413
Conductivity	EPA 120.1	µmho/cm	1.0	691
Alkalinity	SM 2320-B	mg/L	1.0	194
pH	SM 4500-H-B	std. units	0.10	7.18

Trace Metals				
Aluminum	EPA 200.8	mg/L	0.10	< 0.10
Arsenic	EPA 200.8	mg/L	0.001	< 0.001
Barium	EPA 200.8	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.8	mg/L	0.05	< 0.05
Copper	EPA 200.8	mg/L	0.01	< 0.01
Iron	EPA 200.7	mg/L	0.03	2.83
Lead	EPA 200.8	mg/L	0.05	< 0.05
Manganese	EPA 200.8	mg/L	0.01	0.94
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.8	mg/L	0.10	< 0.10
Nickel	EPA 200.8	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	0.007
Vanadium	EPA 200.8	mg/L	0.10	< 0.10
Zinc	EPA 200.8	mg/L	0.01	< 0.01

Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	0.646
Radium 226	EPA 903.0	pCi/L	0.2	749
Radium Error Estimate ±				26.8

Quality Assurance Data		Target Range	
Anion	meq		6.74
Cation	meq		7.02
WYDEQ A/C Balance	%	-5 - +5	2.00
Calc TDS	mg/L		404
TDS A/C Balance	dec. %	0.80 - 1.20	1.02

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LABORATORY ANALYSIS REPORT
POWER RESOURCES, INC.

Sample ID:	MP-4
Sample Date:	10-20-99
Sample Matrix:	Water
Laboratory ID:	33889-004
Report Date:	November 11, 1999

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	86.0
Magnesium	EPA 200.7	mg/L	1.0	19.0
Sodium	EPA 200.7	mg/L	1.0	36.0
Potassium	EPA 200.7	mg/L	1.0	7.0
Carbonate	SM 2320-B	mg/L	1.0	< 1.0
Bicarbonate	SM 2320-B	mg/L	1.0	311
Sulfate	EPA 200.7	mg/L	1.0	98.0
Chloride	EPA 200.7	mg/L	1.0	13.0
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.11
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.20
Silica	EPA 200.7	mg/L	1.0	12.0
Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod.	mg/L	10.0	441
Conductivity	EPA 120.1	µmho/cm	1.0	729
Alkalinity	SM 2320-B	mg/L	1.0	255
pH	SM 4500-H-B	std. units	0.10	7.47
Trace Metals				
Aluminum	EPA 200.8	mg/L	0.10	< 0.10
Arsenic	EPA 200.8	mg/L	0.001	0.061
Barium	EPA 200.8	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.8	mg/L	0.05	< 0.05
Copper	EPA 200.8	mg/L	0.01	0.01
Iron	EPA 200.7	mg/L	0.03	0.37
Lead	EPA 200.8	mg/L	0.05	< 0.05
Manganese	EPA 200.8	mg/L	0.01	0.54
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.8	mg/L	0.10	< 0.10
Nickel	EPA 200.8	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	0.32
Vanadium	EPA 200.8	mg/L	0.10	< 0.10
Zinc	EPA 200.8	mg/L	0.01	< 0.01
Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	9.9
Radium 226	EPA 903.0	pCi/L	0.2	3360
Radium Error Estimate ±				120

Quality Assurance Data		Target Range	
Anion	meq		7.53
Cation	meq		7.70
WYDEQ A/C Balance	%	-5 - +5	1.12
Calc TDS	mg/L		428
TDS A/C Balance	dec. %	0.80 - 1.20	1.03

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Sample ID:	MP-5
Sample Date:	10-20-99
Sample Matrix:	Water
Laboratory ID:	33889-005
Report Date:	November 11, 1999
Revised Report Date:	March 1, 2000

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	78.0
Magnesium	EPA 200.7	mg/L	1.0	18.0
Sodium	EPA 200.7	mg/L	1.0	42.0
Potassium	EPA 200.7	mg/L	1.0	5.4
Carbonate	SM 2320-B	mg/L	1.0	< 1.0
Bicarbonate	SM 2320-B	mg/L	1.0	284
Sulfate	EPA 200.7	mg/L	1.0	109
Chloride	EPA 200.7	mg/L	1.0	10.0
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.35
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.18
Silica	EPA 200.7	mg/L	1.0	7.3

Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod.	mg/L	10.0	425
Conductivity	EPA 120.1	µmho/cm	1.0	711
Alkalinity	SM 2320-B	mg/L	1.0	233
pH	SM 4500-H-B	std. units	0.10	7.31

Trace Metals				
Aluminum	EPA 200.8	mg/L	0.10	0.10
Arsenic	EPA 200.8	mg/L	0.001	0.009
Barium	EPA 200.8	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.8	mg/L	0.05	< 0.05
Copper	EPA 200.8	mg/L	0.01	< 0.01
Iron	EPA 200.7	mg/L	0.03	2.45
Lead	EPA 200.8	mg/L	0.05	< 0.05
Manganese	EPA 200.8	mg/L	0.01	0.35
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.8	mg/L	0.10	< 0.10
Nickel	EPA 200.8	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	0.003
Vanadium	EPA 200.8	mg/L	0.10	< 0.10
Zinc	EPA 200.8	mg/L	0.01	< 0.01

Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	9.3
Radium 226	EPA 903.0	pCi/L	0.2	382
Radium Error Estimate ±				13.7

Quality Assurance Data		Target Range	
Anion	meq		7.23
Cation	meq		7.55
WYDEQ A/C Balance	%	-5 - +5	2.18
Calc TDS	mg/L		415
TDS A/C Balance	dec. %	0.80 - 1.20	1.02

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COMPLETE ANALYTICAL SERVICES

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LABORATORY ANALYSIS REPORT
POWER RESOURCES

Sample ID:	M.S.A.
Laboratory ID:	30132-1
Sample Matrix:	Water
Sample Date/Time:	01-06-00/NST
Report Date:	February 1, 2000

Major Ions	Method	Units	Reporting Limit	Results
Calcium	EPA 200.7	mg/L	1.0	46.8
Magnesium	EPA 200.7	mg/L	1.0	11.1
Sodium	EPA 200.7	mg/L	1.0	54.6
Potassium	EPA 200.7	mg/L	1.0	6.40
Carbonate	SM 2320-B	mg/L	1.0	2.66
Bicarbonate	SM 2320-B	mg/L	1.0	210
Sulfate	SM 4500-SO_4-E	mg/L	1.0	91.3
Chloride	SM 4500-Cl-B	mg/L	1.0	7.30
Ammonium as N	SM 4500-NH_3-G	mg/L	0.05	0.20
Nitrite as N	SM 4500-NO_2-B	mg/L	0.10	< 0.10
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.10	< 0.10
Fluoride	SM 4500-F-C	mg/L	0.10	0.17
Silica	EPA 200.7	mg/L	1.0	13.5

Non-Metals				
Total Dissolved Solids @ 180°C	SM 2540-C-Mod	mg/L	2.0	318
Conductivity	EPA 120.1	µmho/cm	1.0	539
Alkalinity	SM 2320-B	mg/L	1.0	177
pH	SM 4500-H-B	std. units	0.10	8.35

Trace Metals				
Aluminum	EPA 200.7	mg/L	0.10	< 0.10
Arsenic	EPA 200.8	mg/L	0.001	< 0.001
Barium	EPA 200.7	mg/L	0.10	< 0.10
Boron	EPA 200.7	mg/L	0.10	< 0.10
Cadmium	EPA 200.8	mg/L	0.005	< 0.005
Chromium	EPA 200.7	mg/L	0.05	< 0.05
Copper	EPA 200.7	mg/L	0.01	< 0.01
Iron	EPA 200.7	mg/L	0.03	< 0.03
Lead	EPA 200.7	mg/L	0.05	< 0.05
Manganese	EPA 200.7	mg/L	0.01	0.03
Mercury	EPA 200.8	mg/L	0.001	< 0.001
Molybdenum	EPA 200.7	mg/L	0.10	< 0.10
Nickel	EPA 200.7	mg/L	0.05	< 0.05
Selenium	EPA 200.8	mg/L	0.001	0.003
Vanadium	EPA 200.7	mg/L	0.10	< 0.10
Zinc	EPA 200.7	mg/L	0.01	< 0.01

Radiometrics				
Uranium	EPA 200.8	mg/L	0.0003	0.0087
Radium 226	EPA 903.0	pCi/L	0.2	16.9
Radium Error Estimate ±				1.2

Quality Assurance Data		Target Range	
Anion	meq		5.66
Cation	meq		5.83
WYDEQ A/C Balance	%	-5 - +5	1.46
Calc TDS	mg/L		340
TDS A/C Balance	dec. %	0.80 - 1.20	0.94

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COMPLETE ANALYTICAL SERVICES

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WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M3

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5031.27	
01/19/99				5024.74	
02/02/99				5023.70	
02/04/99	4	215	540	5023.71	
02/15/99				5024.36	
03/01/99				5024.91	
03/15/99				5026.68	
03/30/99				5028.14	
03/31/99	3	206	529	5028.14	
04/13/99				5028.26	
04/27/99				5026.45	
05/13/99				5022.77	
05/25/99				5023.40	
05/26/99	3	216	538	5023.27	
06/09/99				5027.01	
06/22/99				5023.58	
07/06/99				5023.03	
07/20/99				5022.61	
07/20/99	3	208	539	5022.61	
08/03/99				5025.20	
08/17/99				5030.15	
08/31/99				5010.66	
09/14/99				5027.51	
09/16/99	3	214	535	5027.43	
09/30/99				5018.86	
10/14/99				5013.27	
11/09/99				5018.66	
11/10/99	3	215	542	5018.66	
11/23/99				5017.50	
12/07/99				5015.76	
12/21/99				5019.16	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M4

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
02/04/99	5	221	563	5017.75	
03/31/99	4	209	541	5018.42	
05/26/99	4	218	549	5016.21	
07/20/99	4	213	552	5020.05	
09/16/99	4	218	551	5020.65	
11/10/99	3	219	545	5014.96	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M5

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5030.76	
01/19/99				5021.92	
01/22/99				5020.77	
02/02/99				5020.64	
02/04/99	4	213	543	5020.62	
02/15/99				5021.13	
03/01/99				5020.70	
03/15/99				5024.32	
03/30/99				5025.92	
03/31/99	3	203	533	5025.92	
04/13/99				5025.63	
04/27/99				5023.99	
05/13/99				5020.04	
05/25/99				5020.03	
05/26/99	3	209	546	5020.38	
06/09/99				5022.58	
06/22/99				5023.56	
07/06/99				5022.92	
07/20/99				5015.17	
07/20/99	3	205	539	5015.17	
08/03/99				5018.40	
08/17/99				5015.79	
08/31/99				5025.93	
09/14/99				5034.90	
09/16/99	3	208	540	5019.07	
09/30/99				5030.39	
10/14/99				5026.44	
11/09/99				5014.90	
11/10/99	5	211	548	5014.90	
11/23/99				5013.96	
12/07/99				5012.20	
12/21/99				5011.42	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M6

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/22/99				5020.30	
02/04/99	5	190	529	5017.24	
03/31/99	5	183	521	5023.20	
05/26/99	4	187	530	5020.80	
07/20/99	5	187	529	5019.37	
09/16/99	4	193	536	5018.32	
11/10/99	6	192	534	5009.66	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M7

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5031.62	
01/19/99				5022.03	
01/22/99				5020.76	
02/02/99				5021.40	
02/05/99	3	202	511	5021.36	
02/15/99				5022.10	
03/01/99				5023.22	
03/15/99				5024.80	
03/30/99				5022.67	
03/31/99	3	194	506	5022.67	
04/13/99				5023.28	
04/27/99				5023.90	
05/13/99				5020.49	
05/25/99				5019.39	
05/26/99	3	206	529	5020.33	
06/09/99				5022.11	
06/22/99				5022.29	
07/06/99				5021.10	
07/20/99	3	199	518	5018.08	
08/03/99				5012.06	
08/17/99				5013.18	
08/31/99				5014.11	
09/14/99				5013.39	
09/16/99	3	202	522	5015.36	
09/30/99				5011.15	
10/14/99				5005.72	
11/09/99				5014.41	
11/10/99	3	206	523	5014.41	
11/23/99				5013.39	
12/07/99				5011.67	
12/21/99				5010.06	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M8A

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/08/99	7	210	571	5028.38	<0.1
01/22/99				5028.38	
02/04/99	7	212	557	5020.24	
04/05/99	7	211	564	5031.82	<0.1
05/05/99	7	212	558	5027.17	<0.1
06/04/99	7	211	565	5026.00	<0.1
07/06/99	8	214	538	5025.01	<0.1
08/04/99	7	213	559	5027.54	<0.1
09/07/99	9	221	529	5026.29	<0.1
10/07/99	8	212	557	5028.48	
11/08/99	8	220	580	5016.51	<0.1
12/10/99	7	206	557	5012.34	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M9

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5038.79	
01/19/99				5018.62	
01/22/99				5018.24	
02/02/99				5015.30	
02/04/99	5	213	538	5015.30	
02/15/99				5024.37	
03/01/99				5025.16	
03/15/99				5027.20	
03/30/99				5025.97	
03/31/99	5	203	524	5025.97	
04/27/99				5024.64	
05/13/99				5020.57	
05/25/99				5020.01	
05/26/99	5	209	534	5026.35	
06/09/99				5024.82	
06/22/99				5020.26	
07/06/99				5018.17	
07/20/99				5019.10	
07/20/99	5	207	532	5019.10	
08/03/99				5021.74	
08/17/99				5022.96	
08/31/99				5027.24	
09/14/99				5019.75	
09/16/99	5	210	528	5018.50	
09/30/99				5022.11	
10/14/99				5019.60	
11/09/99				5020.09	
11/10/99	5	212	533	5020.09	
11/23/99				5019.06	
12/07/99				5017.32	
12/21/99				5015.41	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M10A

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/04/99	8	294	633	5033.08	<0.1
01/11/99	8	305	656	5020.61	<0.1
01/18/99	8	318	654	5018.22	<0.1
01/25/99	8	326	671	5020.28	0.1
02/01/99	8	320	660	5019.59	0.2
02/08/99	8	318	662	5023.55	<0.1
02/15/99	9	318	648	5021.29	0.1
02/22/99	8	320	662	5023.65	<0.1
03/01/99	8	322	677	5019.12	<0.1
03/08/99	8	317	664	5035.80	0.1
03/15/99	10	304	678	5023.63	0.1
03/22/99	8	311	674	5018.95	0.1
03/29/99	8	314	672	5026.49	<0.1
04/05/99	8	326	665	5021.15	0.1
04/12/99	8	336	643	5019.91	<0.1
04/19/99	9	333	683	5022.16	0.1
04/26/99	9	336	642	5023.09	<0.1
05/03/99	8	336	682	5024.00	0.1
05/10/99	8	333	678	5024.81	<0.1
05/17/99	8	343	675	5023.85	0.1
05/24/99	9	341	663	5020.10	0.1
06/01/99	8	340	666	5021.97	0.1
06/07/99	8	338	654	5022.70	0.1
06/14/99	8	346	685	5020.01	0.1
06/21/99	8	352	671	5020.82	0.1
06/28/99	7	348	703	5022.38	<0.1
07/06/99	8	352	690	5022.10	<0.1
07/12/99	8	349	684	5023.38	0.5
07/19/99	7	350	709	5024.13	0.2
07/26/99	8	342	702	5026.82	0.1
08/02/99	8	350	690	5029.61	0.1
08/10/99	8	341	690	5031.93	0.1
08/16/99	8	345	690	5026.54	0.1
08/23/99	8	348	690	5025.20	<0.1
08/30/99	8	346	692	5027.70	0.1
09/07/99	8	352	679	5026.73	<0.1
09/29/99	8	376	722	5025.94	0.1
10/04/99	10	366	679	5025.18	0.1
10/11/99	8	365	693	5017.33	<0.1
10/18/99	8	362	696	5015.13	0.1
10/25/99	8	367	701	5020.95	0.2
11/01/99	8	368	711	5014.56	0.2
11/08/99	10	372	711	5014.27	0.1
11/15/99	10	377	682	5012.64	<0.1
11/22/99	8	378	684	5010.94	<0.1

