PACIFICORP

DATA AND FINDING SUMMARY

For

INVESTIGATION OF TECHNICAL ISSUES RELATED TO THE ELECTRIC LAKE AND HUNTINGTON CREEK DRAINAGE CONTROVERSY

June 25, 2003

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EXECUTIVE SUMMARY

This Data and Finding Summary report has been prepared in response to a request by the Division of Oil, Gas & Mining (Division). Its purpose is to serve as a documentary aid to the Division in understanding the issues and consequences of mining within the vicinity of Electric Lake, and the Huntington Creek drainage, Utah. Because of the impacts on Electric Lake, an extensive effort has been made by PacifiCorp over the past 12 months to investigate and understand hydrogeologic issues related to Electric Lake, the Huntington Creek drainage, and adjacent Skyline Mine workings owned and operated by Canyon Fuels Company. This effort first began when concerns regarding potential impacts upon Electric Lake were noticed shortly after Skyline mining operations encountered large quantities of water within the 10 Left mains immediately east of the lake. Throughout, PacifiCorp has endeavored to maintain a cooperative attitude with Canyon Fuels Company.

This report not only reviews available well data, but also includes several intensive studies which were conducted with specific focus and reference to Electric Lake and the Huntington Creek drainage. It is important to remember that the results of these studies and investigations are not indicative of other systems. These studies and efforts include a review of historic and present lake histories, a review of monitoring well data, water balance calculations, water quality data collection, dye tracer testing, and the completion of a resistivity survey, an AquaTrack survey, and a diving investigation which surveyed lake bottom conditions. It is PacifiCorp's intent to continue to monitor water level, water quality and dye tracer studies for the foreseeable future to document continued impacts.

The hydrologic link between mine inflows and losses in Electric Lake can be seen in the data discussed herein. Each of these data and study sources point to a confirmation of impact upon surface waters associated with Electric Lake and Huntington Creek drainage.

The data suggests a strong link between waters encountered within the Skyline Mine and water loss in Electric Lake. The myriad of studies and data analyses conducted and reported herein show that this strong hydrologic link between the two systems is not necessarily characteristic of other local and regional hydrologic systems found within the Wastach Plateau. Furthermore, conditions documented herein between the mine and the Huntington Creek drainage hydrologic system, are unlike any other known conditions found or experienced at any mine within the region.

In summary, it is the express purpose of this report to identify and document important issues related to mining activities and noted impacts which are believed by PacifiCorp to have had a direct impact upon the hydrology in and around Electric Lake and the Huntington Creek drainage, Utah. PacifiCorp would be happy to discuss with the Division any of the data contained herein in more detail should it be desired.

INTRODUCTION

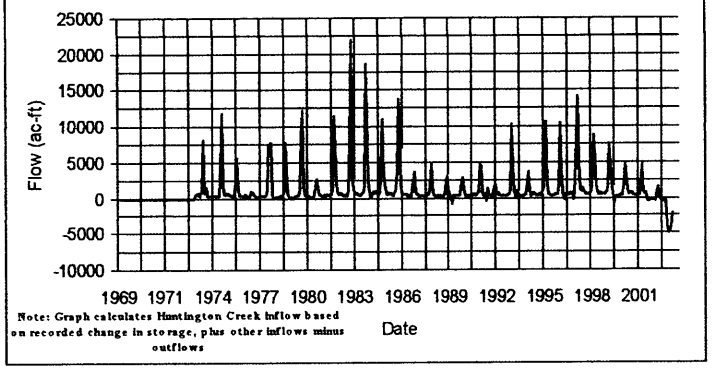
Over the years coal mines located throughout the State of Utah have investigated hydrogeologic conditions and the impacts of mining upon the environment. Typically speaking these impacts have been minor and easily handled through pre-planning or through simple mitigation. One area of significant interest continues to be the relationship between mining and surface and ground water impact. For the most part, mining impacts have not been found to have a significant impact upon surface or ground water resources. Water encountered within mines is usually derived from small perched ground water aquifers that are of limited size, and which have limited interaction with the regional ground water resource. In-mine waters are generally found to emanate from roof zones which initially produce a quantity of water, but which reduce in flow in relative rapid fashion. Many of these flows completely dry up within a few months.

In the development of mine workings at their Skyline mine, the Canyon Fuels Company however encountered a series of substantial flows from the floor of the mine until in August of 2001 the mine encountered a major flow that temporarily halted mining. Concerns regarding the volume of water were raised at the time by several interested parties including, but not limited to, the Skyline Mine (Mine); the Division of Oil, Gas and Mining (DOGM); PacifiCorp Power (PacifiCorp); Carbon County; Emery County; and local water users.

Although concerns were raised by several entities at the time of the encountered inflow, little data was available wherein the source of the water could be clearly identified. In an effort to try to determine the source, the mine hired consultants to help evaluate the hydrogeology and to collect in-mine water samples that could be used to help delineate and/or identify the source. Some of the samples collected and analyses performed included tritium and carbon dating to investigate whether the in-mine water was being derived from a surface source. Initial results of these tests tended to indicate that in-mine waters were of ancient age and were not surface related.

Approximately 9 months after the mine encountered their main in-mine flow PacifiCorp personnel began to notice anomalies in data collected from Electric Lake. These anomalies included uncharacteristically large losses in lake volume which did not match historic trends. As a result, more intensive analyses of data and field investigations were initiated to further define local conditions with the intent and purpose of verifying or denying any impact upon Electric Lake and Huntington Creek drainage by the mine. This report is a summary document of local geology, the history and recorded events, studies, reported and projected impacts, legal issues, and potential mitigation alternatives. In order to assist the reader in interpreting data, full size graphics for the majority of figures included herein are also provided in Appendix A. It should be noted that the figure numbers found within Appendix A will not match those contained directly in the text herein since last minute changes and additions were made to the text that required a change in figure number.

Figure 1. Electric Lake History
Huntington Ck Calc'd Flow - Thru 3/03



Huntington Creek History

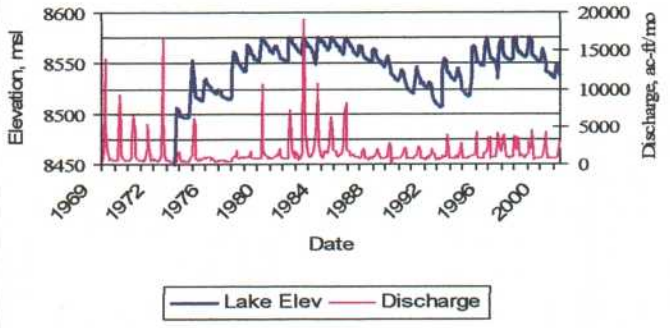
Water flow measurements have not been collected on Huntington Creek inflows into Electric Lake until 2002 when a flume was installed above lake levels at the confluence with James Canyon. Because of this, flows within Huntington Creek have to be calculated for the time period before the

flume was installed. These calculations, plotted in Figure 1 show relative consistency in flow patterns throughout the year, except since the fall of 2001 when the general patterns change showing a significant drop in inflow.

Lake History – Pre 2001

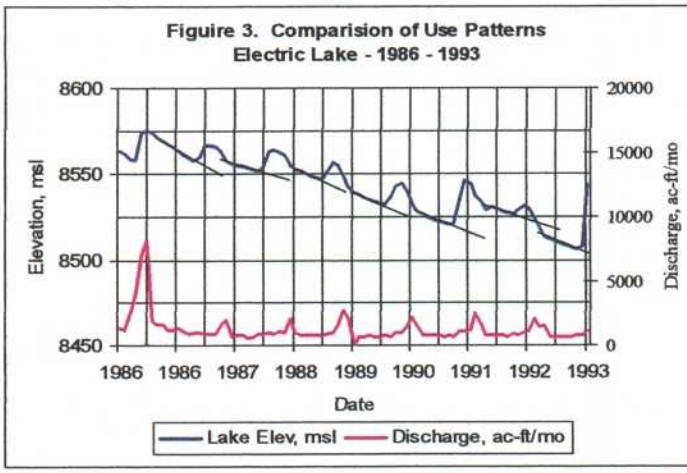
Lake Response. Since its construction Electric Lake has been operated to capture and store runoff flow within the Huntington Creek Drainage for use in power generation at downstream power facilities. As can easily be noted from Figure 2, the great majority of stored water is captured during spring runoff periods. Also noted in the figure is discharge data for the period of record through August of 2001. Note from the graph that with the exception of the mid 1980's when extreme snowfall amounts were recorded, that discharges have remained within the same general order of magnitude.

Figure 2. Electric Lake History Through August 2001



A careful review of the data presented in Figure 2 also reveals that the rate of water level decline within the lake has been relatively constant over time. In order to help verify this conclusion Figure 3 was prepared from a representative time period of the lake history. The lines which have been added to the figure are a visual fit of the reservoir water surface elevation through the summer use period. Note from the figure the similarities in the slopes of the lines which have been drawn through these summer use and demand periods.

Figure 3. Comparision of Use Patterns Electric Lake - 1986 - 1993

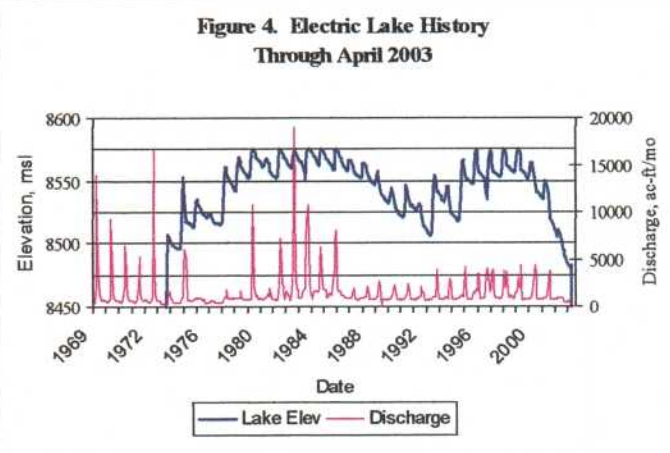


Lake History – Post 2001

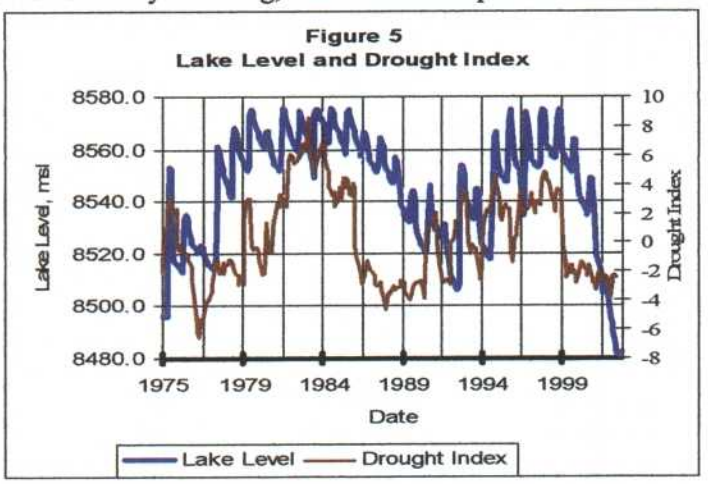
Electric Lake

During the summer of 2002 data collected from Electric Lake were reviewed and evaluated with the purpose to identify whether mine discharges were affecting or interacting with surface waters of Electric Lake and Huntington Creek drainage and vicinity. As part of this evaluation various data were collected, reviewed and analyzed, including a comparison of pre and post August 2001 lake conditions and responses.

Figure 4. Electric Lake History Through April 2003



The first graphic that was prepared, and the one that is clearly revealing, was a continued plot of lake levels for the entire period of record. As can be seen in Figure 4, Electric Lake shows a clear and dramatic change in lake level trends which occurred time wise, simultaneously with the mine's August 2001 fault inflow.



A review and comparison of lake levels versus the Palmer Drought Index for Utah Region 5 was made as shown in Figure 5. As can be seen from the figure, the general severity of the drought is similar in nature to the drought experienced between 1986 and 1991, however, the response of Electric Lake is significantly different than at any previous period of recorded time. These changes in patterns are indicative of a major shift on hydrology conditions.

The change in hydrologic conditions is further evidenced through a comparison of historic inflows with and without water returning to Electric Lake via the James Canyon well JC-1. Figure 6 shows calculated inflows into Electric Lake since October 1971 for two conditions. First are conditions as recorded which show relative consistency in the data for the years 1971 through the fall of 2001. The second condition deletes flows contributed by well JC-1 to show a significant drop in inflows which are atypical of historic patterns.

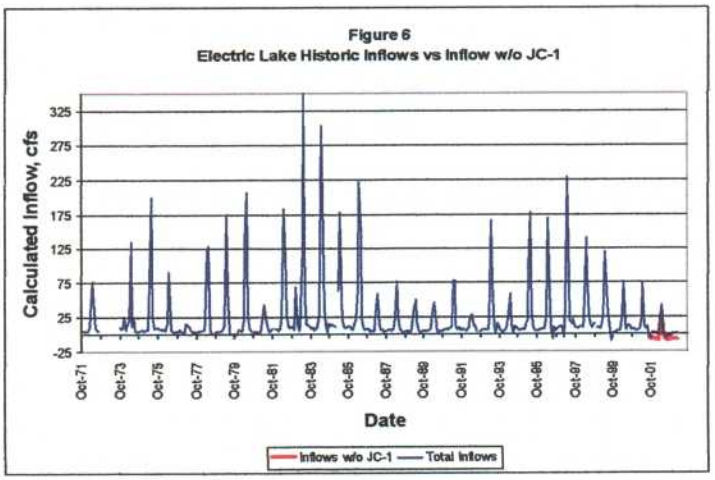
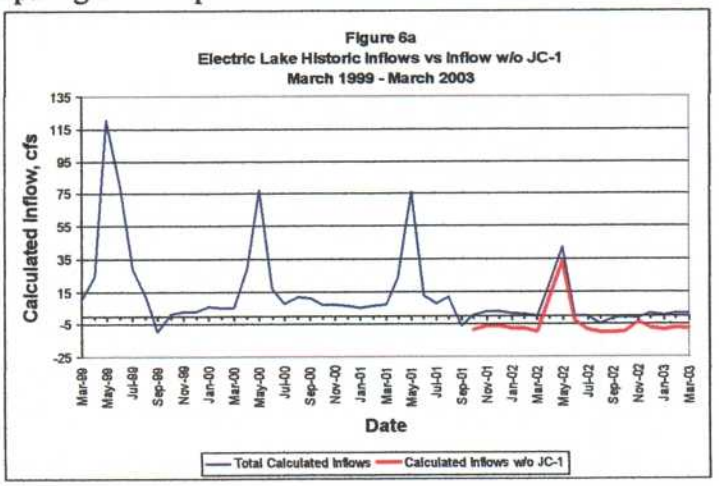
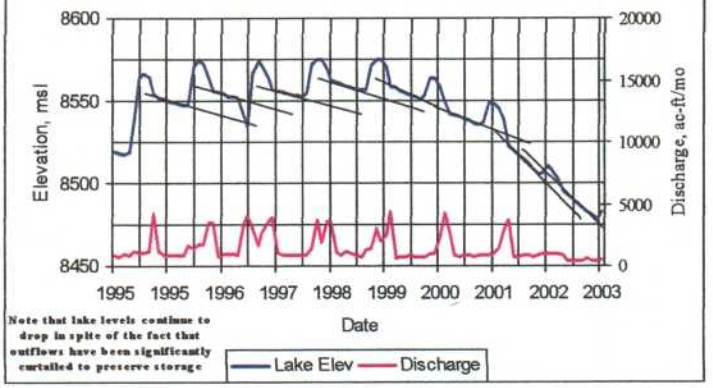


Figure 6a better illustrates this condition by comparing a close up view of the data between March of 1999 and March of 2003. Note from the figure the general consistency of low flow data which averages approximately 5 to 10 cfs prior to September 2001. The calculated inflow data then takes a significant drop and thereafter averages somewhere between 0 and -5 cfs through March 2003. The true impact is however not fully realized until all artificial inflows into Electric Lake are subtracted including well JC-1. Deleting this artificial water source shows a drop in calculated inflows from 5 to 10 cfs prior to September 2001 to between -5 and -10 cfs thereafter, or a total decrease in calculated inflows of 10 to 20 cfs.



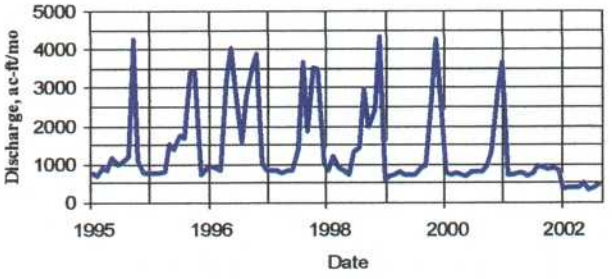
In a similar fashion to Figure 3, Figure 7 has been included to document the change in lake response to normal withdrawal patterns in 2002, and continuing into the spring of 2003. Note from the figure the abnormally low discharges recorded through the 2002 and 2003 runoff periods. Lake levels have continued to decline in spite of the fact that discharges have been reduced to minimal levels. Figure 8 has been inserted to illustrate the noted changes in discharges for the period since 1995.

Figure 7. Comparison of Pre 2001 versus Post 2001 Summer Use Patterns in Electric Lake



In an effort to investigate historic variations and to ensure that existing drought conditions are not abnormally affecting the surface waters of Electric Lake and Huntington Creek drainage, a review of the Palmer Drought Index for Utah was made. The drought index graphic shown in Figure 9 clearly shows relative annual rainfall patterns for the region of interest. Note from the figure the relative magnitude of wet and dry periods within the region. Of special note are the facts that 1) the most recent drought is not as severe as the drought experienced between 1988 and 1992, and 2) that although the wet period noted between 1992 and 2001 was not as sustained as that noted between 1982 and 1988, that the lake did not experience abnormal behavior until the fall-winter period of 2001 (see Figure 7). In other words, the drought index data shown in Figure 9 would not generally be expected to produce the extreme variations noted since 2001 in Figures 4 through 8.

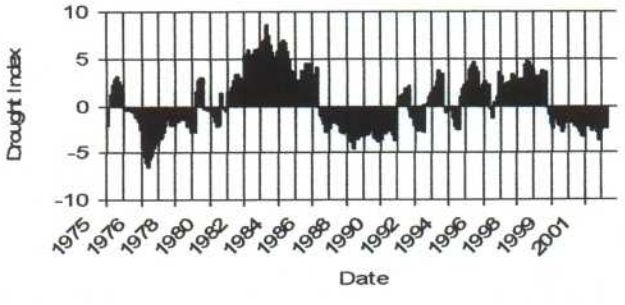
Figure 8.
Electric Lake Discharge History



Scofield Reservoir

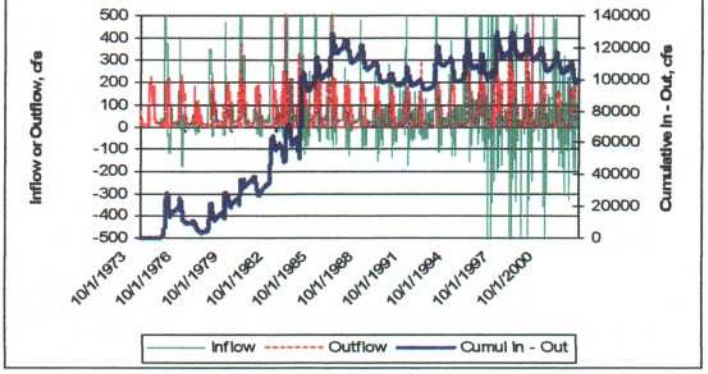
Reservoir operations and characteristics for other local reservoirs were investigated in an effort to verify the anomalous conditions being experienced at Electric Lake. One of the reservoirs investigated was Scofield Reservoir. Upon review of the data for Scofield Reservoir two major issues were noted. First, all in-mine water encountered within the Skyline mine which has been discharged to the surface has entered Eccles Creek (a tributary to Scofield reservoir) up until well JC-1 was installed. Following the installation of well JC-1, all discharged waters continued in Eccles Creek except for the flows diverted directly into Electric Lake via well JC-1. The second discovery was related to reservoir

Figure 9
Palmer Drought Index
Utah - Region 5 - Updated 1/13/03



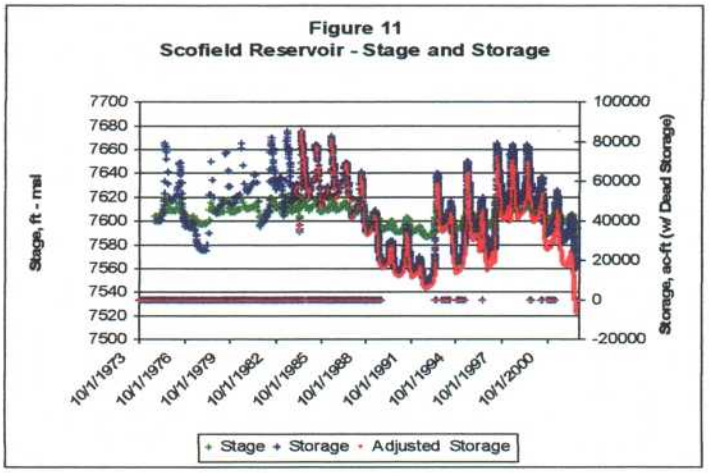
outflows. Many reservoirs manage or adjust outflows based on drought conditions resulting in periods of lower outflows to help hold storage in reserve. A review of inflows and outflow data obtained from the Internet for Scofield reservoir (See Figure 10) shows above normal inflow conditions (in spite of a drought) and continued high rates of outflow. The fact that the reservoir has been discharging higher than normal flows for climatic conditions is further evidenced by reviewing the Cumulative In-Out line on Figure 10. Note that the cumulative line over the last few years has continued to decline in spite of higher than natural inflows indicating excess discharge for drought conditions.

Figure 10
Scofield Reservoir - Inflow and Outflow



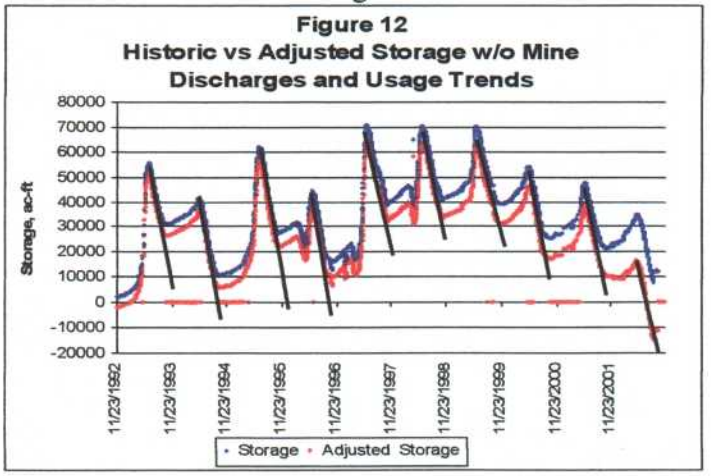
A graphic showing reservoir stage, recorded storage, and adjusted storage is shown in Figure 11. This graph was prepared to illustrate historic variations in stage level as compared to calculated storage if mine inflows discharged to Eccles Creek had remained either within the mine or had been discharged to Electric Lake. It is our conclusion after a review of the data shown, and when considering the issues discussed previously, that Scofield Reservoir does not show the same trends and characteristics as that seen in Electric Lake. Impacts noted are easily identified and explained to be the result of abnormal inflows and reservoir management.

Figure 11
Scofield Reservoir - Stage and Storage



One additional piece of information that was reviewed with respect to Scofield Reservoir was a comparison of reservoir levels with and without the addition of mine discharges into Eccles Creek. A time plot of expected variations between November 1991 and November of 2002 is illustrated on Figure 12.

Figure 12
Historic vs Adjusted Storage w/o Mine Discharges and Usage Trends



Joes Valley Reservoir

A plot of Joes Valley Reservoir (JVR) inflow, outflow and cumulative inflow minus outflow was prepared as shown in Figure 13. As can be seen from the figure, historic inflows and outflows show a relatively predictable pattern consistent with natural climatic variations. It is our understanding that the anomaly noted in the year 2002 was the result of a management decision to drain the reservoir for repair and or maintenance.

Figure 14 was prepared in similar fashion to that prepared for Electric Lake wherein the historic operational characteristics of the reservoir were compared for pre versus post 2001 time periods. As can be seen in the figure, variations noted within 2002 are typical of those noted within the period of record shown, even though the reservoir was artificially drained to accommodate management operations.

Other

Other reservoirs considered for evaluation included the Huntington North, Miller Flat, Robinson, Upper Huntington, Boulger Canyon, Lower Gooseberry, Cleveland and Millsite reservoirs and Fairview Lake. All these water bodies were eliminated from further evaluation due to the fact that they are either highly regulated and not representative, or they have insufficient data from which to make an evaluation.

Figure 13
Joes Valley Reservoir - Inflow and Outflow

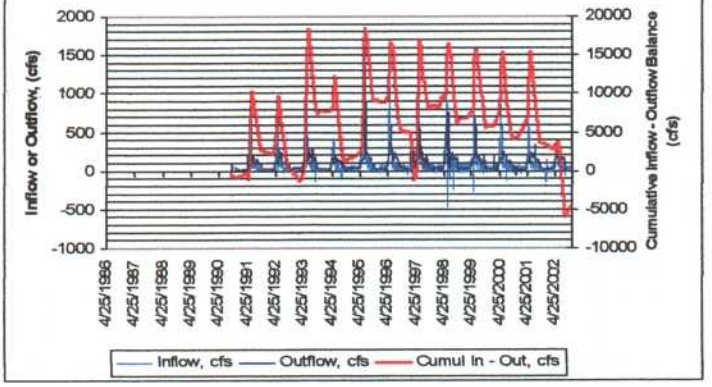
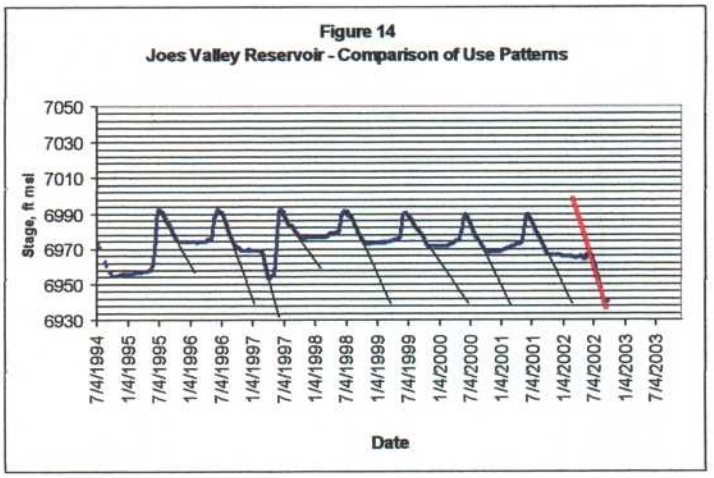


Figure 14
Joes Valley Reservoir - Comparison of Use Patterns



STUDIES, TESTS AND INVESTIGATIONS

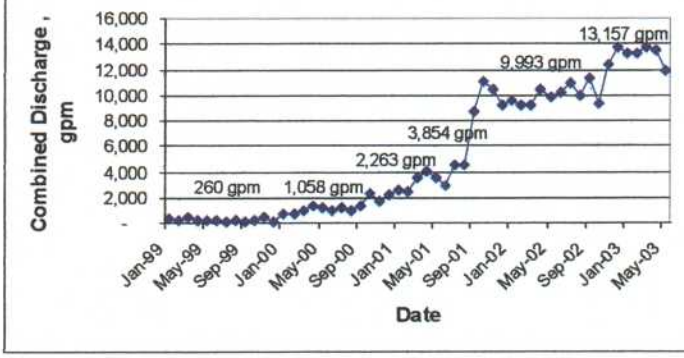
Data analyses and reviews

Several data investigations and reviews have been conducted by HAL for the purpose of identifying possible explanations for water losses in Electric Lake. These investigations have included reviews of well and ground water data obtained either directly from wells accessible to PacifiCorp, or as provided by Skyline mine personnel. A general discussion and summary of data collected follows:

Drawdowns. Ground water level data has been reviewed for the general area for the 1995 and 2003 time periods. Generally speaking, mine pumping (whether from well JC-1 or in-mine pumping) has lowered the water table within the area of well JC-1 and the James Canyon south ridge well (W79-35-1A) an approximate 300 feet. Pumping from the mine has effectively created a ground water withdrawal cone of depression centered around the James Canyon area.

Historic mine discharge data provided by DOGM shown in Figure 15 illustrates the continued significant increase in discharge from the Skyline mine since January of 1999. The numbers shown on the graph are average discharge rates for the specified time periods wherein an increase in discharge appears to be visually apparent. Note from the graph the continued and significant flow rates encountered within the mine even prior to the major September 2001 event. Over the course of 18 months flows encountered within the mine rose from approximately 259 to 3,854, a 1,488% increase. These flow increases are important to note when reviewing water level changes in local monitoring wells.