WELL M10A CONTINUED

11/29/99	8	378	701	5010.41	0.2
12/06/99	10	387	696	5009.81	0.1
12/13/99	8	389	689	5009.45	0.2
12/20/99	8	385	717	5008.81	0.1
12/27/99	8	384	717	5009.83	0.1

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M11

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/04/99	22	288	713	5032.32	0.3
01/11/99	22	289	716	5020.45	0.3
01/18/99	23	292	709	5018.16	0.4
01/25/99	23	289	711	5015.54	0.4
02/01/99	22	290	706	5021.46	0.5
02/08/99	22	288	708	5023.08	0.3
02/15/99	22	286	690	5022.30	0.3
02/24/99	23	291	714	5023.18	0.3
03/01/99	22	285	715	5017.83	0.2
03/08/99	22	288	713	5039.38	0.2
03/15/99	23	273	718	5031.84	0.3
03/22/99	23	274	710	5035.38	0.3
03/29/99	22	277	713	5026.60	0.3
04/05/99	22	287	709	5024.35	0.3
04/12/99	22	291	698	5025.41	0.2
04/19/99	23	291	719	5027.13	0.3
04/26/99	24	292	709	5028.70	0.2
05/03/99	23	295	720	5028.42	0.3
05/10/99	22	291	716	5027.62	0.2
05/17/99	23	290	722	5028.69	0.4
05/24/99	24	291	700	5021.20	0.3
06/01/99	23	289	716	5022.95	0.3
06/07/99	23	289	710	5025.40	0.3
06/14/99	23	293	714	5020.56	0.3
06/21/99	24	291	717	5022.40	0.3
06/28/99	22	285	718	5024.07	0.2
07/06/99	24	287	714	5022.76	0.3
07/12/99	24	287	743	5025.45	<0.1
07/19/99	22	283	728	5026.08	0.3
07/26/99	22	283	724	5029.33	0.3
08/02/99	23	290	716	5031.17	0.3
08/10/99	22	284	717	5032.89	0.3
08/16/99	22	286	711	5026.98	0.2
08/23/99	22	285	712	5026.02	0.2
08/30/99	22	285	711	5027.99	0.2
09/07/99	23	286	700	5026.62	0.1
09/29/99	24	289	722	5025.73	0.1
10/04/99	23	288	717	5025.02	0.3
10/11/99	22	287	720	5017.59	0.2
10/18/99	23	287	707	5017.48	0.3
10/25/99	23	289	711	5020.75	0.3
11/01/99	22	287	710	5015.07	0.3
11/08/99	23	287	718	5014.87	0.2
11/15/99	23	287	704	5010.75	0.1
11/22/99	24	289	706	5008.66	0.1

WELL M11 CONTINUED

11/29/99	22	294	705	5007.96	0.2
12/08/99	21	285	702	5007.37	0.2
12/13/99	23	290	699	5010.02	0.2
12/20/99	22	292	704	5009.48	0.3
12/27/99	22	291	705	5010.65	0.2

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M12

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5029.54	
01/19/99				5013.51	
02/02/99				5017.56	
02/04/99	11	225	574	5017.54	
02/15/99				5019.09	
03/01/99				5019.88	
03/15/99				5021.61	
03/30/99				5024.61	
03/31/99	11	214	564	5024.61	
04/13/99				5025.34	
04/27/99				5022.79	
05/13/99				5019.77	
05/25/99				5019.39	
05/26/99	10	224	562	5019.59	
06/09/99				5023.19	
06/22/99				5021.47	
07/06/99				5021.29	
07/20/99				5016.01	
07/21/99	3	206	512	5016.01	
08/03/99				5019.65	
08/17/99				5025.81	
08/31/99				5019.17	
09/14/99				5017.61	
09/16/99	10	219	566	5017.71	
09/30/99				5017.18	
10/14/99				5015.00	
11/09/99				5012.78	
11/10/99	9	221	569	5012.78	
11/23/99				5011.19	
12/07/99				5009.45	
12/21/99				5008.21	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M13

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
02/05/99	4	210	523	5027.07	
03/31/99	5	197	520	5029.73	
05/26/99	4	202	529	5028.55	
07/21/99	5	204	527	5025.60	
09/16/99	5	199	523	5026.23	
11/10/99	4	211	534	5023.77	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M14

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5034.43	
01/19/99				5027.69	
02/01/99				5027.60	
02/02/99				5027.44	
02/05/99	3	214	522	5027.43	
02/15/99				5026.93	
03/15/99				5028.75	
03/30/99				5029.40	
04/01/99	3	208	532	5029.40	
04/13/99				5029.24	
04/27/99				5058.53	
05/13/99				5026.90	
05/25/99				5027.10	
05/27/99	3	216	517	5026.32	
06/09/99				5028.97	
06/22/99				5016.37	
07/06/99				5016.33	
07/20/99				5011.15	
07/21/99	3	213	526	5014.69	
08/03/99				5018.02	
08/17/99				5017.56	
08/31/99				5030.55	
09/14/99				5027.41	
09/17/99	3	213	515	5010.79	
09/30/99				5029.83	
10/14/99				5025.32	
11/09/99				5023.00	
11/11/99	3	216	534	5022.65	
11/23/99				5021.84	
12/07/99				5021.30	
12/21/99				5020.27	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M15

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
01/05/99				5032.78	
01/19/99				5028.99	
02/02/99				5028.13	
02/05/99	3	216	524	5028.12	
02/15/99				5027.63	
03/01/99				5028.38	
03/15/99				5031.18	
03/30/99				5029.98	
04/01/99	3	208	526	5029.98	
04/13/99				5030.10	
04/27/99				5029.38	
05/13/99				5027.17	
05/25/99				5027.48	
05/27/99	3	209	523	5026.38	
06/09/99				5028.60	
06/22/99				5026.88	
07/06/99				5026.46	
07/20/99				5023.38	
07/21/99	3	203	508	5023.38	
08/03/99				5025.08	
08/17/99				5017.96	
08/31/99				5031.09	
09/14/99				5028.32	
09/17/99	3	206	526	5009.85	
09/30/99				5027.25	
10/14/99				5025.48	
11/09/99				5024.93	
11/11/99	3	208	518	5023.63	
11/23/99				5023.97	
12/07/99				5023.54	
12/21/99				5019.73	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M16

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	287	688		
02/05/99	5	208	523	5027.21	
04/01/99	6	195	520	5027.19	
05/27/99	6	197	525	5024.35	
07/21/99	6	200	529	5021.92	
09/17/99	6	197	527	5014.87	
11/11/99	7	193	517	5020.09	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL M01

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	16.00	276	795		
01/20/99	5	201	678	5052.34	
03/17/99	4	186	629	5053.05	
05/12/99	4	202	656	5053.40	
07/07/99	5	214	633	5052.76	
09/01/99	4	203	609	5053.59	
10/27/99	6	216	614	5052.66	
12/22/99	6	228	629	5050.50	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MO2

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	16.00	276	795		
01/20/99	4	196	547	5048.71	
03/17/99	4	182	561	5049.88	
05/12/99	3	194	569	5049.21	
07/07/99	4	194	565	5048.18	
09/01/99	4	196	557	5050.32	
10/27/99	4	198	567	5049.17	
12/22/99	4	194	562	5046.76	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MU1

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	252	632		
01/20/99	3	191	530	5034.96	
03/17/99	3	179	519	5035.10	
05/12/99	3	190	527	5035.46	
07/07/99	3	187	520	5035.05	
09/01/99	3	188	513	5037.60	
10/27/99	3	191	517	5036.55	
12/22/99	3	193	518	5036.85	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MU2

Date	Chloride (mg/l)	Bicarbonate (mg/l)	Conductivity (uMhos/cm)	Water Elevation (ft. MSL)	U308 (mg/l)
NRC-DEQ UCL	9.00	252	632		
01/20/99	15	190	575	5028.53	
03/17/99	14	178	565	5029.85	
05/12/99	10	188	552	5033.49	
07/07/99	15	188	572	5033.72	
09/01/99	15	188	565	5035.42	
10/27/99	13	190	561	5030.40	
12/22/99	12	189	553	5024.39	

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MP1

Date	Chloride (mg/l)	Bicarb (mg/l)	Conductivity (uMhos/cm)	U308 (mg/l)	Water Elevation (ft. MSL)
Baseline High	4.70	224	562	0.07	
Target Values	4.20	215	525	0.04	
02/05/1999	12	236	560	0.4	5018.63
04/01/1999	11	238	571	0.1	5020.76
05/27/1999	11	268	631	0.8	5018.83
07/21/1999	13	254	625	0.2	5022.37
09/17/1999	12	234	598	0.2	5019.33
11/12/1999	12	254	621	0.3	5017.65

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MP2

Date	Chloride (mg/l)	Bicarb (mg/l)	Conductivity (uMhos/cm)	U308 (mg/l)	Water Elevation (ft. MSL)
Baseline High	4.70	224	536	0.09	
Target Values	4.20	215	525	0.04	
02/05/1999	18	238	636	0.3	5019.61
04/01/1999	17	219	647	0.1	5020.38
05/27/1999	17	222	679	0.7	5018.71
07/21/1999	18	244	708	0.1	5022.36
09/17/1999	16	210	680	0.2	5020.04
11/11/1999	18	264	692	<0.1	5020.05

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MP3

Date	Chloride (mg/l)	Bicarb (mg/l)	Conductivity (uMhos/cm)	U308 (mg/l)	Water Elevation (ft. MSL)
Baseline High	4.80	214	553	0.03	
Target Values	4.20	215	535	0.04	
02/05/1999	18	248	642	0.7	5005.15
04/01/1999	18	252	691	0.5	5018.91
05/27/1999	17	233	646	1.5	5017.24
07/21/1999	6	124	366	0.5	5020.08
09/17/1999	15	208	614	0.6	5017.29
11/11/1999	17	246	707	0.6	5013.62

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MP4

Date	Chloride (mg/l)	Bicarb (mg/l)	Conductivity (uMhos/cm)	U308 (mg/l)	Water Elevation (ft. MSL)
Baseline High	4.90	212	523	0.05	
Target Values	4.20	215	525	0.04	
02/05/1999	18	320	661	5.5	5028.48
04/01/1999	18	308	685	10.8	5027.18
05/27/1999	18	304	703	11.5	5018.60
07/21/1999	19	327	732	10.8	5020.89
09/17/1999	19	294	717	10.4	5017.61
11/11/1999	20	299	716	10.6	5018.68

WELL DATA FOR POWER RESOURCES 03/27/2000

DATA FOR WELL MP5

Date	Chloride (mg/l)	Bicarb (mg/l)	Conductivity (uMhos/cm)	U308 (mg/l)	Water Elevation (ft. MSL)
Baseline High	5.20	224	519	0.06	
Target Values	4.20	215	525	0.04	
02/05/1999	14	241	546	5.9	0.00
04/01/1999	17	282	655	7.9	5025.19
05/27/1999	18	294	692	6.6	5016.70
07/21/1999	18	292	692	6.7	5020.21
09/17/1999	17	274	688	10.1	5015.37
11/11/1999	18	271	708	11.0	5015.65

Attachment A

Responses to P. Cutillo's Memorandum Dated August 3, 1999 Concerning PRI's A-Wellfield Ground Water Restoration Report

Stability

1. LQD Comment

   PRI has requested to sample production wells for all Guideline No. 8 parameters every two months during stability. This request is acceptable.

   PRI Response

   No response necessary.

2. LQD Comment

   PRI has requested that the water quality data collected in February 1999 be considered the first round of the required samples for the stability period. This request is acceptable.

   PRI Response

   No response necessary.

3. LQD Comment

   Please provide a list of all wells, and their monitoring schedule that will be sampled to determine stability and restoration success.

   PRI Response

   Prior to the start of mining operations in the A-Wellfield, five wells (MP-1 through MP-5) were completed in the mineralized portion of the 20-Sand production zone. These wells were used to establish baseline water quality for the wellfield as a mine average. As required in the Permit to Mine, these were also the wells used to determine restoration success. During the stabilization period, these same wells were used to determine the stability of the ground water quality. These wells were sampled three times during the stabilization period with at least two months between sampling events and were analyzed for a full suite of LQD Guideline No. 8 parameters. The dates these wells were sampled are included in the A-Wellfield Ground Water Quality Stabilization Report (attached), Section 2.2.2, Table 1.

One perimeter ore zone monitor well, Well M-8A, was also sampled to determine restoration success. Well M-8A was sampled on January 6, 2000 and was analyzed for Guideline No. 8 parameters.

4. LQD Comment

Please provide an end of stability potentiometric surface map and at least six months of water level data, when obtained, to determine if the ground water flow pattern is stable.

PRI Response

A potentiometric surface map, which was developed from water level data collected at the end of stability, is provided as Figure 1 in the A-Wellfield Ground Water Quality Stabilization Report. As discussed in Section 2.2.1, Potentiometric Surface Map, this map shows that the ground water flow pattern is stable. Water level data are included for all of 1999 in Appendix 5.2.

5. LQD Comment

Please provide at least six months of water quality data, when obtained, to determine if the aquifer geochemistry is stable.

PRI Response

Over six months of water quality data was collected during stability. The data is presented in the A-Wellfield Ground Water Quality Stabilization Report. As discussed in Section 2.2.2, A-Wellfield Ground Water Quality, the data shows that the aquifer geochemistry is stable.

Production Wells

6. LQD Comment

PRI states that 20 of the 35 parameters have been returned to baseline or better water quality. Please discuss the method used to determine if a parameter has been returned to baseline.

PRI Response

PRI stated in the A-Wellfield Report dated April 23, 1999, that 20 of the 35 Guideline No. 8 parameters had been returned to baseline water quality. Prior to beginning mining operations, baseline water quality data was established for the MP-Wells. Baseline restoration values were calculated for each parameter on a mine unit average by using data obtained during the baseline sampling program from each MP-Well.

The method used to determine that a constituent had returned to baseline was a simple comparison for each parameter of the average end-of-restoration concentration for the five MP wells with the equivalent average baseline concentration. If the restoration average was equal to or less than the baseline average, then the parameter was considered "returned to baseline". Due to the limited number of samples, statistical methods were not used in this determination. Seventeen of the stated group of 20 water quality parameters meet this criterion.

In the April 23, 1999 report, PRI also concluded that three additional parameters, nitrite, nitrate and ammonia, had been returned to baseline even though the end-of-restoration concentrations did not appear to be the equal to or less than the respective baseline concentrations. A discussion of each of these parameters is presented below.