Figure 15
Combined Mine Discharges



Gradients. Historic ground water gradients are documented within the Skyline Mine permit. Mine dewatering activities have however significantly altered the ground water table and ground water gradients as is discussed below.

Monitoring/Dewatering Wells. Water level data has been collected by PacifiCorp since August of 2002 at three locations including Well JC-1, Boulger Canyon well 99-4-1, and Swen's Canyon well 20-28-1. These data shown in the following figures were collected through the use of pressure transducers and dataloggers.

JC-1 Well. Well JC-1 data presented in Figure 16 shows multiple events including the shutdown and water level recovery of the well beginning on August 12, 2002 with subsequent start-up and shutdown events shown. The data shown is as was recorded and have not been altered nor adjusted. Generally speaking, it appears that the overall water table at this site has dropped an approximate 300 feet over what would appear to be the non-pumping water table. It must however be acknowledged that in addition to pumping from well JC-1, significant mine pumping and discharge to Eccles Creek (on the order of 7,000 to 9,000 gpm) was occurring throughout this period of time.

Figure 16
Well JC-1 Water Levels

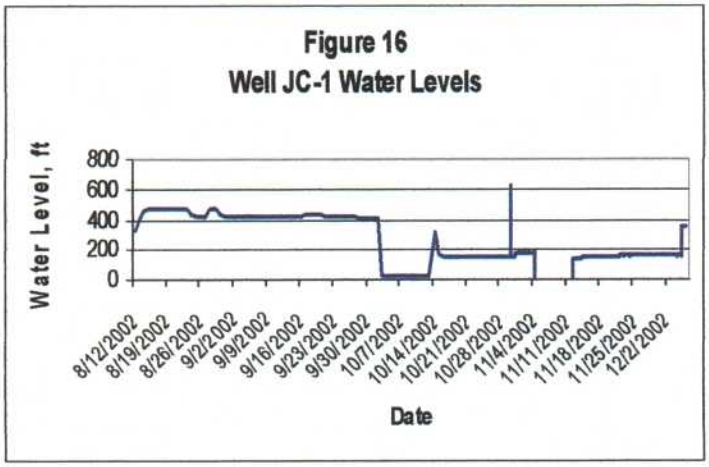
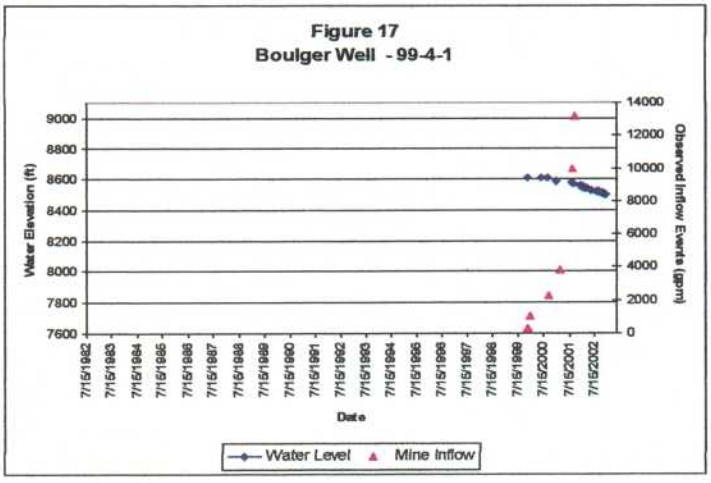


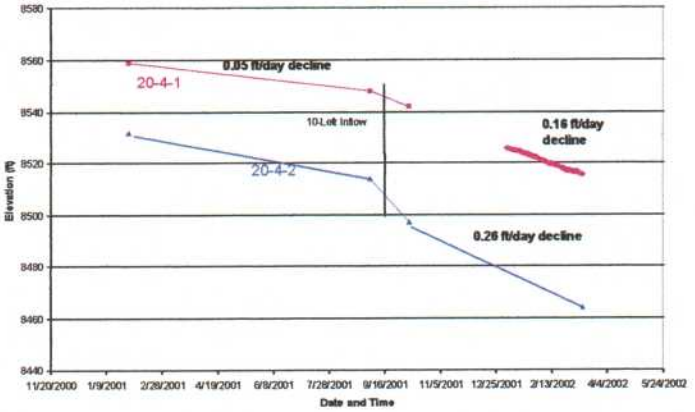
Figure 17
Boulger Well - 99-4-1



Boulger Well. Boulger Canyon Well (shown in Figure 17), located approximately 2.3 miles to the southwest of well JC-1, shows declines in excess of 120 feet since the record began in 1999 with the majority of these declines occurring since the summer of 2000. Note in the figure also the increased rate of water level decline as more significant mine inflows were encountered.

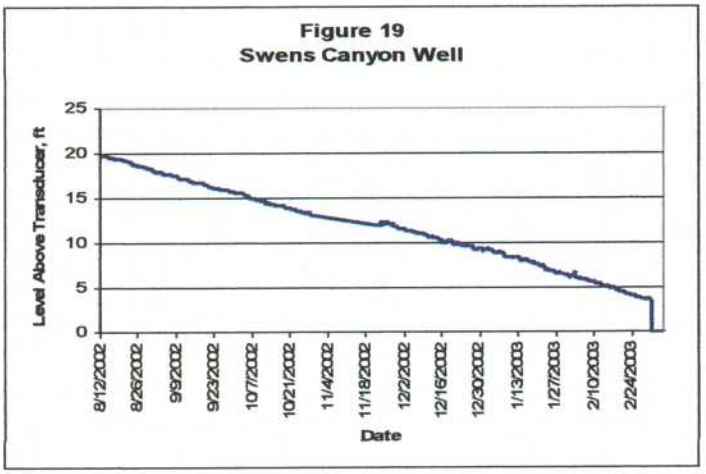
In addition to the data shown in Figure 17, the mine collected data from the South Boulger Canyon well (20-4-1) and from well 20-4-2 located on the ridge to the east of Boulger Canyon between January 2001 and May 2002. The data (shown in Figure 18) shows a general ground water decline on the order of 0.05 ft/day prior to the September 2001 event versus a decline between 0.16 and 0.26 ft/day after the event.

Figure 18
Water Levels in Monitoring Wells 20-4-1 and 20-4-2



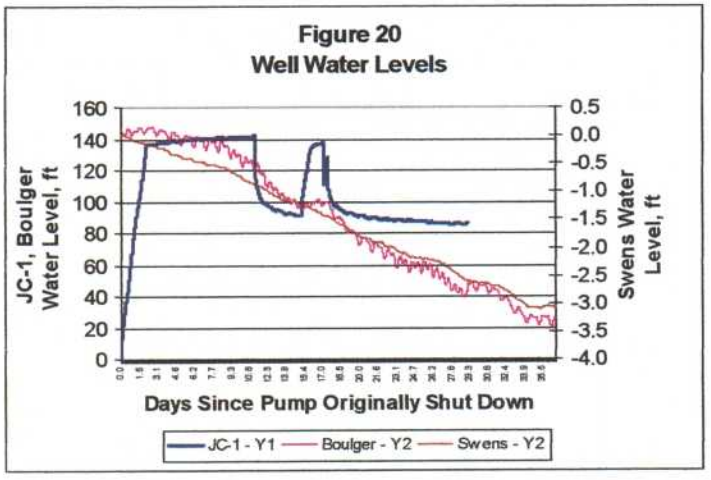
Swens Canyon Well. Although only a short period of record is available for the Swens Canyon Well, the data observed in Figure 19 shows continued ground water level declines since August of 2002 on the order of 15 feet. If the same rate of decline has occurred at this well since August of 1999 (similar in nature to that noted for the Boulger Canyon well), then the total amount of water level decline due to in-mine pumping would be anticipated to have been on the order of 105 feet.

Figure 19
Swens Canyon Well



As can be seen on Figure 20, the Boulger and Swens Canyon wells noted a response when the JC-1 well was stopped on August 12, 2002 then restarted twice within 19 days. From the data it would appear that the Boulger Canyon well responds to pumping within a day or so, whereas the Swen's Canyon well (located approximately 1.8 miles to the northwest of well JC-1) has a less dominant response time which may be on the order of 13 to 14 days.

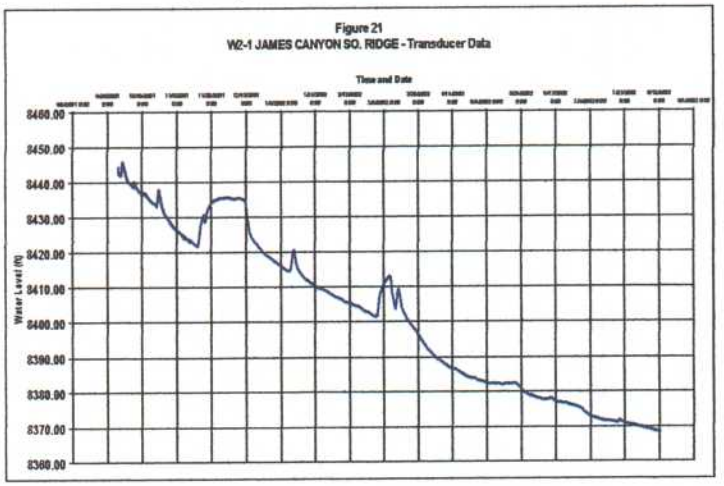
Figure 20
Well Water Levels



James Canyon Ridge Well. The well located on the south ridge of James Canyon (W2-1 or W79-35-1A) shows in Figure 21 a gradually decreasing water level which was impacted by pumping activities of well JC-1. The rebounds in data indicate periods of time when well JC-1 was non-operational.

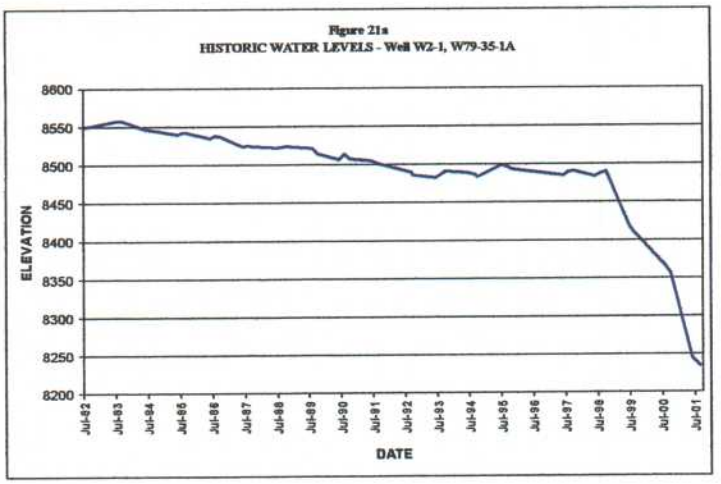
Figure 21a shows the entire period of record for the James Canyon Ridge well beginning

in 1982 and ending in 2003. It is interesting to note the more rapidly decreasing water levels at this well site with the increase in discharge from the mine since the 1998 – 1999 period of time when additional inflows were encountered within the mine.



Burnout Canyon Well. Water levels were recorded by the mine using a pressure transducer for the period between September 2001 and September 2002. Not only does the water level data shown in Figure 22 show the continued water level decline impact of mining, but also shows the short term impact resulting from starting and stopping well JC-1.

Other Wells. Other wells were reviewed for water level impacts resulting from mine pumping include those shown in Table 1. Data plots showing water levels and mine inflows are provided in Appendix C. Note in many of the plots the significant decrease in water level with increased pumping from the mine.



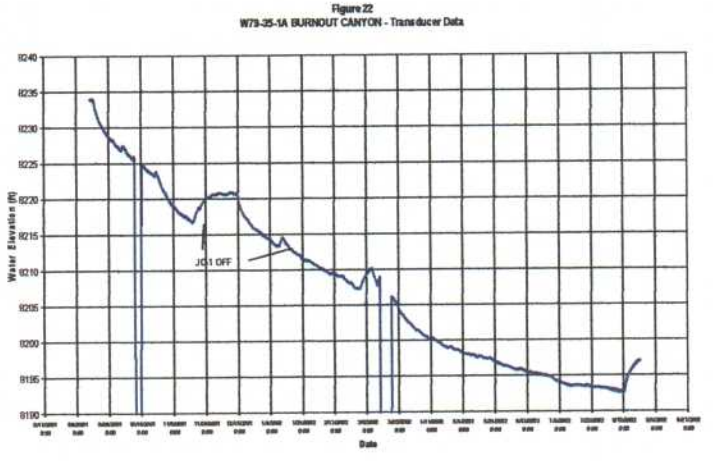


TABLE 1
Wells Reviewed For Mine Impact

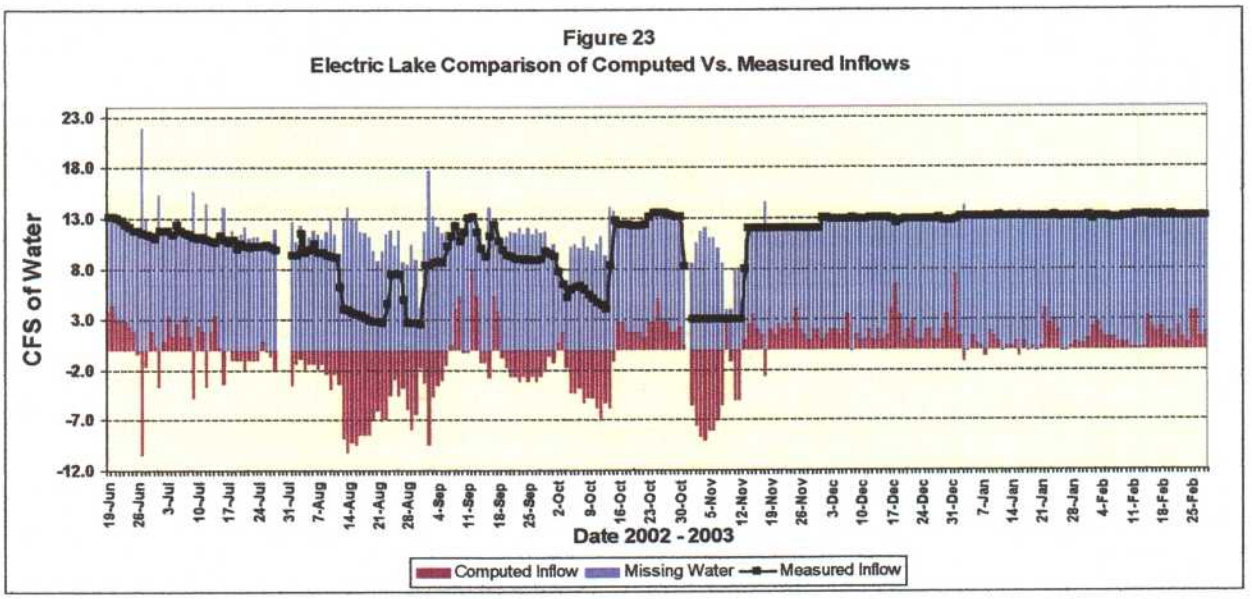
Well No.	Location	Distance from 10L Inflow	Approximate Water Level Impact
20-4-1	Boulger Canyon – South Well	2.1 miles	90 feet
20-4-2	Ridge East of Boulger Canyon	1.7 miles	110 feet
W79-10-1	Unknown	Unknown	Up 100 feet?
W79-10-1b	Unknown	Unknown	Up 100 feet?
W79-14-2a	South Side of Upper Eccles Ck	3.1 miles	0 feet
W79-26-1	Burnout Canyon – East Well	1.4 miles	50 feet
W79-35-1A	Burnout Canyon – West Well	0.9 miles	320 feet
W79-35-1B	Burnout Canyon – West Well	0.9 miles	0 feet
92-91-03	Unknown	Unknown	0 feet
W2-1, 98-2-1	Ridge South of Swens Canyon	0.8 miles	220 feet
98-2-1m	Ridge South of Swens Canyon	0.8 miles	140 feet
99-4-1	Boulger Canyon – North Well	1.9 miles	110 feet
99-21-1	Ridge North of Swens Canyon	2.5 miles	110 feet
99-28-1	Ridge South of Swens Canyon	2.1 miles	140 feet

Water Balance Calculations. Water budgets have been evaluated by PacifiCorp for Electric Lake using available historic data and new data generated over the past one to two years. Historical data related to Electric Lake has consisted of stage, volume, discharge, precipitation and evaporation. Prior to 2002 there were no consistent inflow measurements taken on the lake. A Parshall flume however was installed on Huntington Creek at the mouth of James canyon to monitor flows into the lake. These flows would be representative of those originating from Upper Huntington Canyon and Flat Canyon. Data from this flume was collected throughout 2002 via hard measurements as well as via a datalogger.

It was noted in 2002 at the time of installation that the chosen location would not be a long term solution since the flume would be inundated during high lake water, and likely spring snowmelt runoff events. The location however was chosen because it did not require any special permitting requirements since it was below the high lake water elevation. As anticipated the flume washed out in the spring of 2003 and was being repaired at the time of writing of this brief report. The long term solution is to install a flow measuring device upstream of the lake wherein consistent long term data can be collected. This effort is being coordinated by PacifiCorp with appropriate regulatory entities.

Attempts to calculate appropriate water balances for the lake have taken into account three general unknowns including 1) natural leakage, 2) side tributary and spring inflows, and 3) consistent surface channel inflows. As a method to get around some of these issues, PacifiCorp has evaluated what they term "Missing Water". This missing water is simply a reverse calculation showing over time the amount of water which is unaccounted for in the lake. Figure 23 has been inserted to represent this concept.

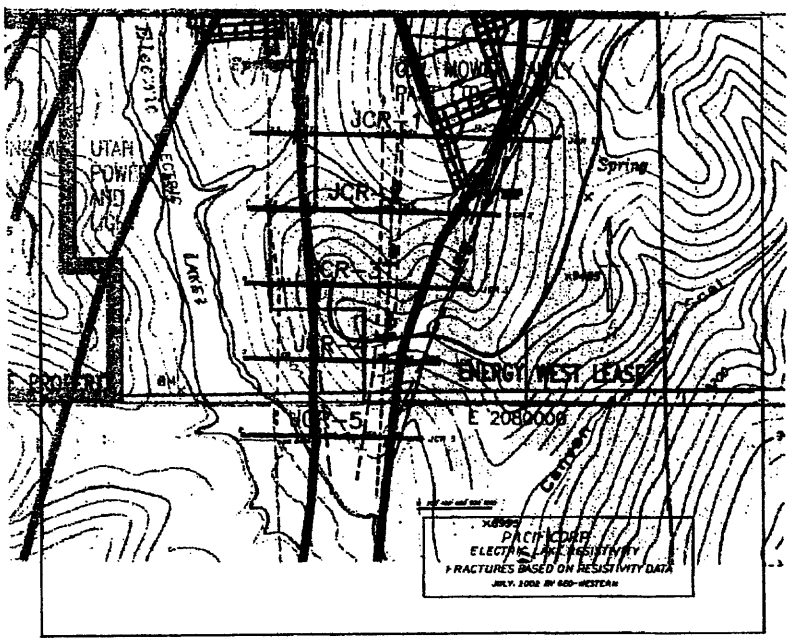
Figure 23
Electric Lake Comparison of Computed Vs. Measured Inflows



Resistivity Survey. Because of the documented water loss from Electric Lake and the fact that the Skyline Mine had intersected significant quantities of groundwater emanating from a fault that extends from the mine to the lake, geophysical studies were conducted to document the water migration between the two points. A pole-dipole resistivity survey was conducted between July 17 and July 28, 2002. The survey consisted of five parallel lines which were positioned normal to the Connelsville and Diagonal faults. Survey cross-sections are provided in Appendix D. Data collection points were positioned on 50 foot intervals along each of the lines.

The resistivity survey showed water-bearing fractures to be present along both of the faults and in areas between the two faults. The survey supported PacifiCorp's suspicion that water was indeed moving from the lake to the mine along the Diagonal and Connelsville faults. The depth of the water along the anomalies identified was at least 200 feet or more.

Resistivity and Induced Polarization tests were conducted on the East side of Electric Lake during late July of 2002. Five long East-West profiles, 1000 feet apart were completed near the North end of the lake in an attempt to locate faulting or fracturing along the East flank of the lake and to determine the presence of water on such fracturing. The most Northerly line was labeled JCR-1 and is the longest at 4,100 feet, with its zero point at the West, approximately 1000 feet East of the lakeshore. The zero point on all of the five lines is on a line bearing North-South. Line length is increasingly shorter as the survey advances South until at line five the length is 2500 feet. The zero point on line five is in the lake with the current water level at station 7 (700') East. The slope east of the Lake is rather steep ranging for 20 to 25 degrees on most lines.



Electrode Array. The survey points had been laid out in advance of the data collection with pin flags at 50 foot intervals. Because of the wide electrode separations necessary to achieve depth penetration up to 600 feet it was decided to employ the pole-pole electrode array since there was insufficient survey points beyond the West and East ends to facilitate the normal pole-dipole array. The pole-pole array requires a fixed current and potential electrode at infinite with one each current and potential electrode advancing along the profile at fixed interval. In order to collect sufficient data to develop a pseudo-section three "A" spacings were used (400-800-1200 feet) with the current electrode leading to the East. Depth penetration is considered to be roughly one half of the electrode separation. In this case 200, 400, and 600 feet which places the deepest penetration approximately 400 feet below the lake shore (8,500 feet) and about 350 feet above the mine workings. This is at the lowest point of the survey on the west end of line JCR-2.

Resistivity/Ip Method. Two conditions must be met in order to develop definable representation of vertical faulting or fracturing within survey data. The first is a relatively consistent conductivity over a broad area. The second requirement is sufficient conductive contrast within the fracture to cause an interruption in electrical continuity. Experience has shown that a fracture containing some wet clay will generally present a lower than normal resistivity contrast while a fracture containing moving fresh water will present a higher than normal resistivity.

While taking resistivity data it is advisable to take induced polarization (IP) data. This data is a product similar to an RC circuit where current is passed through the ground generating an ion flow. Water by its self does not produce IP effect, however clay particles which surround an aquifer, either fresh or saline, will provide a capacitive effect generating small signals which can be measured at the surface. Other polarizers such as metallic sulfides or graphite will also produce IP response. All formations will respond to some small degree and these weak responses are considered to be background effect. Higher than Normal IP responses are normally used as a confirmation of resistivity intersects on fracturing or to confirm the presence of water. Some IP responses were noted in locations other than those supported by resistivity data, and while these may indicated the presence of minor fracturing, they are not noted as fracture intersects.

Cultural Effects. Man made features, such a metal fences, buried cables, power lines or mine activity can cause problems with both resistivity and IP data. In this case where wide separation of potential electrodes required with the pole-pole array the problem could be more significant for both natural (telluric noise) and man made electrical noise. There were no metal fences noted during the survey, however a deep water well located roughly 2500 feet North of the survey created considerable electrical noise when measuring IP response, requiring repositioning of the reference Potential electrode. Resistivity data appeared

not to be effected by electrical noise since the signal is roughly 100 times stronger than IP responses. IP data however, was effected to a considerable degree especially by what appeared to be mine noise at the 1200 foot electrode separation. For this reason IP data were taken only at the 400 and 800 foot separations.

Instrumentation. The GEO-WESTERN HEW-200 resistity/IP portable system was used with a rechargeable power supply coupled to a DC-DC converter supplying up to 1000 volts. The transmitter delivers a commutated current at selectable pulse times. In this case a one second current pulse was used with a 50 percent duty cycle. During the off period, following a 300 millisecond delay, a 600 millisecond window was opened for measurement of the IP response.

Topographic Effects. As the survey advances up-slope the current electrode will always be at somewhat higher elevation than the following potential electrode. Since data penetration is considered to be perpendicular to the plane of the two electrodes adjustments must be made in the data point locations to compensate for this error. This can be seen in the pseudo sections where the data stations appear to be farther East than the corresponding surface location.

Data Presentation. Vertical pseudo—sections were made of each line with the surface topographic profile taken from the topographic map. Using a template, data points were plotted at their appropriate locations perpendicular to the plane of the two traveling electrodes. Since IP responses were taken at only the 400 and 800 foot separations the data were insufficient to develop pseudo sections. The data therefore were plotted on a separate sheet at their surface location. For this reason anomalous responses will generally appear slightly to the West of fracture intersects indicated on the resistivity sections.

Anomalous Features. Anomalous features, indicated by contouring of the resistivity data in pseudo—sections are shown as follows along with supporting IP responses. Where the presence of water, either fresh (highly resistive) or saline (more conductive), these features are also indicated. If the feature corresponds to a feature shown on the mine map this is also noted.

STA.	RESISTIVITY		IP	ATTITUDE	QUALITY	WATER	Mapped
JCR-1 Transect							
2.3	high (level change) all spacings		high	Vertical	Minor		No
7.9	low (level change) all spacings		high	Vertical	Major	saline below 200'	yes
18.1	low at 400-800 sep. high at 600'		strong	Vertical	Major	fresh below 600'	no
20.2	low (level change) all spacings		high	Vertical	Major		yes
26.2	broad high all spacings		high	Vertical	Major	fresh below 600'	no
32.8	high (below 300')		none	Vertical	Major	fresh below 300'	no
36.0	high (below 400')		strong	Vertical	Major	fresh below 500'	yes

Note: The inferred fracture at station 7.9 encountered probable saline water beginning 200 feet below the surface and extending to the maximum penetration at 600 feet. Below 300 feet a broad conductive zone with erratic IP responses extends from station 4 to 15 indicating a probable zone of saturation. Very strong IP responses were encountered between the two inferred fractures at 32.8 and 36.0.

STA.	RESISTIVITY		IP	ATTITUDE	QUALITY	WATER	Mapped
JCR-2 Transect							
2.3	high (below 400')		high	Vertical	Major	fresh below 400'	no
4.8	high (below 200')		high	Vertical	Minor	fresh	no
7.7	high (below 300')		very high	Vertical	Major	fresh below 300'	no
18.1	low all spacings		high	Vertical	Major	saline below 400'	no
21.0	low all spacings		high	Vertical	Minor	saline below 400'	yes
27.7	low all spacings		high	Vertical	Major	saline below 400'	yes

Note: From 2.5 East to 13 East a strong resistivity high was encountered below the 400 foot level with a significant (broad IP response) .This feature begins at the two fractures at 4.8 and 7.7 and extends downward along these two inferred fractures to the broad resistivity high at depth and probably indicates fresh water. From 18 East to 28.5 East a broad resistivity low is cut by three inferred fractures at 18.1, 21.0 and 27.7. These features begin at the 400 foot spacing and extend downward to the 1200 foot spacing with most of the activity below the 400' depth. A probable zone of saline water saturation is suggested. With the exception of high IP values at the fracture intersects IP responses were rather flat across the zone.

STA.	RESISTIVITY		IP	ATTITUDE	QUALITY	WATER	Mapped
JCR-3 Transect							
4.7	high all spacing		high	Vertical	Minor	fresh below 200'	no
10.2	high all spacings high		high	Vertical	Major	fresh below 200'	yes
12.9	high all spacings		high	Vertical	Major	fresh below 200'	no
18.4	high vertical			Vertical	Minor	fresh below 300'	no
20.6	low all spacings		high	Vertical	Major		yes
28.5	high 400' spacings			Vertical	Minor		yes

Note: The very high resistivity values, especially at the 1200 foot spacing (600'depth), are consistent with those seen on line two over the West one third of the profile from station 4 to about 14. IP responses over the area are abnormally high. Coupled together these two parameters suggest a strong possibility of fresh water both below and above the lake level.

STA.	RESISTIVITY		IP	ATTITUDE	QUALITY	WATER	Mapped
JCR-4 Transect							
4.4	low all spacings		high	Vertical	Minor		no
9.5	low		strong	Vertical	Major		yes
18.0	high all spacings		weak	80 west	Major	Fresh below 200'	yes
21.5	high all spacings		strong	Vertical	Major	fresh below 200'	no
24.5	high all spacings		no IP	Vertical	Major	fresh below 200'	yes

Note: the fresh water (resistivity high) features at 18.0, 21.5 and 24.3 all indicate the presence of fresh water several hundred feet above the 8,500 foot lake level.

STA.	RESISTIVITY		IP	ATTITUDE	QUALITY	WATER	Mapped
JCR-5 Transect							
16.4	low all spacings		high	Vertical	Minor		no
20.1	low all spacings		high	Vertical	Major		yes
24.9	low		high	Vertical	Minor		no

Note: No indications of fresh water were found on this profile.

Results and Conclusions. Resistivity and IP data taken with the Pole-Pole array, compared to the dipole-dipole system, although somewhat susceptible to sporadic electrical interference, is much less time consuming and equally useful in locating fractures where wide coil separations are required in rough terrain. Although IP data were deemed to be unreliable at the 1200 foot coil separation, due to probable mine activity, the 400 and 800 foot data was considered to be sufficient for confirmation of anomalous resistivity intersects.

With the exception of the major North-South (mapped) fault which should have been intercepted at station 24 on line JCR-3 all of the mapped locations were detected by the survey. Due to insufficient data at the West end of line JCR-5, the most Westerly of the North-South faults is not shown on the section.

The lake shore level, shown on all 5 pseudo-sections, presents a clear overview as to whether the inferred fractures with their accompanying water will occur above or below the lake level.