When the baseline water quality data was collected for nitrite and nitrate in 1987, the lab which performed the analysis (Energy Laboratories, Inc.) used a detection limit of 0.01 mg/l. The baseline concentrations recorded for nitrite and nitrate were at or below this detection limit of 0.01 mg/l. When annual restoration progress sampling began in 1991, the reporting limit had changed to 0.1 mg/l. Therefore, the concentrations of nitrite and nitrate were reported to this higher limit during restoration. This new reporting limit is $1/10^{th}$ of the Class I Domestic Use Suitability Standard for nitrite and $1/100^{th}$ of the Class I Domestic Use Suitability Standard for nitrate. The concentrations of these constituents were below the new reporting limit when last sampled in February 1999, therefore, they were included with the group of wells considered returned to baseline.

In the original submittal referenced above, ammonium was included in the list of parameters, which were returned to baseline. However, upon further review, it appears that ammonium does not meet the criteria as stated above to be included in this group. Therefore, in this report, PRI has revised the number of parameters, which have been returned to baseline from 20 to 19. It should be noted that the ammonium value has not increased significantly and does meet the Class I Domestic Use Suitability Standard of 0.05 mg/l.

Listed in Table 1 are the 19 parameters, which have been returned to baseline.

Table 1 A-Wellfield, Parameters Returned to Baseline

(All values in mg/l)

	BASELINE	END MINING	PRE-H2S	END REST
	(Aug. 1987)	(July 1991)	(May 1998)	(Feb. 1999)
Na	55.0	80.8	37.4	42.2
K	8.0	13.4	4.7	4.4
CO3	0.0	0.0	0.0	0.0
NO2	0.0	0.1	0.1	0.1
NO3	0.0	0.2	0.1	0.1
F	0.2	0.2	0.1	0.15
SiO2	16.0	20.5	12.6	11.9
Al	0.1	0.1	0.1	0.1
Ba	0.1	0.1	0.1	0.1
B	0.1	0.1	0.1	0.1
Cd	0.01	0.03	0.005	0.005
Cr	0.05	0.05	0.05	0.05
Cu	0.01	0.02	0.03	0.01
Pb	0.05	0.05	0.05	0.05
Hg	0.001	0.001	0.001	0.001
Mo	0.10	0.10	0.10	0.10
Ni	0.05	0.08	0.05	0.05
V	0.10	0.19	0.10	0.10
Zn	0.01	0.04	0.01	0.01

7. LQD Comment

PRI has stated that water from the 20-Sand will flow in a southwesterly direction towards the Exxon pit, via the 30-Sand and concludes that elevated levels of Se, Fe, and Mn will be naturally attenuated by precipitation, adsorption and dispersion before this water reaches the Exxon pit.

Due to the variable water quality of the 20-Sand, the high pre-mining water quality of the 30-Sand, the post-mine land use of the Exxon pit, and the presence of livestock wells in the area, the LQD is concerned that the elevated levels of Ra, Se, Fe, and Mn may impact water which is or will be suitable for domestic, livestock or fishery use. For these reasons, the LQD is requesting that PRI further support the above conclusion.

Please provide the estimated water quality over time of the 20-Sand ground water as it reaches the monitor well ring, the 30-Sand, and the Exxon pit. The volume of water from the 20-Sand, which is expected to contribute to the Exxon pit, should also be estimated.

PRI Response

Processes discussed in Section 2.2.3 of the A-Wellfield Ground Water Quality Stabilization Report describe the ability of the formation to cleanse the ground water. Through these processes, the formation actually determines the quality of the ground water. During the mining process the addition of oxygen and carbon dioxide altered the formation inside the pattern areas of the A-Wellfield. However, since the formation outside the mining patterns of the A-Wellfield was not impacted by the mining process, it has not been changed, and therefore the way it affects ground water, also has not changed. The ability of the formation to naturally determine ground water quality has remained the same. Therefore, a reasonable way to qualitatively estimate the water quality of the A-Wellfield ground water as it reaches the monitor well ring is to look at the current water quality and apply these natural processes to the water. As the water moves through the formation, the constituents which have been returned to baseline in the A-Wellfield will not increase, since it was the formation which determined the baseline values originally. Some of the constituents, which have been returned to the Class I Domestic Use Suitability Standard, may be lowered in concentration through dispersion, adsorption and precipitation, but it is unlikely that any will increase in concentration. The four remaining constituents that have not been returned to baseline or Class I Domestic Use Suitability Standard will be naturally attenuated, as discussed in Section 2.2.3, through one process or another. Therefore, it is estimated that the water quality of the A-Wellfield ground water at the monitor ring wells will be similar to the ground water quality currently in the A-Wellfield only with significantly lower concentrations of radium-226 and lesser concentrations of selenium, iron and manganese. It is expected that the remaining concentration of radium-226 will approach the baseline concentrations of the down gradient monitor ring wells and the selenium concentration will most likely be less than the EPA's drinking water standard.

Monitoring Wells

8. LQD Comment

Please determine and discuss if the monitor ring, overlying, and underlying monitoring wells are stable and have been returned to baseline. Guideline No. 8 analyses should be obtained for each well and the methods used to determine if these wells have been returned to baseline, needs to be stated.

PRI Response

A discussion of the stability of the monitor ring, overlying, and underlying monitoring wells is presented in Section 2.4.1 of the A-Wellfield Ground Water Quality Stabilization Report. The data collected for these wells during the stabilization period indicates that these wells are stable. Also, with the exceptions of Wells M-8A, M-10A and M-11, the data indicates that these wells have not been impacted by mining solutions. Therefore, it is not necessary to have Guideline No. 8 analyses performed on the other monitor ring wells, or the overlying and underlying wells.

9. LQD Comment

Please discuss the impact on restoration, if any, of the excursion at Well M-8A.

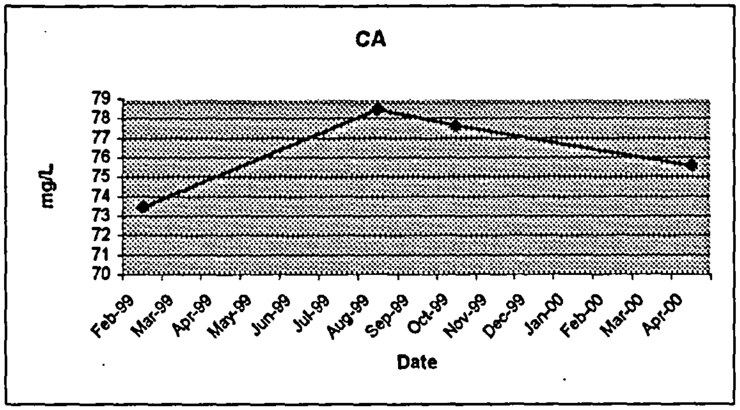
PRI Response

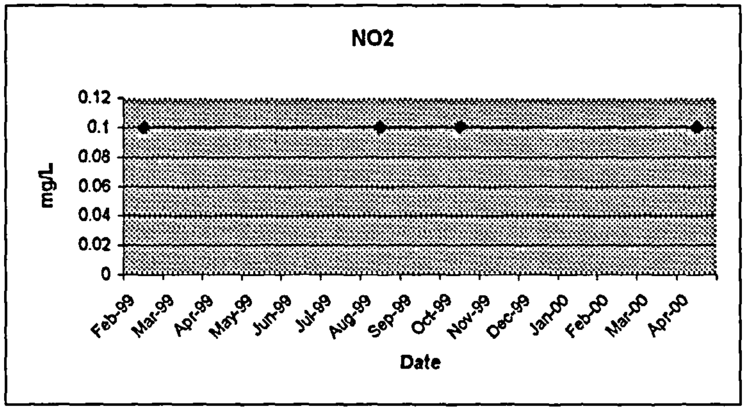
A discussion of the impact of the excursion at this well is presented in Section 2.4.2 of the A-Wellfield Ground Water Quality Stabilization Report. This excursion did not significantly impact the restoration of the A-Wellfield.

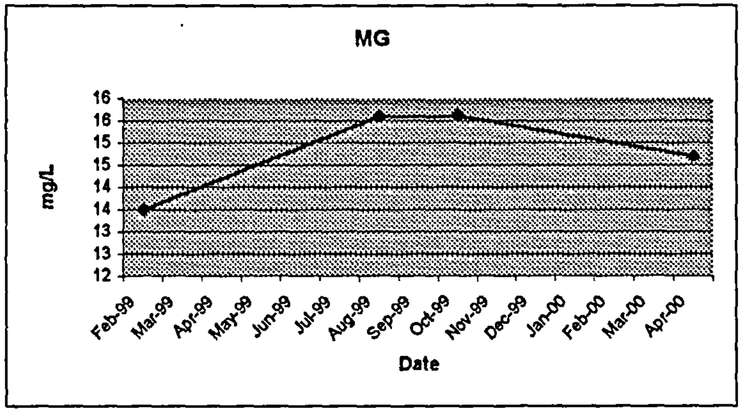
Attachment D

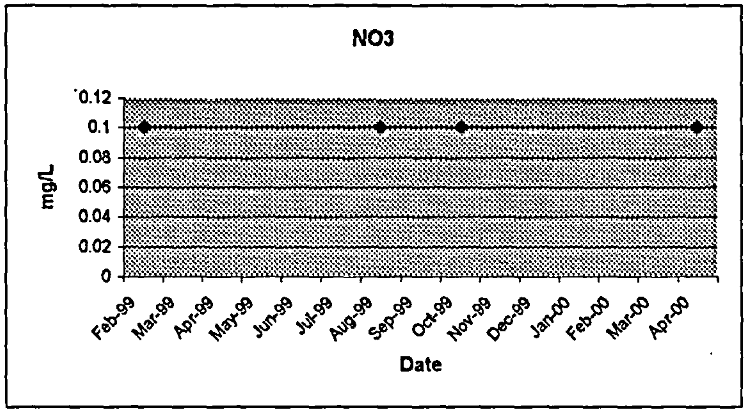
Graphs of Restored Ground Water at the Restoration (MP) Wells during the stability period (February through October 1999) including additional data collected on April 26, 2000