The area stretching through lines JCR-1, JCR-2 and JCR-3,for a minimum distance of 3000 feet North to South, and from 4 East to 14 east for an East-West distance of 1000 feet, appears to contain considerable water. The center of this zone is cut by the inferred North-South fracture at 7.9 on line JCR-1, at 7.7 on JCR-2 and again at 10.2 on line JCR-3. This fracture is presently producing 2,500 gpm on the same fracture roughly 2,500 feet North of JCR-1. Resistivity and IP data collected over the zone appears to suggest a resistive zone at or below the 8,500 foot elevation mark, particularly at the 1200 foot separation where the data is expected to be approximately 600 feet below the surface. Three inferred fractures which are expected to contain fresh water above the 8,500 foot elevation are noted on line JCR3 at 4.7, 10.2 and 12.9. All three are expected to contain fresh water at least 300 feet above the 8,500 foot mark and continuing to at least the 600 foot depth.

High resistivity intersects on line JCR-4 at stations 10.0, 21.5, and 24.5 all indicate the presence of fresh water at least 200 to 300 feet above the 8,500 foot elevation.

The resistivity survey identified fractured or faulted strata that were water saturated. From the data collected on the five lines surveyed, it appears that the primary zone of saturation is along the Connelsville fault at fairly shallow depths on the southern lines. The water saturated zones however appear to get progressively deeper on the northern lines and shift toward the Diagonal fault at some point between lines JCR-3 and JCR-2. These data also suggest that several fractures and faults are present that are saturated which could allow the migration of water from Electric Lake to the underground workings of the Skyline Mine.

AquaTrack Survey. A new geophysical technology has been developed by a regional engineering firm which they refer to as "AquaTrack". In an effort to obtain as much information as possible, PacifiCorp decided to proceed with the AquaTrack study acknowledging it's lack of universal acceptance by local technical professionals. As part of the conditions of the study, it was understood that little to no information was to be given to the engineering firm completing the investigation. This condition was employed in order to obtain as independent a conclusion as possible related to the potential interconnection between Electric Lake and waters encountered within the mine. The results of the effort are included herein as additional information which supports the data presented by the resistivity study, and is offered to the reader for interpretation as appropriate.

The AquaTrack Survey was used in an attempt to map out the groundwater systems within the zone between Electric Lake and the Skyline Mine. The survey was conducted on the same lines and stations that were used for the resistivity survey also discussed herein. In addition, data on intermediate lines was collected by the engineer conducting the study. The fieldwork for the AquaTrack Survey started on August 15th and was completed on August 28th, 2002.

The AquaTrack Survey is reported to work by energizing the groundwater system with an AC electrical current, which in turn generates a complimentary magnetic field. By measuring the intensity and orientation of the magnetic field generated, subsurface groundwater paths are reportedly mapped. This survey (included in Appendix E) indicated that the majority of the groundwater was flowing from the lake near the Connelsville fault but that water flow transfers to the Diagonal fault about half way between the lake and the mine workings. The water then appears to flow along the Diagonal fault and into the mine workings. The survey also indicated that the water flowed increasingly deeper as it migrated from the lake to the mine.

Diving Investigations. After an analysis of the geophysical data (Resistivity and AquaTrack), PacifiCorp felt that a reasonable target had been defined where the lake was leaking along the Connelsville and Diagonal faults. Because of this, a diving company was contracted to inspect the bottom of the lake. Initially, divers were brought into the lake in mid September, 2002. At that time, the lake water was extremely turbid and visibility was less than one foot. A submersible camera did document several small venturi-shaped holes in the bottom of the lake that were suspicious. It was felt that it would be best to send divers into the lake during the winter when the lake was frozen. Under those conditions, algae in the lake would be dormant and the suspended solid content of the water would be at a minimum.

Underwater investigation by Advanced Diving Services, Inc. from Mesquite, Nevada began on February 14th and was completed on February 21st. The objective of the investigation was to characterize and document the nature of the leak zone at the bottom of the reservoir. It was not the intent to map every feature in detail, but to collect data that would show the nature and extent of the leak zones. For the most part, the investigation

was completed by the ROV. This unit, called a Sea Lion, was equipped with a high-resolution video camera, four high-intensity lights, and thrusters that provided full control of roll, pitch and yaw of the ROV. The ROV was connected to the surface by a 500 foot-long umbilical that provided power to the ROV and video feed from the ROV to the monitors and video recorders on the surface. The ROV traveled on sweeping lines approximately 20 feet apart to map out the features on the bottom of the reservoir. When features were viewed on the monitor, the operator would stop the ROV on the bottom and record the image on videotape. A videotape of diving highlights has been included as part of this submittal. The ROV would then be forced in a forward direction causing its skids to move sediments into suspension in front of the ROV. The movement of water into the holes could be documented by watching the suspended sediment being drawn into the holes by the water current. Initially, a 3/8-inch neoprene line that was affixed to the umbilical was used to pump dye down to the ROV to identify water movement into the holes. However, freezing conditions on the surface made the use of the dye impractical and it was found that agitating the sediment on the lake bottom was equally effective.

As features were identified, an operator on the surface would walk along the ice carrying a magnetometer to precisely locate the position of the ROV on the bottom. The operator would then record the exact location using a hand-held Magellan Global Positioning Unit. The location was then marked with a wood lath and the station number was recorded on the lath. This process proved to be a tedious but effective way to map out the features on the bottom of the lake.

The process described above was used to map features on the bottom of the lake in the areas of suspected leakage. In general, the ice covering the water in the lake was measured at 11 to 19 inches in thickness. Several holes in the ice were noted along the trace of the Connelsville, Diagonal and a third fault near the dam. It was discovered that these holes were formed by gas that was being liberated from the bottom of the lake along fractures associated with these faults. An analysis of a sample of the gas being liberated from the bottom of the lake proved it to be 75% methane. Because the methane gas that is being liberated is probably occurring along the same fractures which are allowing water to be lost from the lake, an under-water reconnaissance was conducted at all three locations (see Map 1 in Appendix B).

The first area to be inspected was the Connelsville fault trace. The mapping of lake bottom features along this fault required four days to complete (February 14th through February 17th). The inspections were made by cutting two access holes in the ice with a chain saw that enabled the ROV and divers to access the lake. Numerous features were mapped on the bottom of the lake in this area. These features included numerous venturi-shaped holes that averaged about ½ to 1 inch in diameter. These holes were observed to vent methane and enable water to flow from the lake. It was common to find these holes in clusters and aligned along trends. As the location of these features was identified on the ice using the wood laths, it became apparent that they were located along trends that ran in a N 45°E direction. It appears that the holes in the bottom of the lake are located along individual fractures or jointing associated with the Connelsville fault. These linear features suggest the presence of an en-echelon faulting pattern. Map 2 (see Appendix B) shows the details of the features mapped on the lake bottom in the area of the Connelsville fault. This map shows the waypoint (GPS) location of the features mapped. Also shown are symbols that document methane venting (magenta square) and negative water flow (cyan triangle) at various locations. The data collected at each waypoint is shown on the Dive Data Tabulation found in Appendix B.

At two locations along the Connelsville fault, fluoroscein dye was implanted in the lake bottom sediments to facilitate the tracing of the water connectivity with the Skyline mine. At each location, the dye was in powder form in one-pound plastic-canisters. Numerous holes ¼ inch in diameter were drilled into the canisters to allow the lake water to penetrate the canisters and allow the dye to dissolve. The canisters were taped to a

steel weight (2 one-pound canisters at each location) to insure negative buoyancy and were placed in the lake sediments by a diver. The dye canisters were buried about six inches into the sediment. The dye was implanted along this fault at waypoints 16 and 19 on February 17, 2003.

The trace of the Connelsville fault crosses the lake in such a way that along the lakes southwest shore, the fault trace is above the current water line for a distance of approximately 100 feet. The submerged portion of the fault trace to the south of this was surveyed on February 20th, after the completion of the mapping of the Diagonal fault. Some fracturing of the lake sediments were noted in the southern most area of the Connelsville fault trace that was surveyed in addition to numerous venturi-shaped holes.

The Diagonal fault trace was mapped on February 18th and 19th. Similar conditions were identified along this fault as on the Connelsville fault. The holes in the bottom of the lake were aligned in a N 45°E direction. Numerous fractures were found near the northern end of the Diagonal fault. These fractures were trending on two near perpendicular trends. The fractures were approximately ½ to 1 inch in width and were observed to have water flowing out of the lake along them. The fractures appeared to be tension fractures. The features mapped in the area of the Diagonal fault are shown on Map 2 (see Appendix B). The area of fractures is depicted on this map as magenta lines. The data represented on the map is summarized in the Dive Data Tabulation in Appendix B.

Fluoroscein dye was placed at two locations on the lake bottom along the trace of the Diagonal fault. These locations were the fractured area (waypoint 20) and holes venting gas (waypoint 28). At each of these locations two pounds of dye were implanted on February 19, 2003.

The last area to be surveyed was 1-½ miles to the south of the Connelsville and Diagonal faults along a fault that trends in a northwest-southeast direction (see map 1 in Appendix B). The ice in the area of this fault showed numerous holes associated with the venting of methane gas from the lake bottom. The underwater survey of this area was completed on February 21st. In this area, the ROV was maneuvered along the lake bottom and recorded features on videotape. This area was found to have an abundance of venturi shaped holes as along the other two faults investigated. These holes were shown to be venting methane and allowing water to flow from the lake. This un-named fault intersects both the Diagonal fault and the Connelsville fault about 1 mile to the south of the north end of Electric Lake. It is apparent that the loss of water along this fault is allowed to occur because of the connectivity of this fault with the other investigated faults. The details of the area mapped along this fault are depicted on map 3 in Appendix B.

In all three areas that were surveyed, the features indicative of water loss and methane venting appear to be confined to a zone about 100 to 150 feet from each side of the faults mapped. Outside of this zone, the bottom of the lake appeared to be normal. This indicates that the areas affected by water loss are in zones 300 feet in width along each of these faults. It should be expected that other faults and fractures that intersect these three faults surveyed might also show similar features. In the case of the fault near the dam, the lake bottom was well within the area of dead-water storage in the bottom of the lake. This suggests that a repair of the holes in this area would require a total draining of the lake, including the pumping of dead storage.

It had been noticed that gas (primarily methane) was venting from both the Connelsville and Diagonal faults was keeping the ice from forming in some locations. This phenomena also occurred at the location near the dam. This diving survey identified locations where numerous holes were present in the bottom of the lake. Most of these holes were observed to vent gas and be associated with a negative flow of water from the lake into the subsurface. A summary report of the dive is attached.

The methane venting from the lake bottom is likely a result of the groundwater level drawdown. Methane is held in the pores of the coal and surrounding sandstone by the hydrostatic pressure exerted by the groundwater. As the groundwater level is drawn down to a lower level by the water flowing into the mine, the methane stored within the pores of the rock is allowed to escape. This gas then migrates upward along the same fractures that the water is moving downward from the lake into the strata below and the mine. As the groundwater level is drawn down, the venting of methane should be expected to continue. As the methane is released and migrates to the surface, it is displaced by the water that is flowing downward from the lake.

The mapping of the lake bottom using the ROV and utilizing divers characterized the loss of water from the lake to be associated with thousands of holes, each with a subtle but significant water loss from the lake. The zones around each fault appear to be about 300 feet in width along the entire length of each trace within the area of the high-water level of the lake. Because at least three faults are involved that cover a significant portion of the lake, the repair of the leaks will likely be an extensive and complex project. The fractures in the bedrock are covered by up to 30 through 60 feet of alluvium that has been demonstrated to readily conduct water flow. This will require that any repair address the sealing of the fractures and the overlying alluvium.

Testing

Tracer Dye Study. In that water loss from the lake had been identified by the diving it was determined that it might be beneficial to attempt a dye tracing study to see if a direct connection to the mine could be verified. The two following separate dye testing events were conducted as a result.

February 2003. Just prior to completion of the diving investigation, Mr. Rodger Fry oversaw the installation into the lake bottom of eight, one pound dye packs. This installation involved the burying these containers adjacent to identified fissures within the bottom of the lake. Two, one pound canisters were buried at each of four locations, two each on the Diagonal and Connelsville faults. At the same time, screen enclosed carbon packs were installed at the sample port of well JC-1, and at a location on Eccles Creek approximately ½ mile downstream of the Skyline Mine Offices and surface facilities.

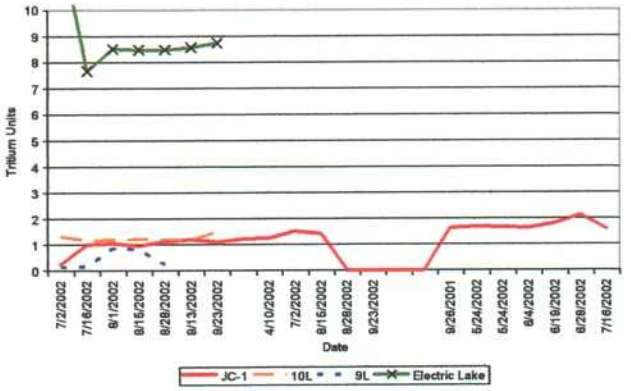
During the dye installation and filter pack placement, contact was made with USGS regarding sampling protocol used by the Federal government. During that conversation it was suggested that one of the best authorities on the subject of dye tracing was Mr. Tom Aley of Ozark Underground Laboratories, Inc. As a result, Mr. Aley was contacted and the efforts expended to date were explained. Mr. Aley then considered the information provided and determined that the dye placed was likely not sufficient to make a firm determination. He then recommended modifications to the sampling and testing program which were taken into consideration by PacifiCorp. It was thereafter decided to re-conduct the dye test per Mr. Aley's recommendations as soon as practical while there was still a cover of ice on the lake that would provide access and prime water temperature conditions. This effort was conducted in April, 2003.

April 2003. Mr. Tom Aley, President of Ozark Underground Laboratories, Inc. was contracted to plan and oversee the placement of dye into the lake to document the connectivity of water flow zones and water flow rates from the lake into the subsurface. To place the dye, holes were drilled in the ice and a one-inch PVC pipe was lowered to within six inches of the lake bottom. Water was pumped from the lake into a 30-gallon drum on the surface and the dye was mixed to the proper concentration and then pumped back into the lake. Dye placed along the Diagonal fault included 50 pounds of Eocene dye with 35 pounds of Fluorescien dye being placed on the Connelsville fault. Monitoring for the dye is currently in progress. The work plan for the dye-tracing program is attached in Appendix F.

At the time of writing of this report, and as expected, dye had not yet been positively detected at the identified sampling points. It is recognized that travel times within the hydrologic system may be short, or may take several months as the water mixes with other base water and moves through the fault / fracture systems. If and when noted, a positive detection or spike of dye collected at the sample sites will confirm a positive flow path between the lake and the mine. However, a negative dye detection does not confirm that a flow path does not exist between the lake and the mine since it can mean that either 1) travel times are long and dye has not yet made it to the sampling point, or 2) the systems are not connected. Results of the Dye study are not yet complete but will be made available when finished.

Tritium. Samples are being collected by PacifiCorp and Canyon Fuels of waters discharged from well JC-1. These samples are being analyzed for their tritium content. The lab used for all samples collected by both PacifiCorp and Canyon Fuels is the University Miami Tritium Laboratory. Table 2 summarizes the data of analyses received to date and Figure 24 shows it graphically.

Figure 24
Tritium Analyses



of

TABLE 2
Summary of Tritium Sampling

Location	Date	$\delta^{13}C$ (‰)	^{14}C (pmC)	Tritium (TU)	Mean residence time (radiocarbon years)
In-Mine					
10L Sump	7/2/2002	10.4	24.2	1.31	6,300
10L Sump	7/16/2002	---	---	1.16	
10L Sump (alternate)	8/1/2002	---	---	1.19	
10L Sump	8/15/2002	---	---	1.21	
10L Sump	8/28/2002	---	---	1.20	
10L Sump (alternate)	9/13/2002	---	---	1.18	
10L Sump	9/23/2002	---	---	1.46	
9L Borehole XC59	4/10/2002	10.4	16.91	0.16	9,300
9L Horizontal Borehole	7/2/2002	10.1	15.60	0.17	9,700
9L Horizontal Borehole	8/15/2002	---	---	0.86	
9L Horizontal Borehole	8/28/2002	---	---	0.83	
9 Left Horizontal Borehole	9/23/2002	---	---	0.24	
Mine Dewatering Wells					
JC-1	9/26/2001	11.8	30.42	0.24	4,600
JC-1	5/24/2002	---	---	1.00	
JC-1	5/24/2002	---	---	1.04	
JC-1	6/4/2002	---	---	0.96	
JC-1	6/19/2002	---	---	1.11	
JC-1	6/28/2002	---	---	1.18	
JC-1	7/16/2002	---	---	1.09	
JC-1	8/1/2002	---	---	1.22	
JC-1	9/13/2002	---	---	1.25	
JC-1	9/24/2002	---	---	1.50	
JC-1	9/28/2002	---	---	1.42	
JC-1	10/14/2002	---	---	Pending	
JC-1	10/21/2002	---	---	Pending	
JC-1	10/29/2002	---	---	Pending	
JC-1	12/5/2002	---	--	Pending	
JC-1 argon purged	12/10/2002			1.62	
JC-1 triple rinsed	12/10/2002			1.69	
JC-1 argon purged	12/11/2002			1.66	
JC-1 triple rinsed	12/11/2002			1.64	
JC-1	1/31/2003			1.8	
JC-1	2/15/2003			2.12	
JC-1	3/10/2003			1.59	
Electric Lake					
Upper Electric Lake	9/26/2001	-8.3	72.44	12.6	Modern
E. Lake-1 Mid Lake	5/24/2002	---	---	7.67	
E.Lake-2 North End	5/24/2002	---	---	8.52	
North End Shallow Elect.	7/11/2002	---	---	8.48	
North End Deep Elect.	7/11/2002	---	---	8.49	
South End Shallow Elect.	7/11/2002	---	---	8.57	
South End Deep Elect.	7/11/2002	---	---	8.74	

Sampling by the University of Utah. In September 2002, Dr. Kip Solomon of the University of Utah also sampled and analyzed the water from the Skyline Mine and from well JC1 located in the vicinity of the mine. The samples were analyzed for tritium (^3H), and dissolved gases including chlorofluorocarbons (CFCs), helium (He), neon (Ne), nitrogen (N_2), and argon (Ar). Collectively known as environmental tracers, these analytes provide information regarding the travel time of water in the subsurface.

The preliminary results, preliminary interpretations, and a possible conceptual model relating to Dr. Solomon's sampling and analysis are provided below. Due to the dynamic nature of the situation, these results, interpretations, and model may be modified as additional information becomes available. These should be viewed as preliminary and are subject to change if/when additional information or understanding becomes available.

Results. Field measurements of water temperature, dissolved oxygen, electrical conductivity, total dissolved gas pressure and barometric pressure are shown in Table 3. The dissolved gas results are shown in Table 4. Gas concentrations are reported in cm^3 of gas at Standard Temperature and Pressure (STP) per gram of water. The helium isotope ratio is reported as R/Ra where Ra is the $^3He/^4He$ ratio of the air standard (1.384×10^{-6}.)

The ^3H results are shown in Table 5. All ^3H values are reported in tritium units (TU) where 1 TU is equal to 1 ^3H atom per 10^{18} atoms of stable hydrogen.

CFC results are shown in Table 6. Results for the three in-mine stations sampled are presented in pmoles/kg.

In all of the samples, the concentrations of N_2, ^{40}Ar,, and ^{20}Ne can be explained by equilibrium solubility with the atmosphere along with a modest amount of excess air. Table 7 shows values calculated from the measured values including the amount of tritiogenic ^3He, terrigenic ^4He, recharge temperature, and excess air. The tritiogenic ^3He is reported in tritium units (TU) for the convenience of comparison with tritium values.

TABLE 3
Field Measurements on Water Samples Collected September 23, 2002.

Location	Water Temperature (°C)	Dissolved O2 (mg/L)	Conductivity (uS/cm)	Total Dissolved Gas Pressure (mmHg)	Barometric Pressure (mmHg)
XC 5 E	15.22	0.05	307	723	576
10 Left	12.81	0.20	358	627	654
9 Left	10.14		396	617	654

TABLE 4
Analysis of Dissolved Gases in Water Samples Collected September 23, 2002.

Location	N2 (ccSTP/g)	Ar40 (ccSTP/g)	Ne20 (ccSTP/g)	He4 (ccSTP/g)	R/Ra
XC 5 E	0.0221	5.53E-04	3.00E-07	1.93E-07	0.426
10 Left	0.0182	4.59E-04	2.37E-07	9.10E-08	0.701

Location	N2 (ccSTP/g)	Ar40 (ccSTP/g)	Ne20 (ccSTP/g)	He4 (ccSTP/g)	R/Ra
10 Left	0.0178	4.48E-04	2.15E-07	8.02E-08	0.717
9 Left	0.0188	5.27E-04	2.55E-07	8.78E-08	0.693
9 Left	0.0237	5.54E-04	2.60E-07	1.00E-07	0.699

TABLE 5
Results of Tritium Analysis of Water Samples Collected September 23, 2002.

Location	Tritium (TU)	± (TU)
XC 5 East	0.01	0.01
10 Left	1.60	0.15
9 Left	0.33	0.05
Well JC1	1.52	0.08

TABLE 6
Analysis of CFC in Water Samples Collected September 23, 2002.

Location	CFC-11 (pmoles/kg)	CFC-12 (pmoles/kg)
XC 5 E	3.64	0.64
XC 5 E	2.88	0.27
10 Left	1.49	0.24
10 Left	1.41	0.19
9 Left	1.31	0.13
9 Left	1.87	0.16

TABLE 7
Values Calculated From Analysis of Water Samples Collected September 23, 2002.

Location	TritHe3 (TU)	Age of Young Fraction (yr)	Terrigenic He4 (ccSTP/g)	Rech. Temp (C)	Excess Air (ccSTP/g)
XC 5 East	0	NA	1.1E-07	0.0	1.06E-02
10 Left	0.4	4.0	2.8E-08	0.0	6.02E-03
10 Left	0.6	6.1	2.4E-08	0.0	4.87E-03
9 Left	0	NA	1.9E-08	0.0	7.34E-03
9 Left	0	NA	3.0E-08	0.0	8.92E-03

Preliminary Interpretations. According to Dr. Kip Solomon, the tritium result from cross section 5 east submain is consistent with water that has been isolated from the atmosphere for more than 50 years (and probably more than 100 years.) *In contrast, the tritium results from 10 Left, 9 Left, and well JC1 (areas all related to the large August 2001 inflows) all indicate the presence of modern water.* Current tritium concentrations in precipitation in Utah are approximately 15 TU (Manning, 2002.) A *mixture of approximately 10% modern water (less than 50 years old) with 90% pre-modern (older than 50 years) water would explain the observations in 10 Left and well JC1.* Water discharging from 9 Left appears to be mostly pre-modern water, but unmistakably contains a small amount of modern water. The tritium values measured by the University of Utah are similar to replicate samples sent to the University of Miami. In Dr. Solomon's judgment, it is highly unlikely that the tritium values measured in 10 Left and well JC1 are the result of analytical errors or are sampling artifacts. Moreover, other environmental tracers support Dr. Solomon's conclusions.

The helium isotope ratios are consistent with the interpretation that water discharging from 10 Left is a mixture of modern and pre-modern water. *Water from 10 Left clearly contains ^{3}He that results from ^{3}H decay (tritiogenic ^{3}He.) The apparent ^{3}H/^{3}He age of this water is about 5 years ± 3 years.* When modern (tritiated) water mixes with pre-modern (non-tritiated) water, the apparent ^{3}H/^{3}He age is that of the modern fraction irrespective of the fraction of modern water in the mixture. This is because the ^{3}H/^{3}He age is derived from the ratio of ^{3}He to ^{3}H and this ratio does not change if tritium-free water dilutes that absolute ^{3}H or ^{3}He concentrations. Only the samples from 10 Left clearly contain tritiogenic ^{3}He. While the presence of some ^{3}H in 9 Left suggest that it should contain tritiogenic ^{3}He, the absolute amount is too low to be reliably detected.

A ^{3}H/^{3}He age of 5 years in 10 Left is significant because it shows that the ^{3}H observed in 10 Left entered the saturated zone in the past few years rather than being a very small fraction of water that entered the saturated zone in the mid 1960s when ^{3}H values in precipitation reached a peak. *The occurrence of both ^{3}H and tritiogenic ^{3}He is strong evidence that the discharge coming from 10 Left is hydraulically connected to the shallow hydrologic system.*

Also, the concentration of dissolved ^{4}He can provide an indication of groundwater age in the range of 1000 to about 1 million years. Terrigenic ^{4}He was present in all the samples, but only in modest amounts, suggesting that the pre-modern water discharging into the mine is perhaps a few thousand years old; however, it is unlikely to be more than about 20,000 years old. In order to perform precise dating with ^{4}He it is necessary to measure the uranium and thorium content of the water bearing formations, and to evaluate the release of ^{4}He from mineral phases into water. Since this has not occurred it is only possible at this time to use ^{4}He as a qualitative indicator age. Nevertheless, assuming that the release of ^{4}He from minerals has reached a steady state with respect to the decay of U and Th, and assuming a typical production rate of 3 □cc/m^3/yr the age of the water based on ^{4}He would be about 5500 years for cross section 5 east submain and about 1300 years for 10 Left. If the ^{4}He production rate were only 1 □cc/m^3/yr (a minimum "reasonable" value), the calculated ages would be 3 times older.

CFC concentrations in all samples were low, but the results were inconclusive due to potential problems with purging of the CFC sampling tubes.

Conceptual Model. Based upon this preliminary information, Dr. Kip Solomon found that the environmental tracer data he reviewed are consistent with the following conceptual model. Pore waters within the Star Point Sandstone are part of a regional flow system that has a mean residence time on the order of 1000 to 10,000 years. This age is consistent with both the ^{4}He measurements presented in this report, and

^{14}C measurements presented by Mayo et al. (2000.) Dr. Solomon believes that it is highly unlikely that these pore waters are connate and hydraulically isolated from the near surface flow system. Instead, it is likely that sluggish (but finite) flow occurs in this system as a result of regional hydraulic gradients and the generally low permeability nature of this formation. Superimposed on this regional flow system are fast fracture flow paths. These pathways are hydraulically connected to the surface water hydrology of the area. *The computed $^{3}H/^{3}He$ age of water moving along the fast flow paths leading to 10 Left is approximately 5 years. This indicates that mining operations have altered or possibly completely created these fast pathways. A simple mass balance of ^{3}H suggests that approximately 10% of the flow discharging at 10 Left is modern water that was at or near the surface about 5 years ago (± 3 years.) The existence of a clear hydraulic connection between the surface water hydrologic system and mine discharge indicates that mine discharge has and will continue to impact shallow groundwater and surface water in this area.*

Gas Analysis. Analyses of gasses found to be emanating from anomalies within the bottom of Electric Lake were performed with the results as shown in Tables 8 through 10. A brief interpretation of the results made by Mr. Tom Aley follow each respective table.

TABLE 8
Age Dating Sample Collected from Well JC-1 on March 26, 2003

Sample ID	RunID	N2 (ccSTP/g)	Ar40 (ccSTP/g)	Ne20 (ccSTP/g)	He4 (ccSTP/g)	R/Ra	TritHe3 using Ne (TU)	Tritium (TU)	Age using Ne (yr)
JC1-2	06070304	0.0130	3.24E-04	1.62E-07	5.62E-08	0.844	3.8	1.8 (est.)	20.3

Sample ID	TerrHe4 using Ne (ccSTP/g)	Rech. Temp (C)	Excess Air (ccSTP/g)	Comment
JC1-2	1.5E-08	4.2	1.34E-03	Mass Spec. was drifting. Need to run duplicate. Age is probably ± 5 years. 3H is an estimate based on Miami data; Utah sample is pending.

Interpretation of Age Dating Data. The majority of water is older than 50 years. The 3H/3He is an estimate of the young fraction of water entering the well. The uncertainty in the apparent age is about ± 5 years, in part due to drift in the mass spectrometer; the duplicate will be run to improve this. The age of the young fraction is OLDER than previous samples collected from the mine proper.

TABLE 9
CFC Data from Well JC-1 on March 26, 2003

Sample #	CFC-11 pmoles/kg	CFC-12 pmoles/kg	CFC-113 pmoles/kg	CFC-11 eq.air conc (ppt)
JCI-1	0.10	0.12	0.00	7.0
JCI-3	0.12	0.13	0.00	7.9
JCI-5	0.05	0.02	0.00	3.6
JCI-2	0.08	0.03	0.00	5.1
JCI-4	0.14	0.18	0.00	9.0
JCI-6	0.07	0.03	0.00	4.4
Average	0.09	0.09	0.00	6.15

Sample #	CFC-12 eq.air conc (ppt)	CFC-113 eq.air conc (ppt)	CFC-11 Rech year	CFC-12 Rech year	CFC-113 Rech year
JCI-1	31.9	0	1957	1960	#N/A
JCI-3	33.7	0	1958	1961	#N/A
JCI-5	5.4	0	1955	1950	#N/A
JCI-2	7.6	0	1956	1951	#N/A
JCI-4	46.9	0	1959	1963	#N/A
JCI-6	8.1	0	1956	1951	#N/A
Average	22.26	0.00	1956.83	1956.00	

Interpretation of CFC Data. The majority of water in JC1 is older than 50 years. The apparent CFC age of a mixture of waters is NOT linearly proportional to the mixing fraction, especially when the old fraction is older than 50 years. The presence of detectable amounts of CFCs is consistent with the presences of small amounts of tritium.