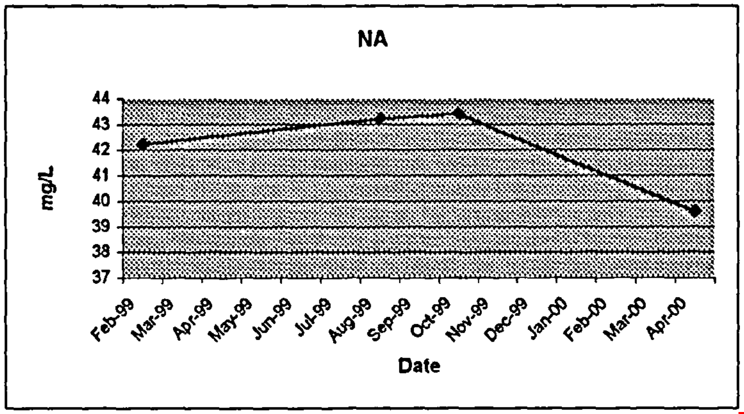
A-Wellfield MP-Well Stability Data

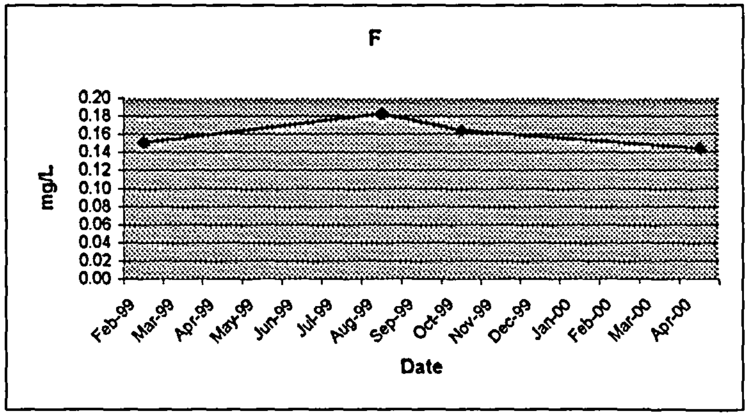




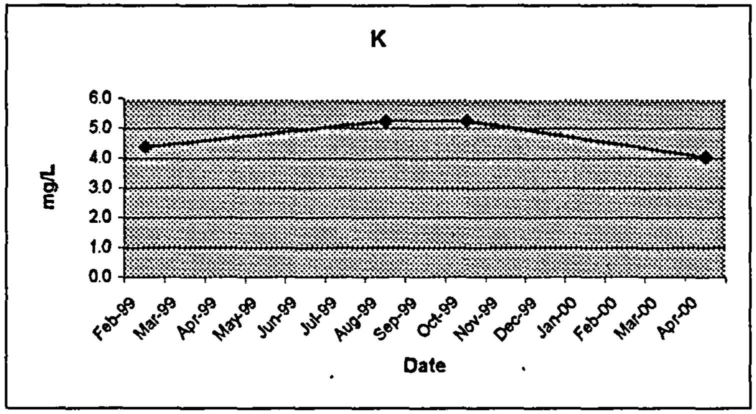


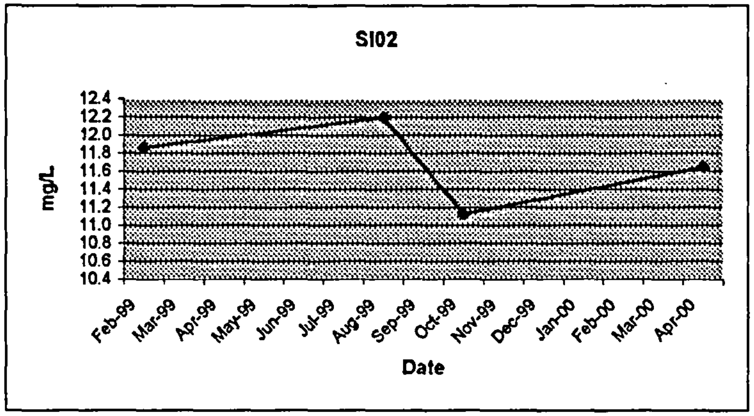


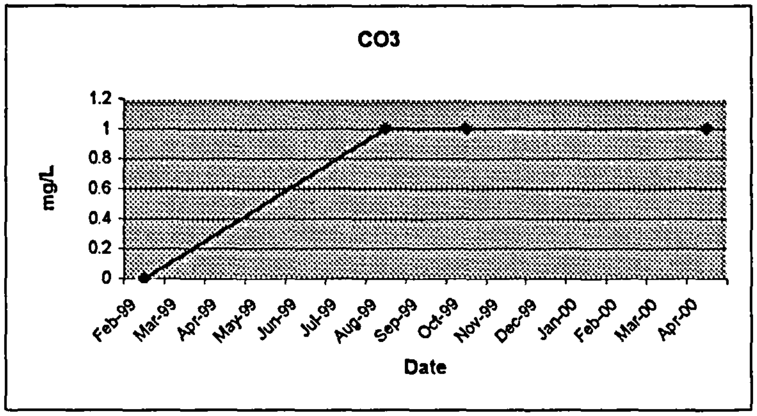


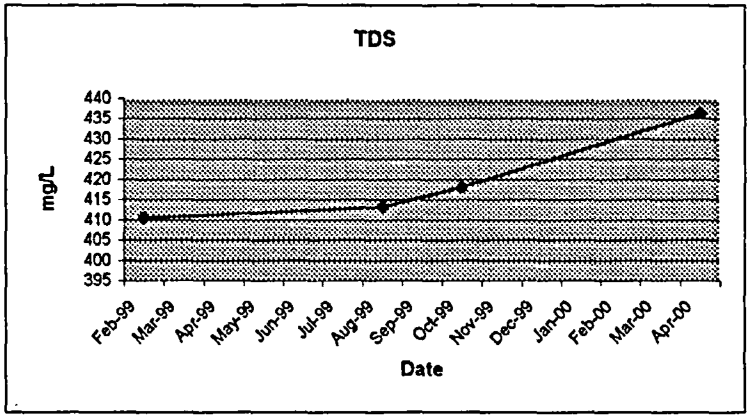


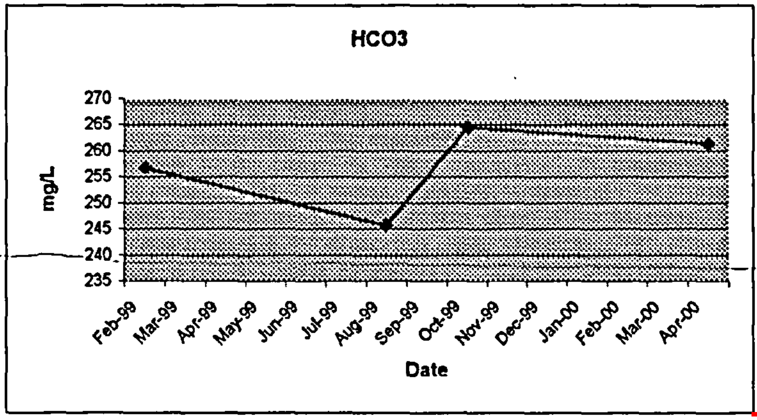
A-Wellfield MP-Well Stability Data

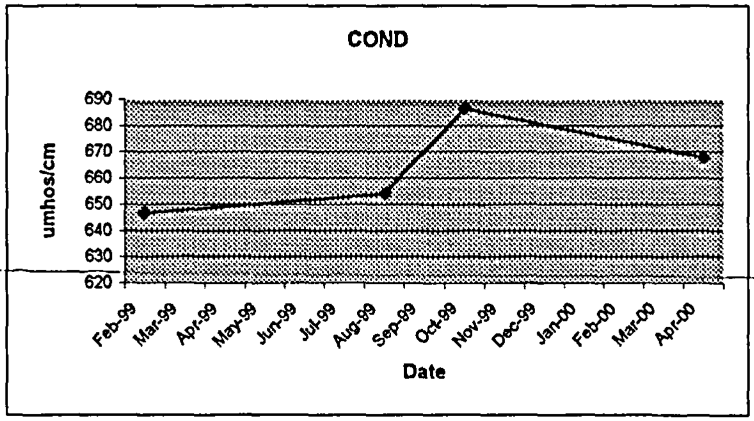




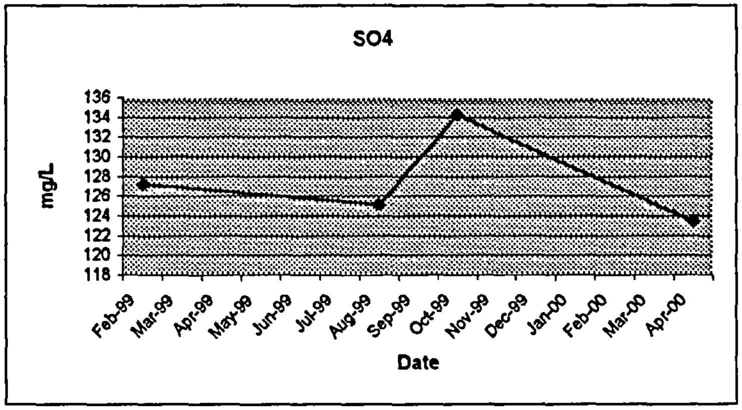


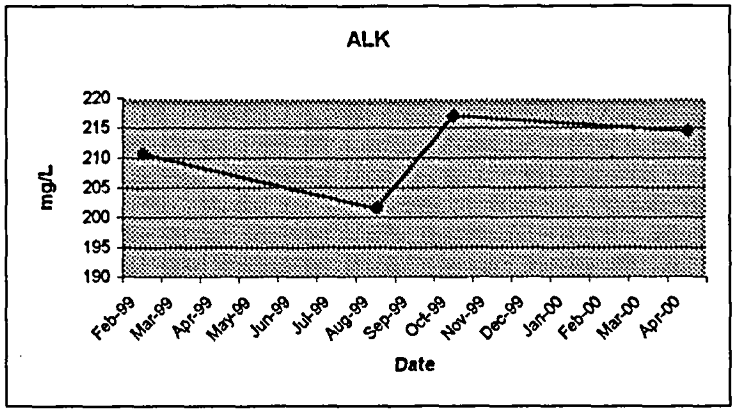


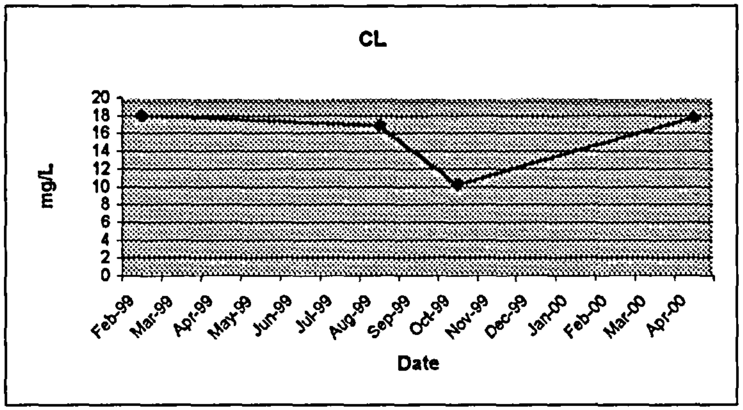


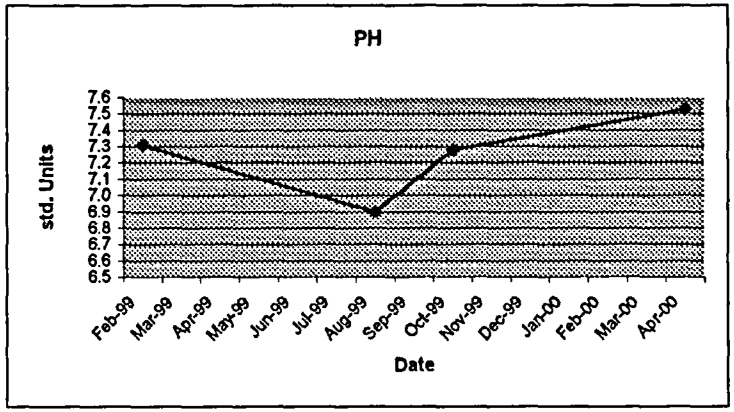


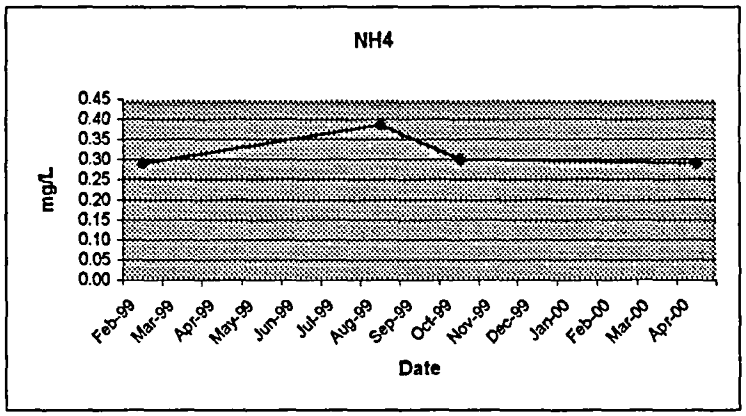
A-Wellfield MP-Well Stability Data

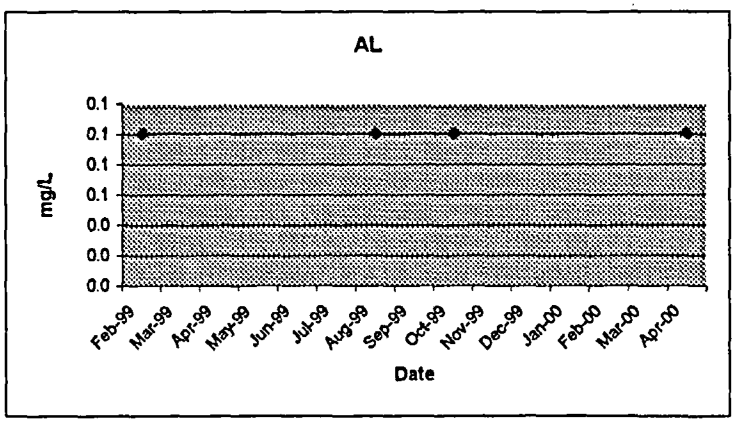




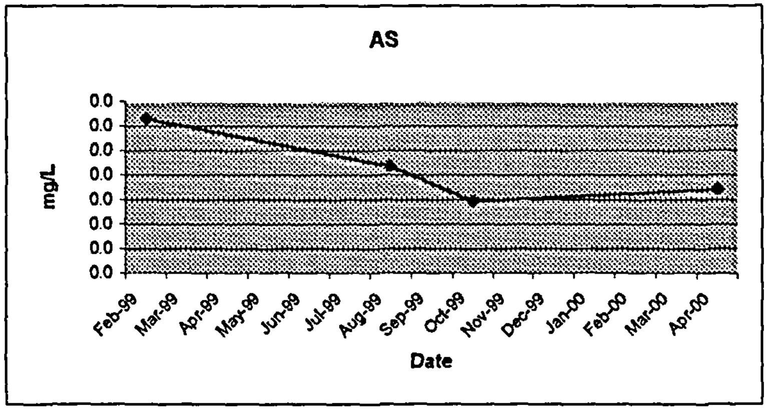


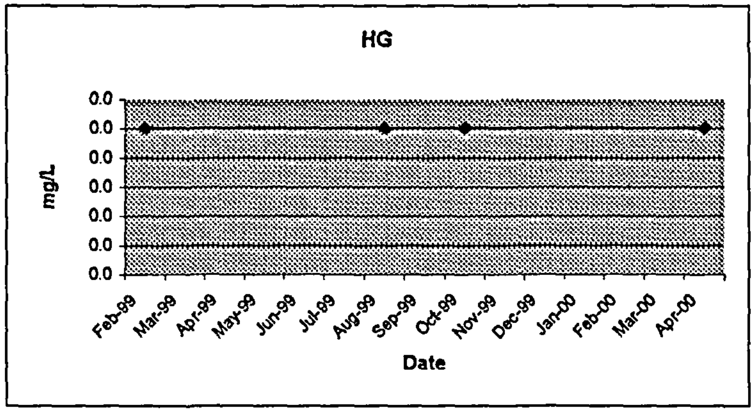


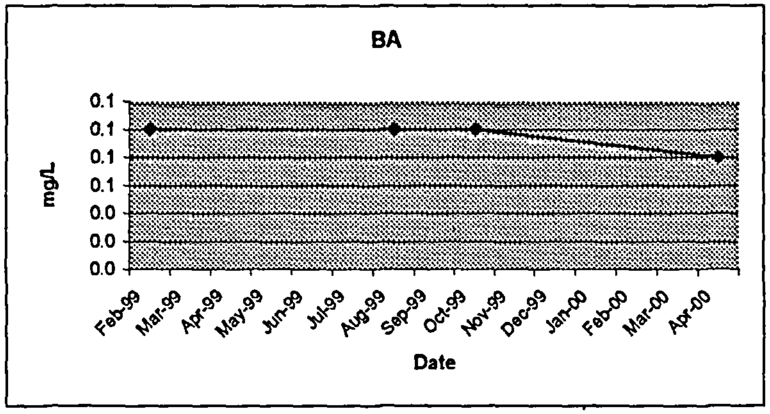


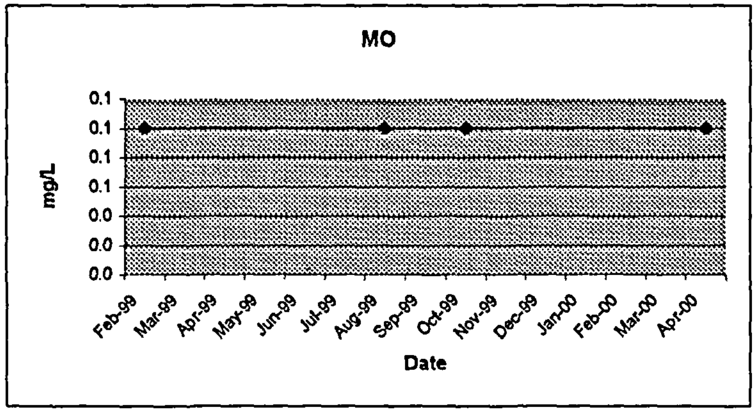


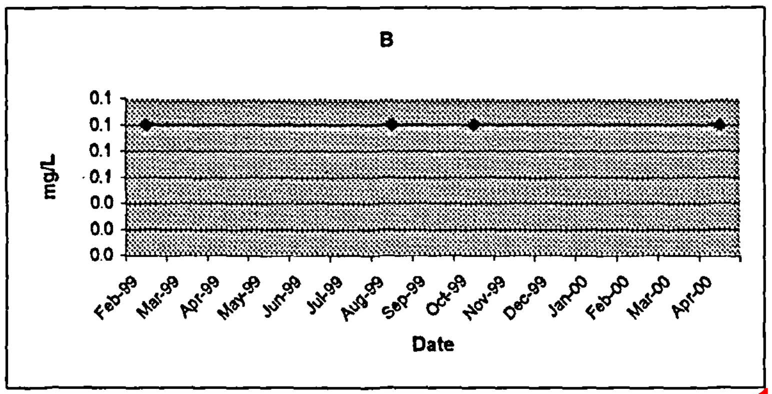
A-Wellfield MP-Well Stability Data