TABLE 10
Gas Data Collected from Well JC-1 on March 26, 2003

CH4	O2	N2	Ar	C3H8	H2O	CO2
66.4%	1.0%	18.8%	0.13%	0.24%	0.0034%	0.0052%

Comments and Interpretation of Gas Data. Gas was collected from Electric Lake using inverted funnel method on March 26, 2003. Gas composition is approximate with uncertainty approximately ± 10% of the value. Gas seeping from the bottom of Electric Lake is typical of natural gas. Its low CO2 content suggests that it is not from a shallow, biogenic source in the lake sediments. Gas flow rates were measured and range from about 25 to 150 ml/min from individual vents. Such high rates are not typical of biogenic

production in lake sediments and suggest the gas is coming from depth. The presence of gas from depth indicates open pathways.

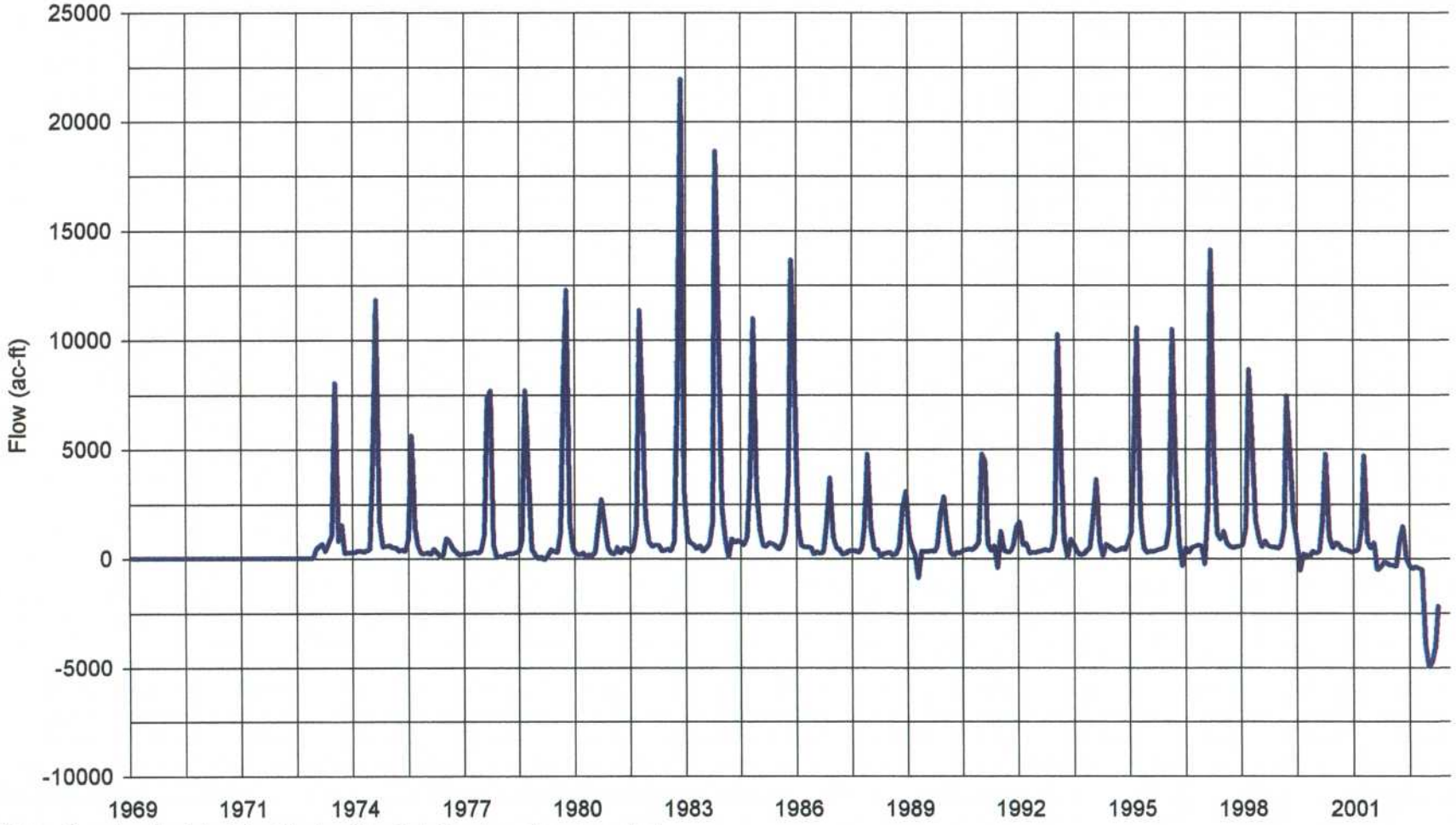
SUMMARY AND CONCLUSIONS

As stated in the Executive Summary, the data suggests a strong link between waters encountered within the Skyline Mine and water loss in Electric Lake. The myriad of studies and data analyses conducted and reported herein show that this strong hydrologic link between the two systems is anomalous to other local and regional hydrologic systems. These links between mine inflows and losses in Electric Lake can be seen in the various forms of data including water balance calculations, mine monitoring wells, reservoirs, water quality analyses, resistivity and AquaTrack studies, and diving investigations. Each of these data and study sources point to a confirmation of impact upon surface waters associated with Electric Lake and Huntington Creek drainage and vicinity. PacifiCorp would be happy to discuss with the Division any of the data contained herein in more detail should it be desired.

Apppendix A

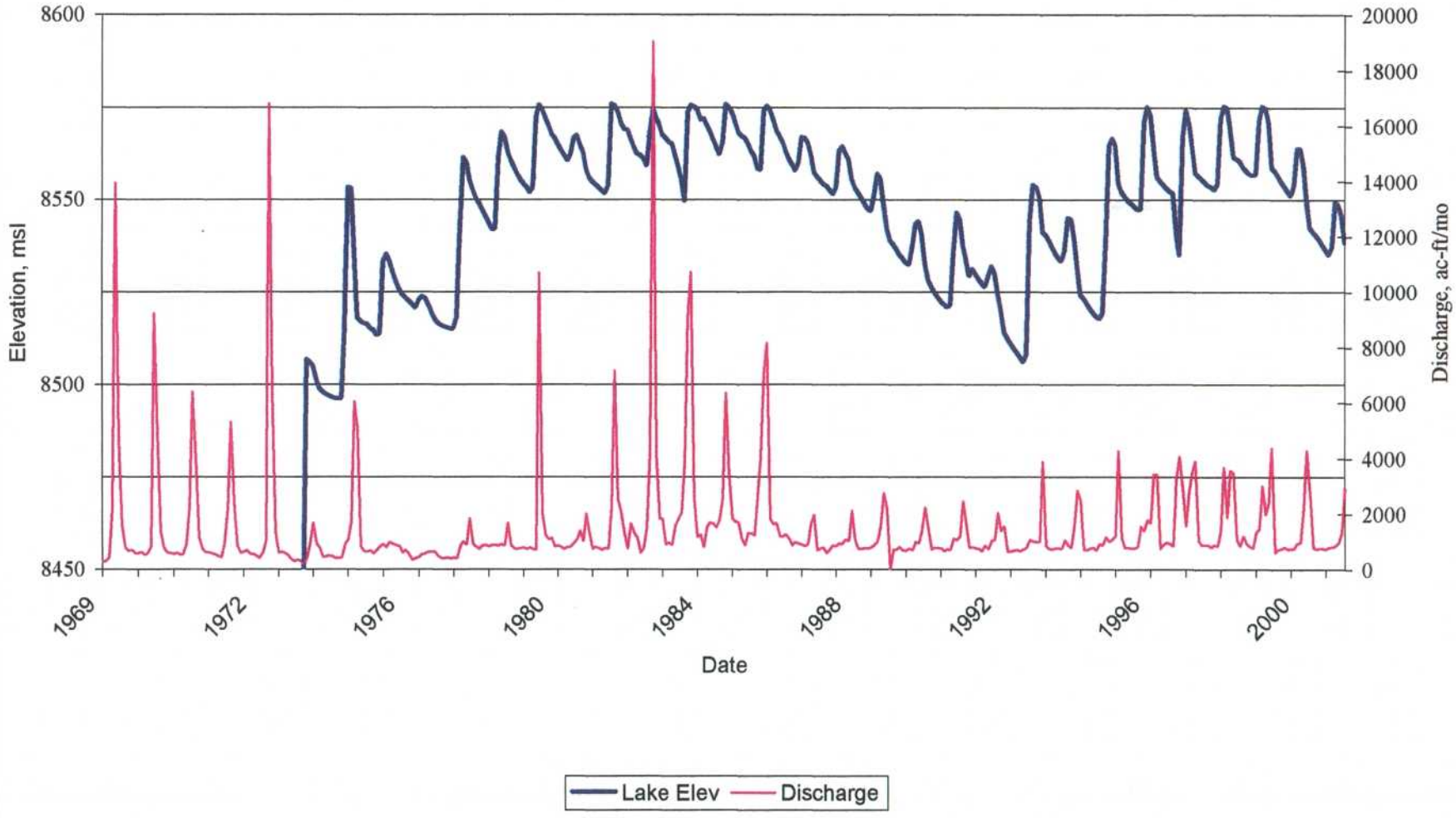
Full Size Data Plots

Figure 1. Electric Lake History
Huntington Ck Calc'd Flow - Thru 3/03



Note: Graph calculates Huntington Creek inflow based on recorded change in storage, plus other inflows minus outflows