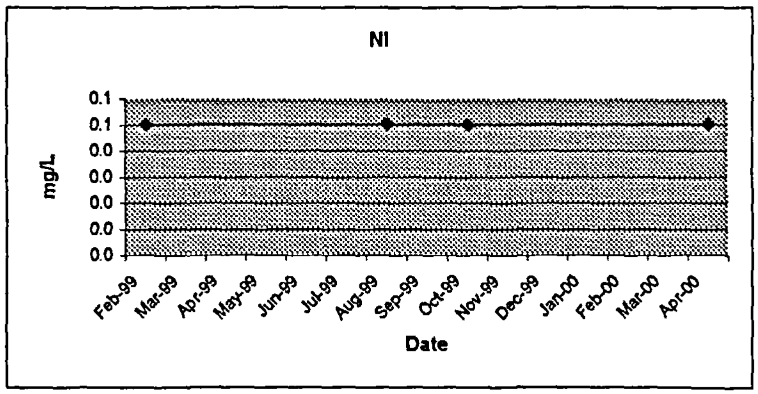




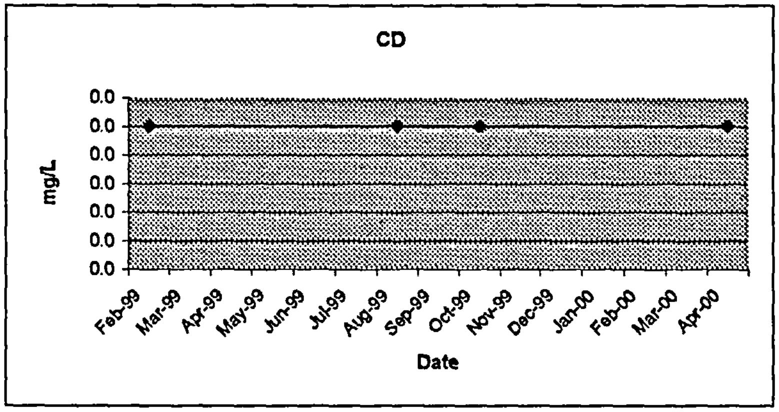


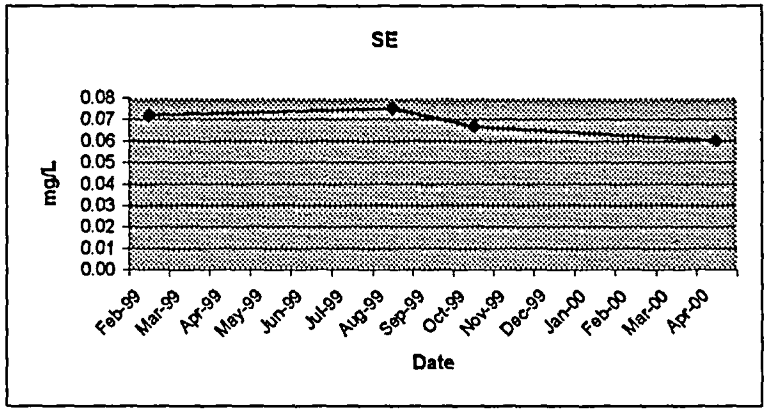


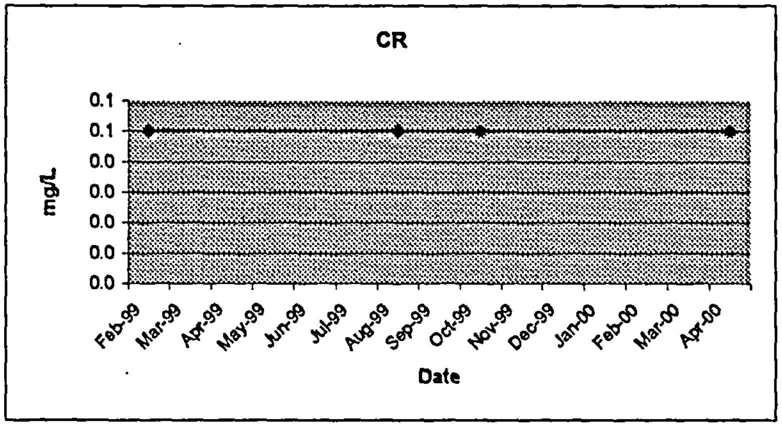


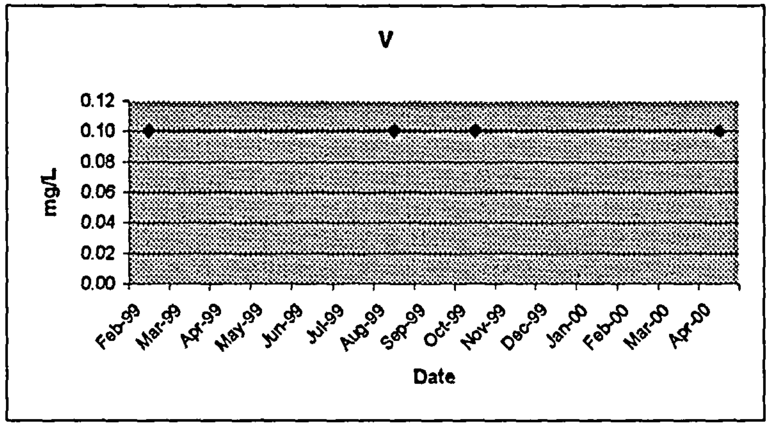


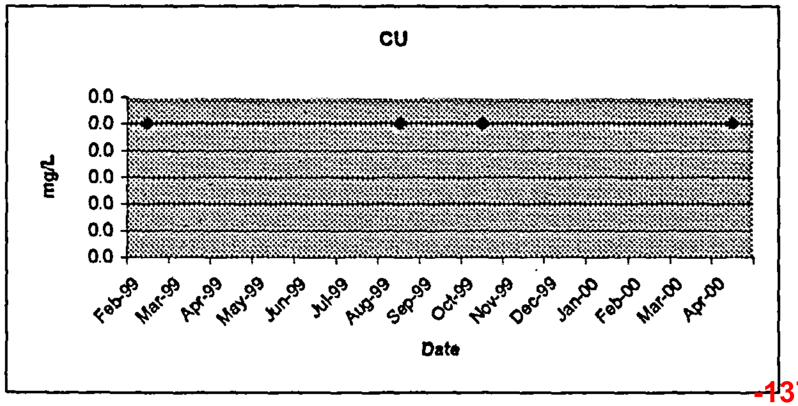
A-Wellfield MP-Well Stability Data

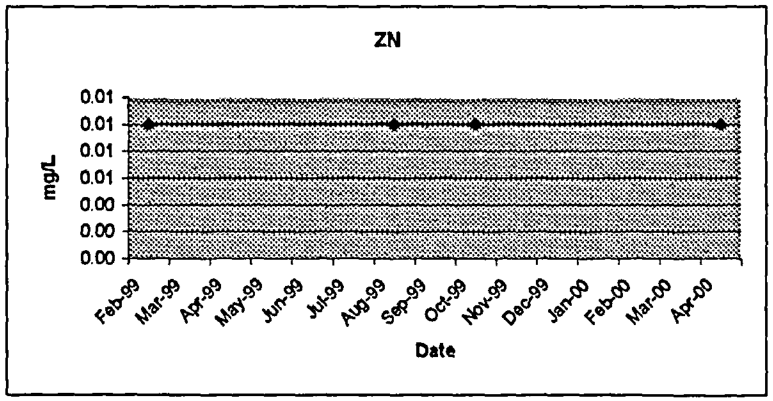




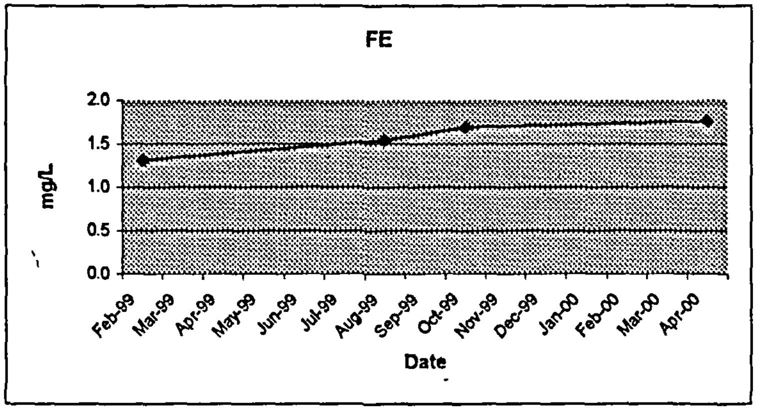


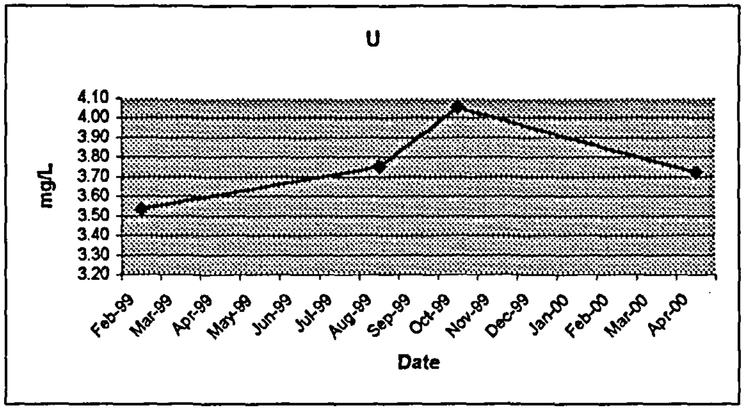


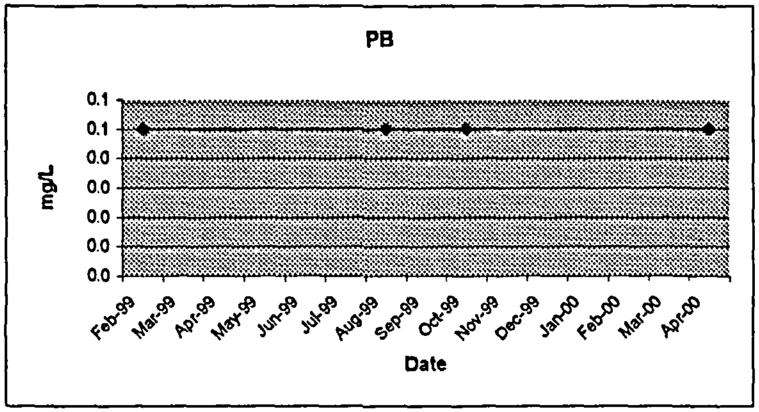


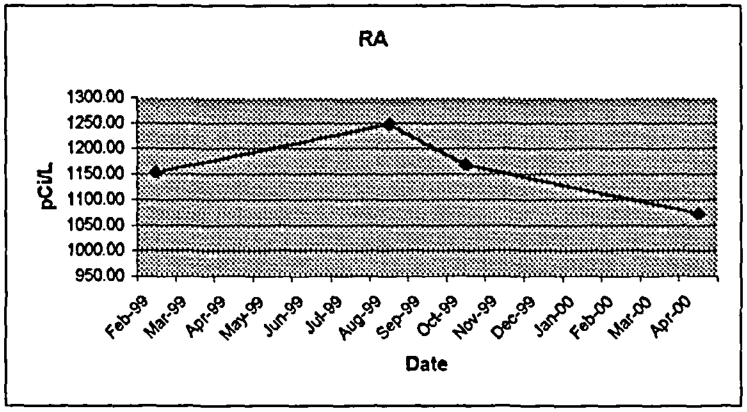


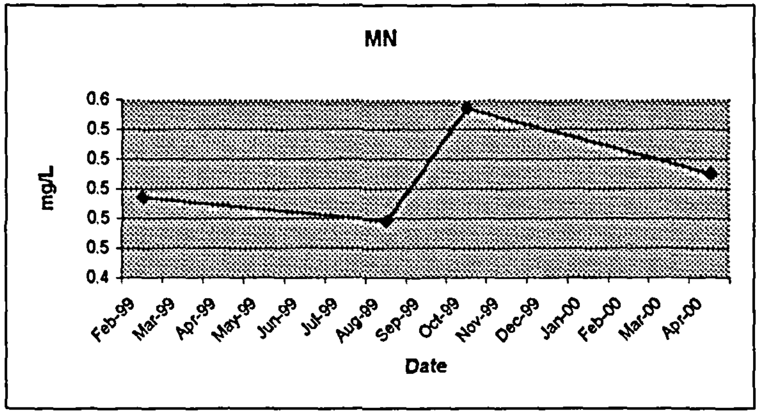
A-Wellfield MP-Well Stability Data





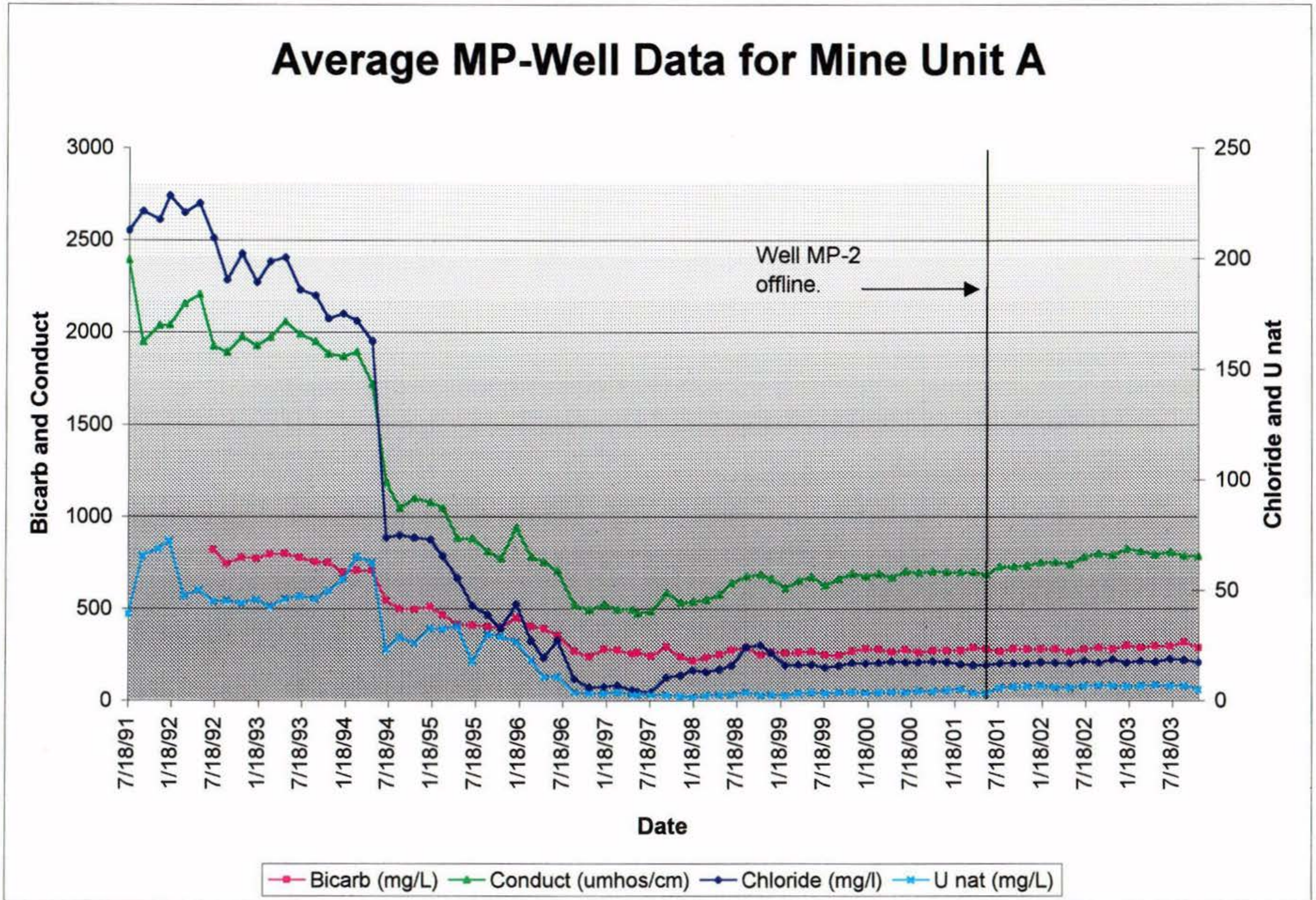






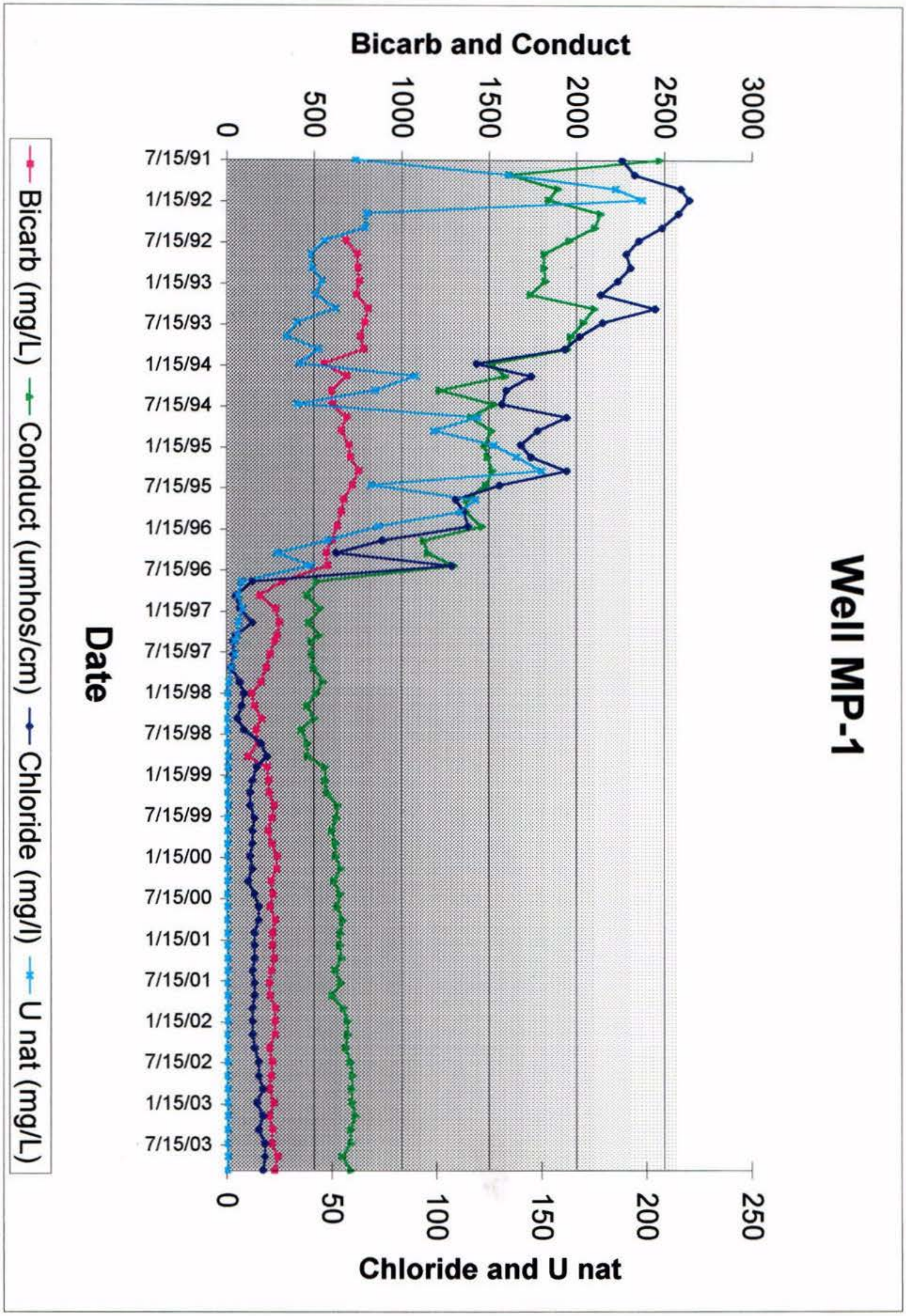
Attachment E

Graph of the average chloride, bicarbonate, conductivity and uranium from July 1991 (start of restoration) through November 2003 at the five Restoration Wells (Wells MP-1 through MP-5)

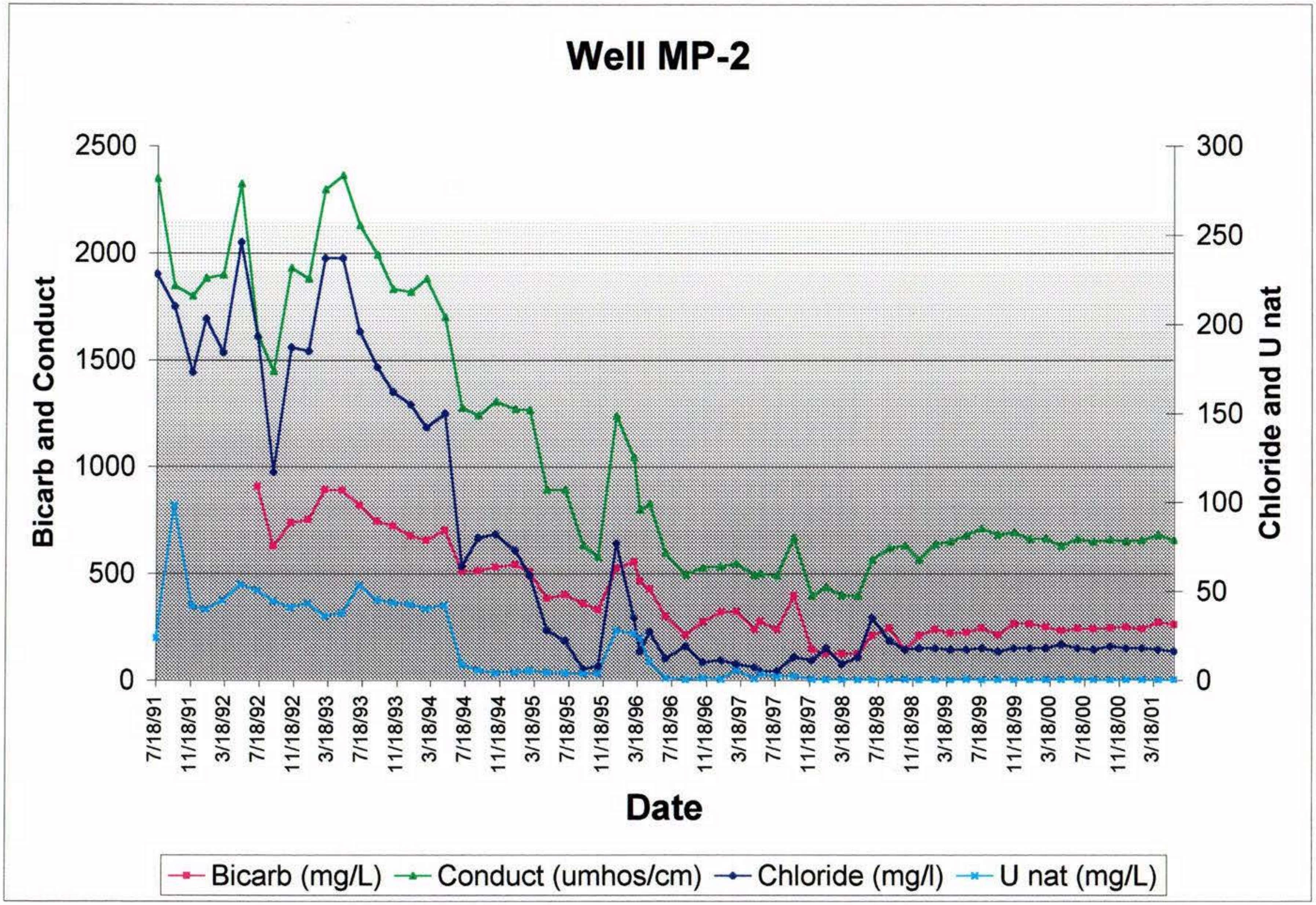

Average MP-Well Data for Mine Unit A
Bicarb and Conduct
3000
2500
2000
1500
1000
500
0
Chloride and U nat
250
200
150
100
50
0
Well MP-2
offline.
7/18/91
1/18/92
7/18/92
1/18/93
7/18/93
1/18/94
7/18/94
1/18/95
7/18/95
1/18/96
7/18/96
1/18/97
7/18/97
1/18/98
7/18/98
1/18/99
7/18/99
1/18/00
7/18/00
1/18/01
7/18/01
1/18/02
7/18/02
1/18/03
7/18/03
Date
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)

Attachment F

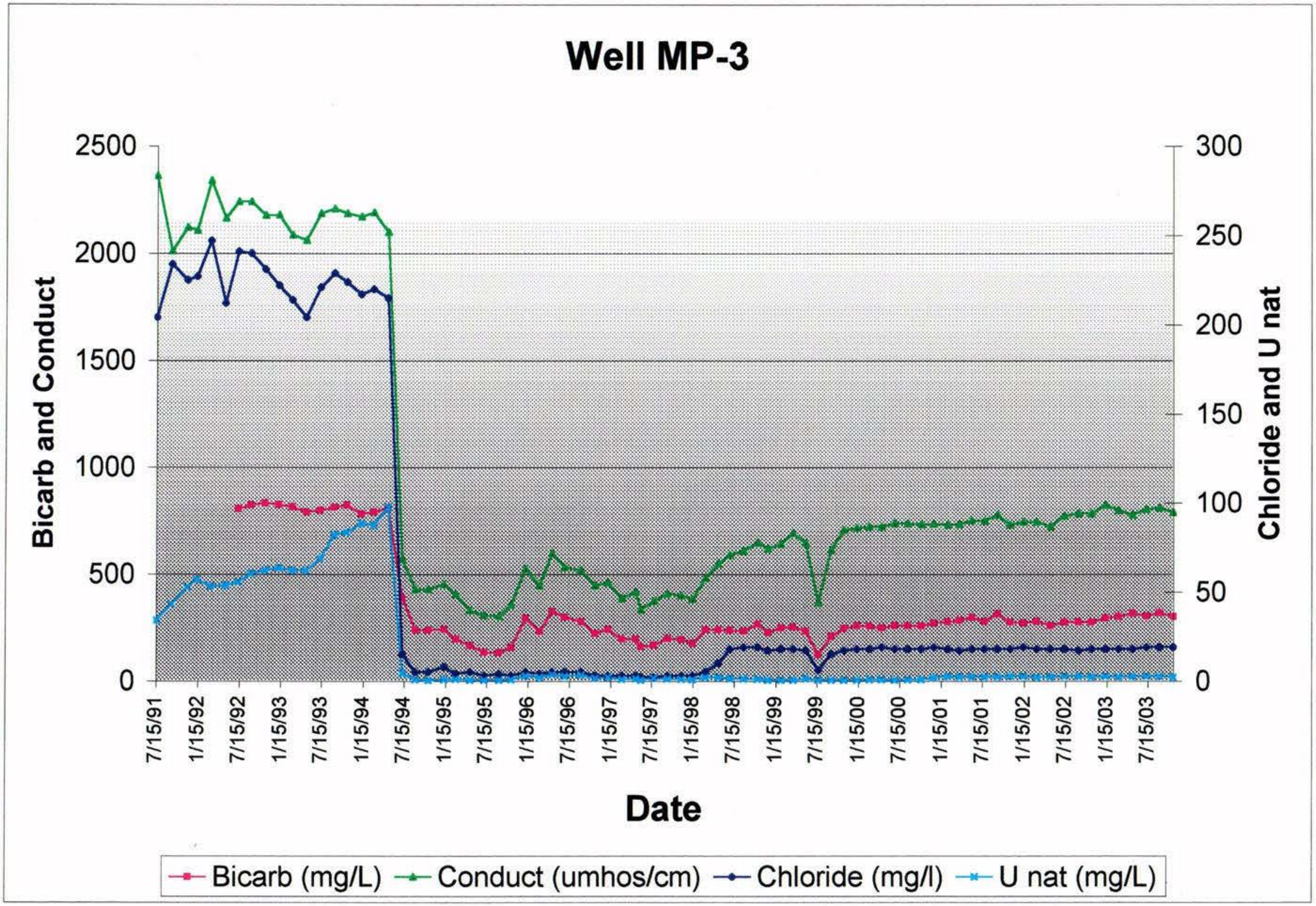
Graphs of the chloride, bicarbonate, conductivity and uranium from July 1991 (start of restoration) through November 2003 at the five individual Restoration Wells (Wells MP-1 through MP-5)



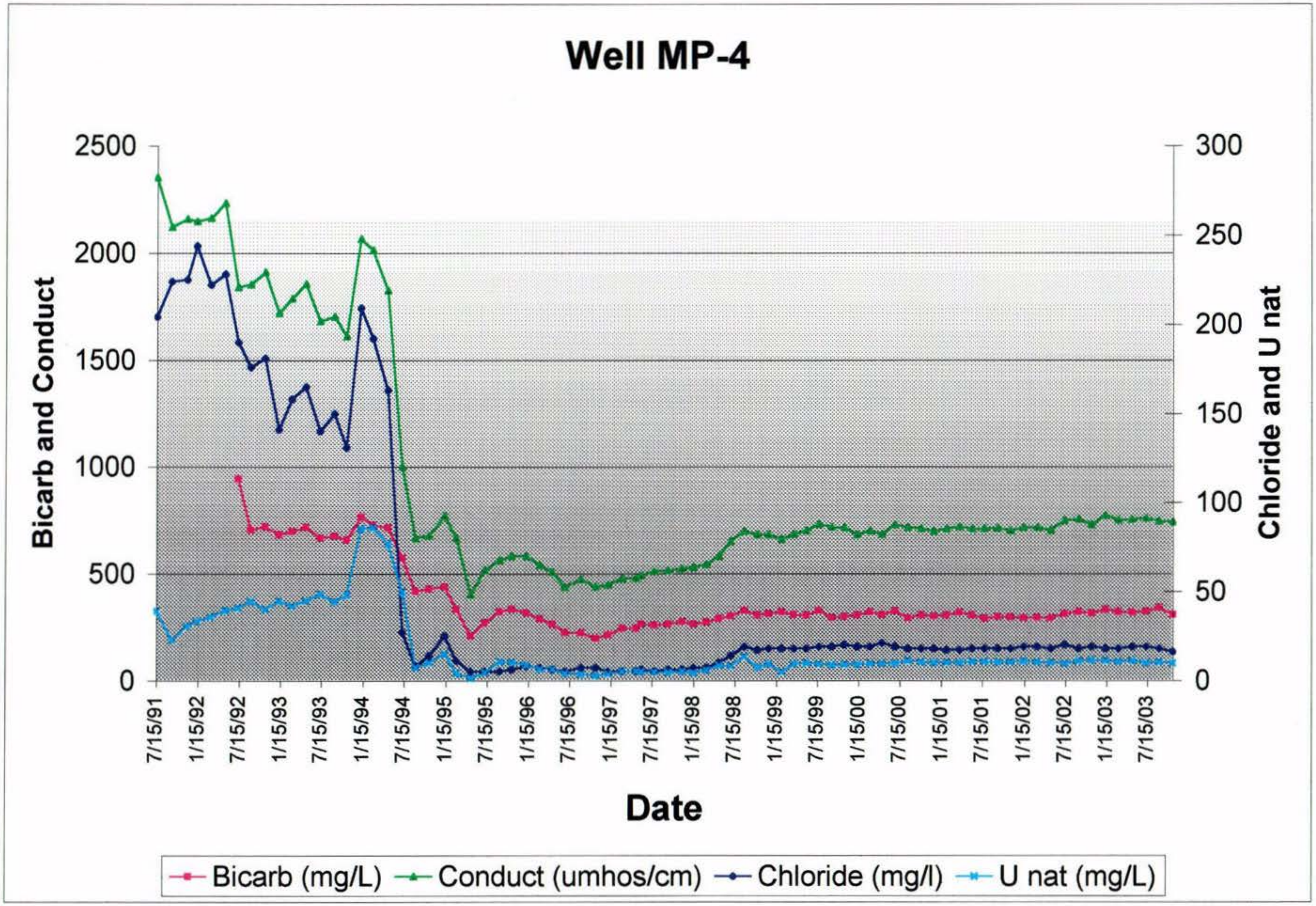
Well MP-1
Bicarb and Conduct
3000
2500
2000
1500
1000
500
0
7/15/91
1/15/92
7/15/92
1/15/93
7/15/93
1/15/94
7/15/94
1/15/95
7/15/95
1/15/96
7/15/96
1/15/97
7/15/97
1/15/98
7/15/98
1/15/99
7/15/99
1/15/00
7/15/00
1/15/01
7/15/01
1/15/02
7/15/02
1/15/03
7/15/03
Date
0
50
100
150
200
250
Chloride and U nat
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)


Well MP-2
Bicarb and Conduct
2500
2000
1500
1000
500
0
Chloride and U nat
300
250
200
150
100
50
0
7/18/91
11/18/91
3/18/92
7/18/92
11/18/92
3/18/93
7/18/93
11/18/93
3/18/94
7/18/94
11/18/94
3/18/95
7/18/95
11/18/95
3/18/96
7/18/96
11/18/96
3/18/97
7/18/97
11/18/97
3/18/98
7/18/98
11/18/98
3/18/99
7/18/99
11/18/99
3/18/00
7/18/00
11/18/00
3/18/01
Date
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)

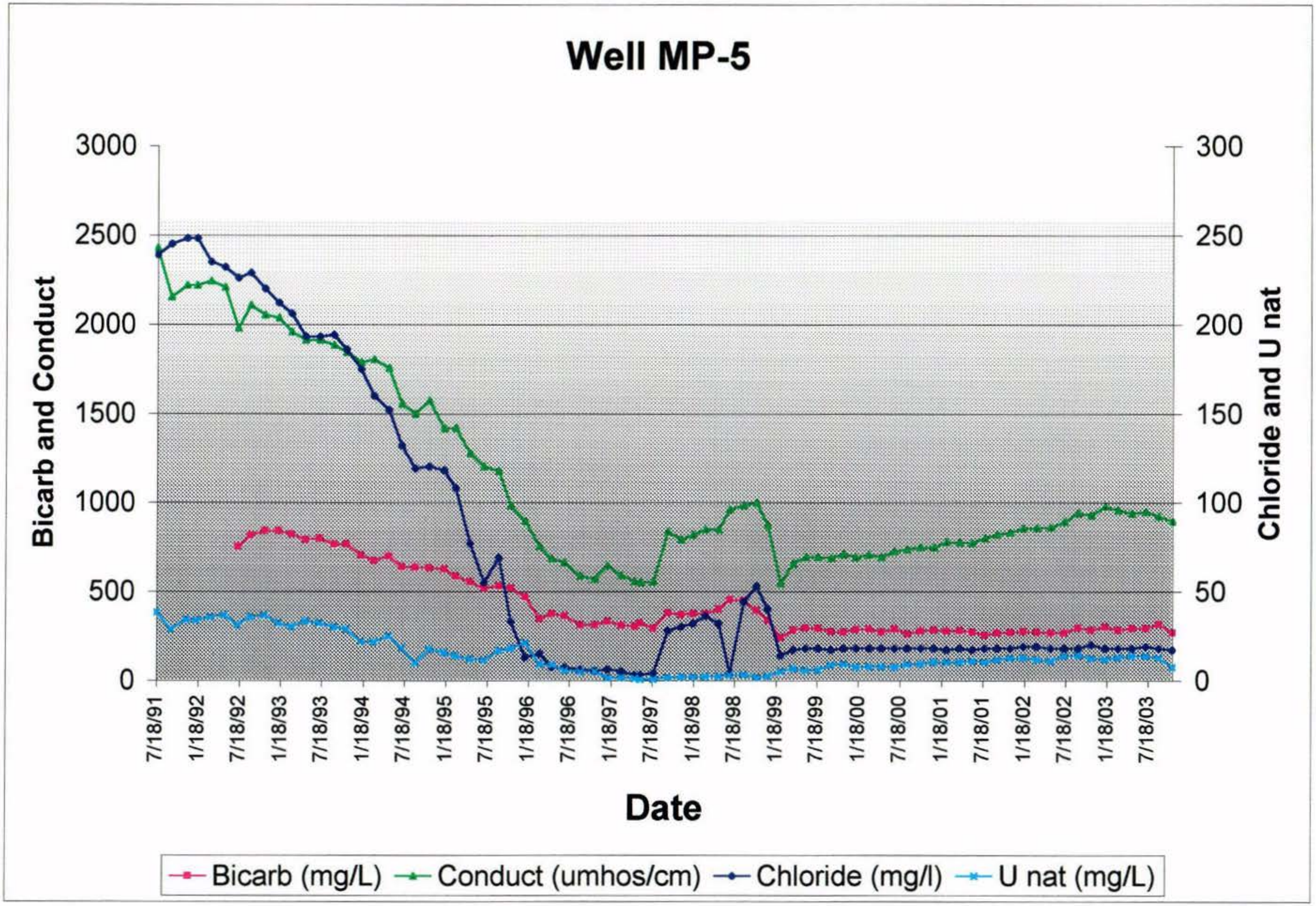
C03



Well MP-3
Bicarb and Conduct
2500
2000
1500
1000
500
0
300
250
200
150
100
50
0
Chloride and U nat
7/15/91
1/15/92
7/15/92
1/15/93
7/15/93
1/15/94
7/15/94
1/15/95
7/15/95
1/15/96
7/15/96
1/15/97
7/15/97
1/15/98
7/15/98
1/15/99
7/15/99
1/15/00
7/15/00
1/15/01
7/15/01
1/15/02
7/15/02
1/15/03
7/15/03
Date
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)


Well MP-4
Bicarb and Conduct
0
500
1000
1500
2000
2500
Chloride and U nat
0
50
100
150
200
250
300
7/15/91
1/15/92
7/15/92
1/15/93
7/15/93
1/15/94
7/15/94
1/15/95
7/15/95
1/15/96
7/15/96
1/15/97
7/15/97
1/15/98
7/15/98
1/15/99
7/15/99
1/15/00
7/15/00
1/15/01
7/15/01
1/15/02
7/15/02
1/15/03
7/15/03
Date
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)

C05


Well MP-5
Bicarb and Conduct
3000
2500
2000
1500
1000
500
0
Chloride and U nat
300
250
200
150
100
50
0
7/18/91
1/18/92
7/18/92
1/18/93
7/18/93
1/18/94
7/18/94
1/18/95
7/18/95
1/18/96
7/18/96
1/18/97
7/18/97
1/18/98
7/18/98
1/18/99
7/18/99
1/18/00
7/18/00
1/18/01
7/18/01
1/18/02
7/18/02
1/18/03
7/18/03
Date
Bicarb (mg/L)
Conduct (umhos/cm)
Chloride (mg/l)
U nat (mg/L)

COC

Attachment G

Additional selenium and uranium ground water quality data collected at three additional wells submitted to the WDEQ in correspondence dated May 23, 2003

L+H

POWER RESOURCES

Smith Ranch - Highland
Uranium Project
P. O. Box 1210
Glenrock, Wyoming USA 82637
Casper: 307-235-1628
Douglas: 307-358-6541
Fax: 307-358-4533

May 23, 2003

Mr. John Wagner, Cheyenne Office Program Manager
Land Quality Division
Wyoming Department of Environmental Quality
Herschler Building
122 West 25th Street
Cheyenne, WY 82002

RE: Permit to Mine 603-A2
A-Wellfield Sample Results, May 2003

Dear Mr. Wagner:

On May 5, 2003 Mr. Richard Chancellor and Mr. Steve Ingle of the Land Quality Division (LQD) in a phone conference with Mr. Steve Collings and Mr. Leland Huffman requested that Power Resources Inc. (PRI) collect additional ground water samples from three selected A-Wellfield mining zone wells. The ground water samples were sent to Energy Laboratories, Inc. in Casper, Wyoming and analyzed for concentrations of selenium and uranium. Enclosed with this correspondence are the results of the analyses performed by Energy Laboratories on the ground water samples collected from the A-Wellfield mining zone wells.

Also, additional A-Wellfield mining zone ground water sample results collected since the end of the A-Wellfield stability period and analyzed at Energy Laboratories are included. The additional ground water sample results include data from the five A-Wellfield mineralized production zone monitor wells (MP-Wells) and five mining wells.

Mr. Chancellor and Mr. Ingle requested the most recent set of ground water samples due to concerns about elevated uranium and selenium concentrations at Well MP-4, therefore the samples were only analyzed for these parameters. The wells sampled were chosen to investigate the extent of the elevated uranium and selenium concentrations near Well MP-4.

The results of this sample set are consistent with data submitted to LQD under cover dated March 31, 2000 in the report titled "A-Wellfield Ground Water Stabilization Report". Since the average uranium concentration is below 5 mg/L and the average selenium concentration is below 0.05 mg/L, this confirms that restoration and stabilization of the A-Wellfield have been achieved.

A member of the Cameco *group of companies*

Please call if you have any questions.

Sincerely,

Leland Huffman
Restoration Superintendent

LAH/ksj

cc:	S.P. Collings	R. Knode	S.A. Bakken
	File HUP-4.4.1	File HUP-4:3.3.1	File HUP-4.6.4.2
	S. Ingle-LQD/WYDEQ		

PRI Highland Uranium Project

A-Wellfield Mining Zone Ground Water Sample Results

WELL_ID	DATE	U mg/L	Se mg/L
MP1	7/18/02	0.11	0.001
MP2	10/20/99	0.30	0.001
MP3	7/18/02	2.86	0.051
MP4	7/18/02	10.50	0.282
MP5	7/18/02	14.20	0.006
P3	8/8/00	6.62	0.021
P13	8/8/00	0.698	0.035
P23	8/8/00	1.53	0.051
P27	8/8/00	2.38	0.004
I40	8/8/00	2.98	0.084
P15	5/7/03	0.344	0.003
P21	5/7/03	13.0	0.006
I34	5/7/03	0.603	0.001
Wellfield Average		4.32	0.042

ENERGY LABORATORIES, INC. - 2393 Salt Creek Highway (82601) • P.O. Box 3258 • Casper, WY 82602
Toll Free 888.235.0515 • 307.235.0515 • Fax 307.234.1639 • casper@energylab.com • www.energylab.com

LABORATORY ANALYTICAL REPORT

Client: Power Resources Inc
Project: HUP
Lab Order: C03050447
Report Date: 05/19/03

Lab ID: C03050447-001
Client Sample ID: P-15
Matrix: AQUEOUS
Collection Date: 05/07/03 16:30
DateReceived: 05/14/03

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS - DISSOLVED							
Selenium	0.003	mg/L		0.001		E200.8	05/15/03 17:36 / smd
Uranium	0.344	mg/L		0.001		E200.8	05/15/03 17:36 / smd

Lab ID: C03050447-002
Client Sample ID: P-21
Matrix: AQUEOUS
Collection Date: 05/08/03 10:30
DateReceived: 05/14/03

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS - DISSOLVED							
Selenium	0.006	mg/L		0.001		E200.8	05/15/03 17:42 / smd
Uranium	13.0	mg/L		0.001		E200.8	05/15/03 17:42 / smd

Lab ID: C03050447-003
Client Sample ID: I-34
Matrix: AQUEOUS
Collection Date: 05/08/03 12:30
DateReceived: 05/14/03

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS - DISSOLVED							
Selenium	0.001	mg/L		0.001		E200.8	05/15/03 18:13 / smd
Uranium	0.603	mg/L		0.001		E200.8	05/15/03 18:13 / smd

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

Attachment H

WDEQ correspondence dated November 23, 2003

The State
of Wyoming

CC FTN, SPC
BH, RK
CWA 11/25/03
8 pgs

Department of Environmental Quality

Dave Freudenthal, Governor

Herschler Building • 122 West 25th Street • Cheyenne, Wyoming 82002

ADMIN/OUTREACH	ABANDONED MINES	AIR QUALITY	INDUSTRIAL SITING	LAND QUALITY	SOLID & HAZ. WASTE	WATER QUALITY
(307) 777-7758	(307) 777-6145	(307) 777-7391	(307) 777-7368	(307) 777-7756	(307) 777-7752	(307) 777-7781
FAX 777-3610	FAX 777-6462	FAX 777-5616	FAX 777-6937	FAX 777-5864	FAX 777-5973	FAX 777-5973

November 25, 2003

W.F. Kearney
Manager - Health, Safety & Environmental Affairs
Power Resources, Inc.
P.O. Box 1210
Glenrock, Wyoming 82637

RE: Restoration of the A-Wellfield, Highland Uranium Project
Permit No. 603, TFN 3 4/261

Dear Mr. Kearney:

As you are aware, we have had extensive discussions concerning the restoration of the A-Wellfield. This letter contains my formal decision concerning the restoration of the wellfield.

Statutory and Regulatory Requirements

There are several statutes and regulations in both the Land Quality and Water Quality Division's rules that govern evaluation of groundwater restoration. The most important of these are listed below.

W.S. §35-11-103(f)

> *(iii) "Groundwater restoration" means the condition achieved when the quality of all groundwater affected by the injection of recovery fluids is returned to a quality of use equal to or better than, and consistent with the uses for which the water was suitable prior to the operation employing the best practicable technology.*

> *(i) "Best practicable technology" means a technology based process justifiable in terms of existing performance and achievability in relation to health and safety which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life, and related environmental values.*

Water Quality Division Rules and Regulations Chapter 8

Section 4. Quality Standards Prescribed; Groundwaters of the State Classified.

(d) Unappropriated waters are classified by ambient water quality.

(viii) Groundwater of the State found closely associated with commercial deposits of hydrocarbons and/or other minerals, or which is considered a geothermal resource, is Class V (Hydrocarbon Commercial), Class V (Mineral commercial) or Class V(Geothermal) Groundwater of the State.

(B) A discharge into a Class V (Mineral Commercial) Groundwater of the State shall be for the purpose of mineral production and shall not result in the degradation or pollution of the associated or other groundwater unless the affected groundwater quality can be returned to background or better quality after mining ceases, by a reduction or elimination of pollution; or in the waste of other water resources. If it has been determined by the Administrator that a return to background quality cannot be achieved, the affected groundwater will, at a minimum, be returned to a condition consistent with the pre-discharge use suitability of the water.

Land Quality Division Non-Coal Rules and Regulations, Chapter 11, Section 3(d)(i)

(B) The requirements of Section 3(d)(i)(A) cannot be achieved. In this event the condition and quality of all affected groundwater will at a minimum be returned to a quality of use equal to and consistent with uses for which the water was suitable prior to the commencement of the operation.

Facts and Restoration Results

The "pre-discharge use suitability of the water" is Class IV(A) suitable for industry as determined by the WQD and the LQD due to naturally high concentrations (i.e. ›5pci/l) of radium in the groundwater. Attached is a formal classification from the Water Quality Division and a map indicating where this classification applies.

Twenty of the thirty-five Guideline 8 parameters have been returned to baseline. Eleven of the remaining parameters have been returned to Class I standards. Of the remaining parameters, Iron has been returned to Class II standards and Selenium has been returned to Class III standards. Manganese is above Class II standards and there is no Class III standard for Manganese (see attached Tables). Radium remains above average baseline conditions but below the maximum found in the wellfield.

The Land Quality Division has reviewed the fate and transport modeling conducted by PRI and concurs that the modeling indicates natural attenuation will prevent the groundwater within the wellfield from endangering (with an exceedance of EPA's MCL's) the class of use of the adjacent groundwater. In addition, the B-Wellfield has been partially restored to a condition such that any future restoration efforts in the B-Wellfield will not have a negative impact on the groundwater in the A-Wellfield through the hole in the aquitard between the A and B-Wellfields.

Restoration Determination

The Land Quality Division concurs that PRI has used Best Practicable Technology in its restoration efforts in the A-Wellfield. As outlined in the Joint LQD/WQD Policy (attached), the restoration results have reached baseline or have become asymptotic.

The groundwater has not been returned to its background quality.

I do determine, as allowed in the WQD Rules and Regulations, Chapter 8, Section 4(d)(viii)(B), that although the groundwater has not been returned to baseline conditions, the groundwater quality is consistent with the pre-discharge use suitability of the water (Class IV(A) suitable for industry). This determination is based on the requirement that treatment would be required of the premining groundwater prior to use because of the elevated background concentration of radium. The restored groundwater in the A-Wellfield would require similar treatment before use.

It is my determination that the A-Wellfield has been restored to the statutory and regulatory requirements.

However, because the groundwater conditions differ from the background water quality and because of the reliance on natural attenuation for the protection of adjacent groundwater monitoring will be required to substantiate the model predictions. This requirement is consistent with the joint LQD and WQD policy adopted by the two Advisory Boards in situations in which natural attenuation is being relied on. Please submit a groundwater monitoring plan within the next 90 days. It is my understanding the LQD staff has provided you with some of the available guidance on monitored natural attenuation. Wells within the wellfield may not be abandoned until the monitoring plan is approved.

If you have any questions or need additional information, please contact me.

Sincerely,

Richard A. Chancellor, Administrator
Land Quality Division

xc: John Corra
John Wagner
District I

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION
GROUNDWATER POLLUTION CONTROL PROGRAM

Herschler Bldg., 4 West
Cheyenne, Wyoming 82002

PROJECT: Pre-discharge Groundwater Classification: Restoration of the A-Wellfield, Highland Uranium Project, LQD Permit No. 603, TFN 3 4/261

APPLICANT: Power Resources, Inc., P.O. Box 1210, Glenrock, WY 82637

WATER QUALITY DIVISION REFERENCE (PERMIT) NUMBER: Not Applicable

__EXISTING __NEW __AS BUILT

TITLE: Not Applicable

__PROPOSAL __PLANS __REPORT

IS THIS PROPOSAL SUBMITTED PURSUANT TO 'CONDITIONS' TO ANY WQD PERMIT?

√ NO __YES (IF YES, PERMIT #------)

REVIEWING OFFICERS: K. Frederick, P.G., WQD
S. Ingle, P.G., LQD

DATE OF THIS REVIEW: November 20, 2003

ACTION: **Pre-discharge Groundwater Classified for the '20-Sand', A-Wellfield, Highland Uranium Project.**

Pursuant to Chapter VIII, Section 5 of Water Quality Division Rules and Regulations:

(a) Classification of groundwaters of the State shall be based on the water quality standards of this chapter; excepting a Class I groundwater of the State shall be classified by ambient water quality and the technical practicability and economic reasonableness of treating ambient water quality to meet use suitability standards.

(b) Underground water quality shall be classified for an aquifer which is, or may be, affected by a subsurface discharge or other activity identified in Section 4(a) of these regulations.

The Water Quality Division is classifying groundwater within the 'A-Wellfield' of Power Resources, Inc.'s Highland in-situ uranium mining project in Converse county, Wyoming based upon pre-mining (i.e. pre-discharge) use and quality. The purpose of this classification is to establish the condition and quality of pre-discharge (i.e. pre-mining) use suitability of the water impacted by the mining process pursuant to WQD rules and regulations, Chapter 8, Section 4(d)(viii)(B).

(c) Classification shall be made:

(1) Whenever there is pollution or threat of pollution to groundwater of the State, or;

(2) The physical, chemical, radiological or biological properties of any groundwater of the State are, or may be, altered by man's action.

(d) Classification shall be made for a water in a specified locally defined area by named and described aquifer or receiver. Any aquifer or receiver in its regional setting may have one or more classifications by defined area or areas.

The pre-mining groundwater classification applies to the '20-Sand' of the 'A' wellfield in-situ mining production zone area contained within the monitoring well 'ring' illustrated on the attachment to the letter (RE: Classification of Groundwater at the Highland Uranium Project, Converse County, Wyoming) from William Garland, WQD Administrator to Max Dodson, EPA Director dat5ed June 5, 1987.

(1) The name shall be a recognized geologic name whenever possible, and;

The '20-Sand' of the Fort Union Formation.

(2) The description shall include a lithologic description.

The mine units at the Highland Uranium Project are known locally as the Highland Group of the Fort Union Formation. In this area, the Highland Group consists of three separate sand units named in ascending order the 20/30, 40 and 50 Sands. The Eocene age, medium to coarse grained, fluvial sandstone units are separated by clay and silt layers that range up to 20 feet thick.

(e) **The lateral and vertical limits of an aquifer or receiver, for purposes of classification, shall be based on existing water use, ambient water quality and geologic and hydrogeologic characteristics of the aquifer or of the receiver.**

Only that '20-Sand' groundwater impacted by the mining process within the 'A-Wellfield' mining production zone and contained within the monitoring well 'ring' is being classified. The following are representative of pre-mining conditions:

1. Existing Use:

   There was no pre-mining existing use of groundwater within the '20-Sand' in the area bounded by the monitoring well 'ring'.

2. Ambient water quality:

   The baseline water quality for the 'A-Wellfield' was determined from five wells (MP-1 - MP-5) and consists of between three and five sampling rounds, depending on the parameter. Twenty-three (23) parameters, including TDS, pH, uranium, radium 226, and multiple cations, anions, and metals were evaluated for groundwater classification purposes.

   There were very few trace metal values greater than the detection limit, and no values approached or exceeded the applicable Class I (Domestic use) standards as established in Table 1 of Chapter 8, WQD rules and regulations. Baseline uranium is very low in all wells. The maximum uranium value is 0.121 mg/l, far below the Class I standard of 5 mg/l. The average radium 226 value for all samples was 609 pCi/l, greatly exceeding the Class I standard of 5 pCi/l.

   Based upon the evaluation of water quality information from baseline wells, the pre-mine classification of the **'20-Sand'** groundwater impacted by the mining process within the **'A-Wellfield'** mining production zone (and contained within the monitoring well 'ring') is of **Class IV(A)** quality, suitable for **industrial** use, due to the presence of high concentrations of radium 226 at levels that exceed standards for Class I, II, III, and Special (A), but having TDS concentrations of less than 10,000 mg/l.

3. Geologic/hydrogeologic characteristics:

Depth:	530' Avg.
Thickness:	10' - 30'
Direction of flow:	Northeast
Degree of Confinement:	Semi-confined.

(f) **An underground water may be re-classified if new or additional data warrant re-classification.**

References

Letter (RE: Classification of Groundwater at the Highland Uranium Project, Converse County, Wyoming) from William Garland, WQD Administrator to Max Dodson, EPA Director dated June 5, 1987.

Memo (RE: Baseline water quality for Wellfield A, Permit #603) from S. Ingle to PRI, Highland Uranium Project file dated September 30, 2003.

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
IN SITU GROUNDWATER CLASSIFICATION AND RESTORATION

Introduction

This paper summarizes the revision of policy that has been in use by the Administrators of the Water Quality Division and Land Quality Division for a number of years and most recently discussed in a letter to the Wyoming Mining Association dated June 27, 1997. The major difference is the concept of treatability of radium when classifying groundwater as Class I per WQD Chapter 8 Rules and Regulations (R&R). Currently, the radium standard for Class I, II, and III groundwaters is 5 picoCuries per liter (pCi/l). Historically, radium concentrations of up to 100 picoCuries per liter (pCi/l) were allowed in Class I groundwaters because radium could be removed using standard water treatment techniques (e.g., water softeners or ion exchangers). Treating a groundwater source which contains radium at background concentrations commonly found in the production zone could produce a filtrate or wastewater which would be prohibited for unrestricted release. Therefore, the concept of treatability for radium levels no longer seems applicable with respect to Class I groundwaters.

Groundwater Classification Within and Outside the Production Zone

For groundwater within the production zone, the available analysis for each sampling parameter for all the wells within the production zone is averaged to determine the groundwater background conditions. The production zone does not include the monitor wells and only includes the area within the production zone monitor well ring for the aquifer containing the ore zone, including the injection/production patterns are, to be consistent with the Environmental Protection Agency's (EPA's) definition of an exempted aquifer. Wells outside the production zone are classified by averaging the available analyses for each parameter on a well-by-well basis. Using the revised policy, treatability of radium will not be considered in the classification decision either within or outside the production zone.

The definition of groundwater restoration in the Environmental Quality Act (W.S. §35-11-103(f)(iii)) means the return of the groundwater quality to the pre-mining use or better. While there is a goal of using Best Practicable Technology (BPT) (LQD R&R, Chapter 11, Section 3(d)(i)), to return the groundwater within the production zone to the pre-mining average back groundwater quality, the standard is the restoration to pre-mining class of use. BPT shall be applied until the restoration results become asymptotic unless, of course, background is achieved sooner. Outside the production zone, the goal is to return the groundwater to the pre-mining back groundwater quality for each well. The standard is to return the groundwater to the pre-mining class of use.

Regardless of the restored groundwater quality in the production zone, the adjacent aquifers and other waters within the same aquifers must be fully protected to their class of use. If the restored groundwater in the production zone poses a threat to groundwater class of use outside the production zone, then flow models and fate and transport models shall be used to assist in determining what action needs to be taken. A monitoring program sufficient to verify the model will be required similar to the approach used in other industries and situations where natural attenuation is relied on for groundwater restoration.

Uranium Restoration Within and Outside the Production Zone

All wells inside the production zone are regulated as Class V under Section 4(d)(viii)(B) of Chapter 8, WQD R&R, unless the groundwater has a pre-existing use. All Class I groundwaters located outside the production zone will require uranium to be restored to background pursuant to Section 4(d)(vi) of Chapter 8, WQD R&R.

Treatability of Groundwater to a Class I Standard

As discussed in the introduction under Section 5, Chapter 8 of the WQD R&R, radium will not be considered as treatable due to concerns with the safe disposal of any water treatment by-products. In addition, this allows for consistency in the approach for Class I, II, and III groundwaters (currently treatability is only considered for Class I waters).

This policy is approved by a joint session of the Water & Waste and the Land Quality Advisory Boards on

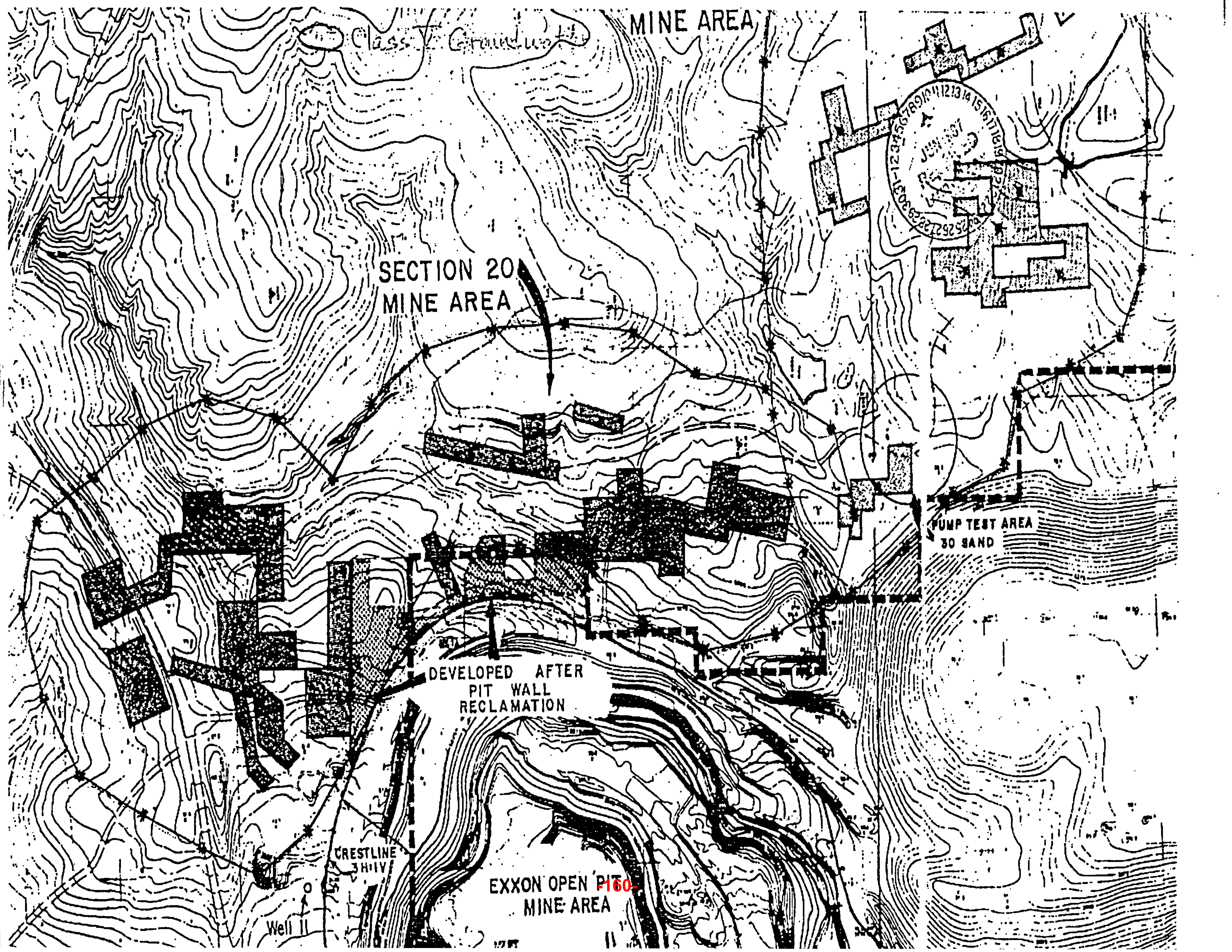
this 14th day of November, 2001

Marshall Gingery
LQD Chairman

Gene George
WQD Chairman

Richard A. Chancellor
Administrator, Land Quality Division

Gary Beach
Administrator, Water Quality Division


MINE AREA
SECTION 20 MINE AREA
PUMP TEST AREA
30 SAND
DEVELOPED AFTER PIT WALL RECLAMATION
CRESTLINE 3H:1V
EXXON OPEN PIT MINE AREA
Well II