Figure 2. Electric Lake History
Through August 2001



Figuire 3. Comparision of Use Patterns
Electric Lake - 1986 - 1993

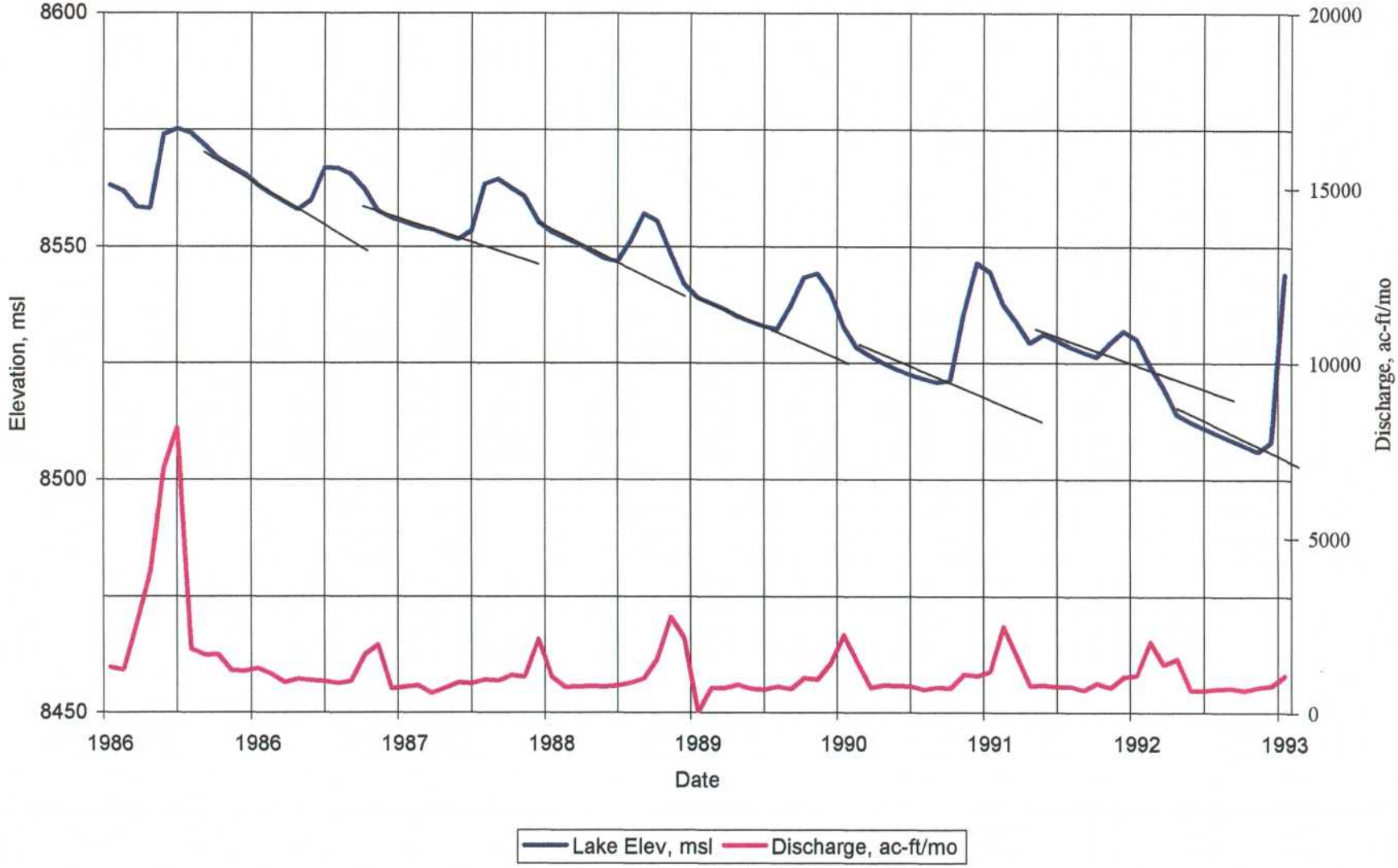


Figure 4. Electric Lake History
Through April 2003

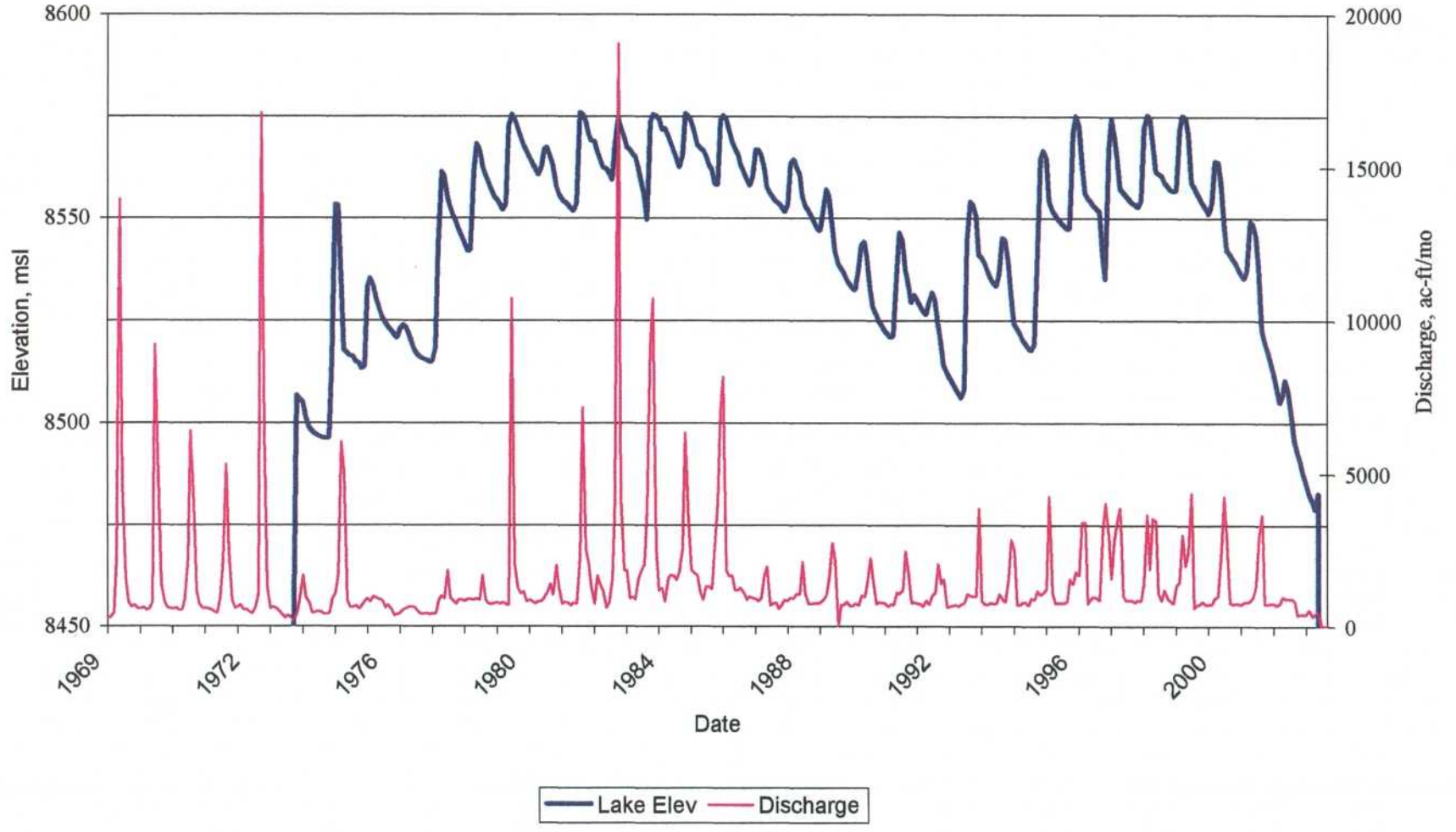


Figure 5
Lake Level and Drought Index

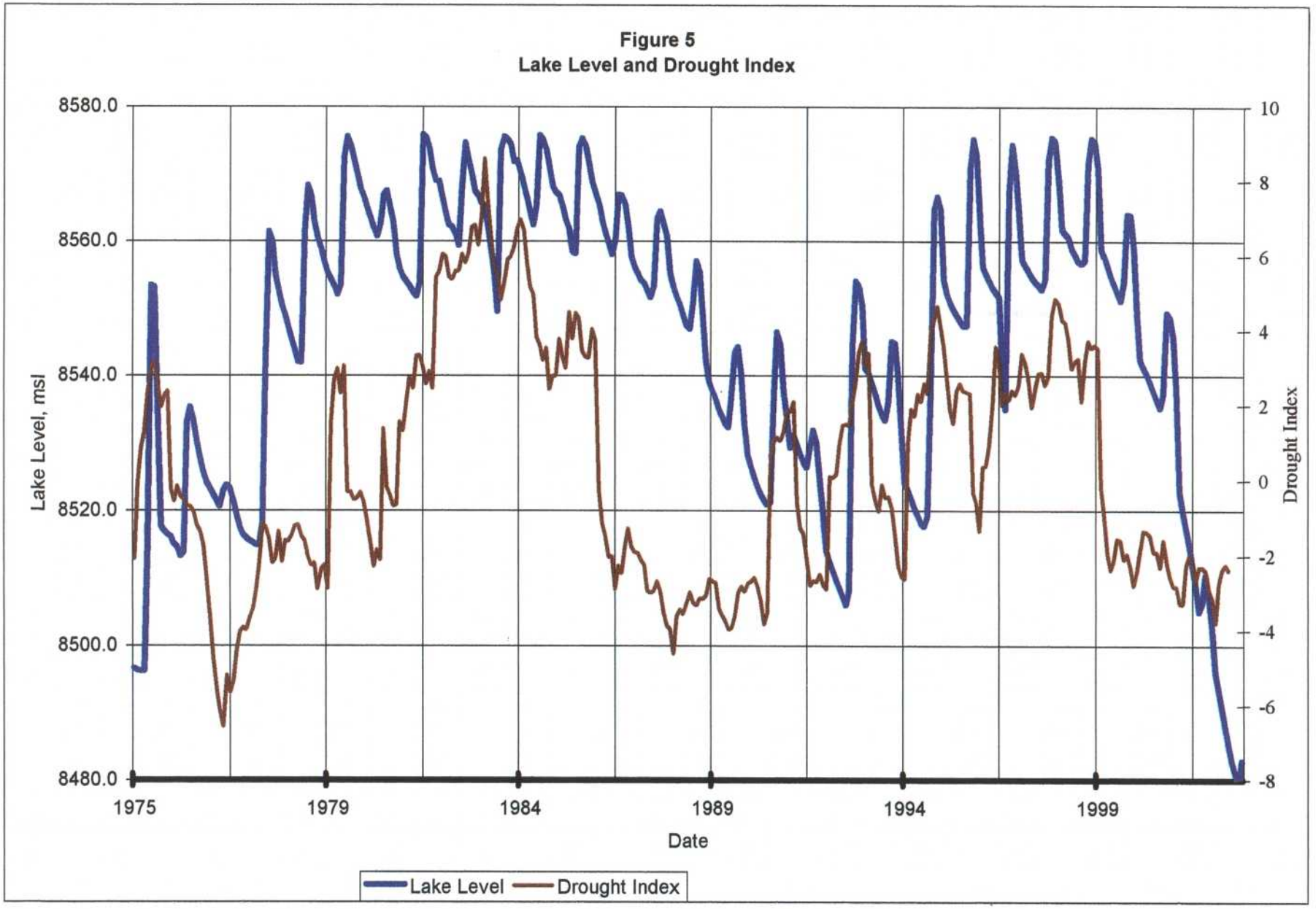


Figure 6
Electric Lake Historic Inflows vs Inflow w/o JC-1

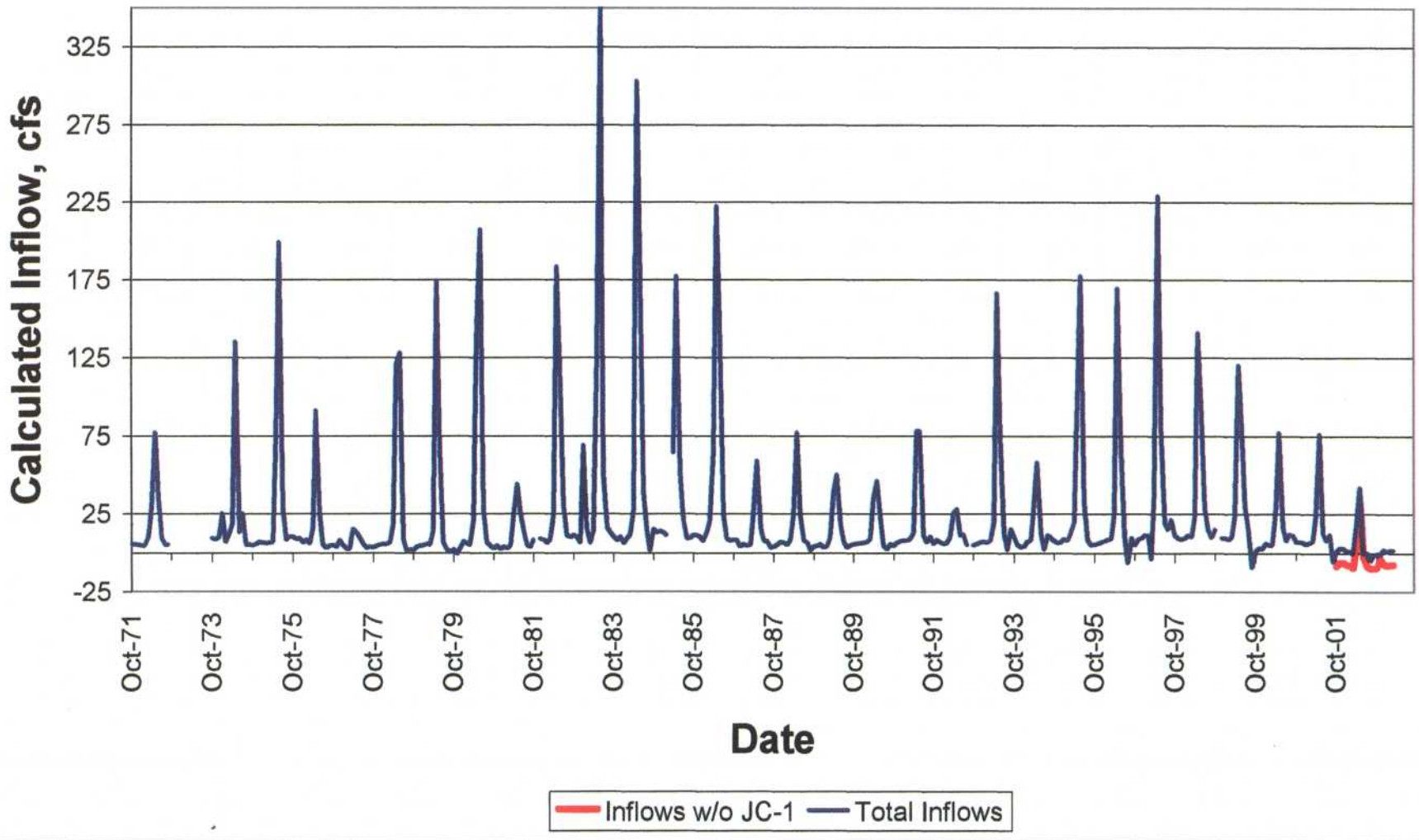


Figure 6a
Electric Lake Historic Inflows vs Inflow w/o JC-1
March 1999 - March 2003

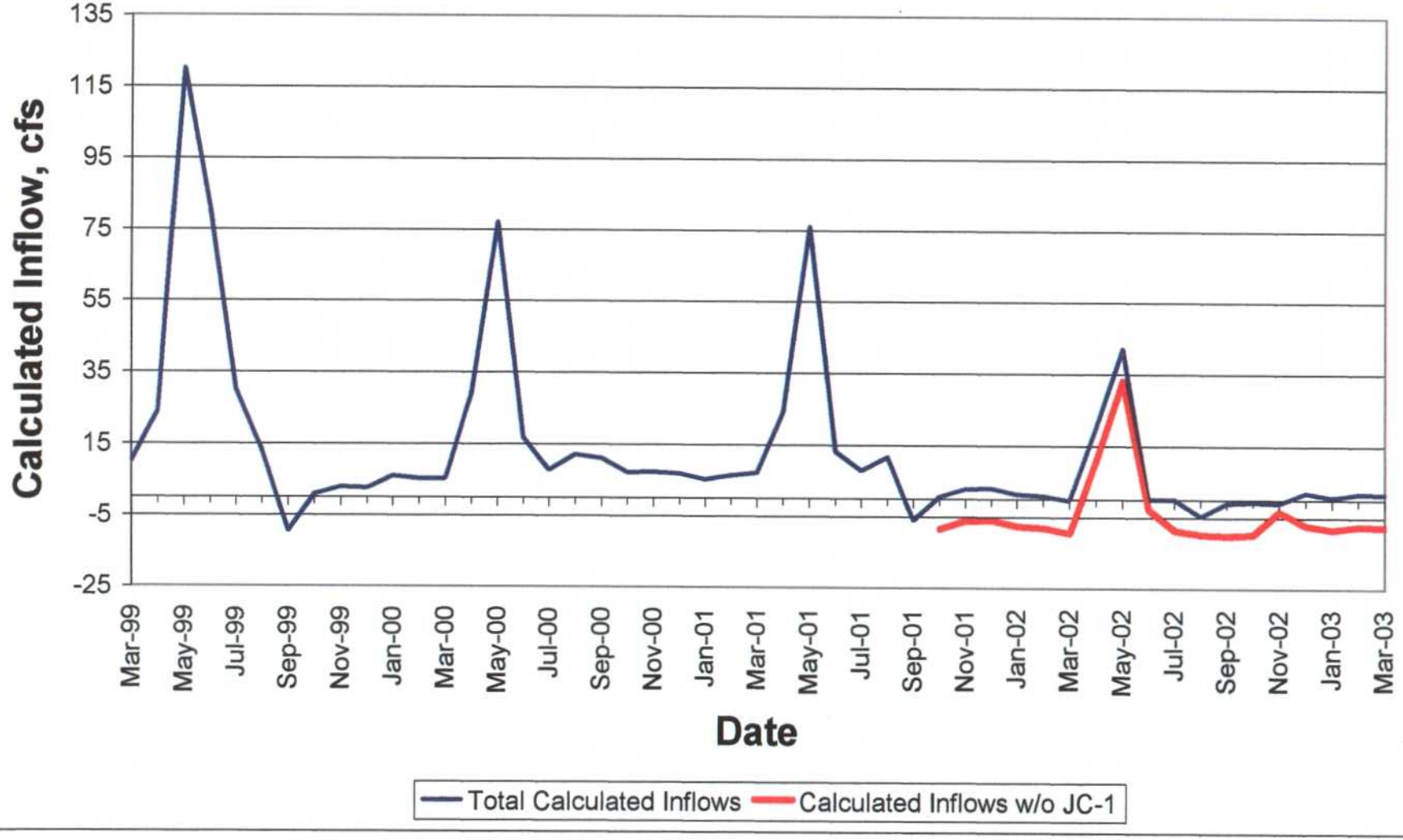
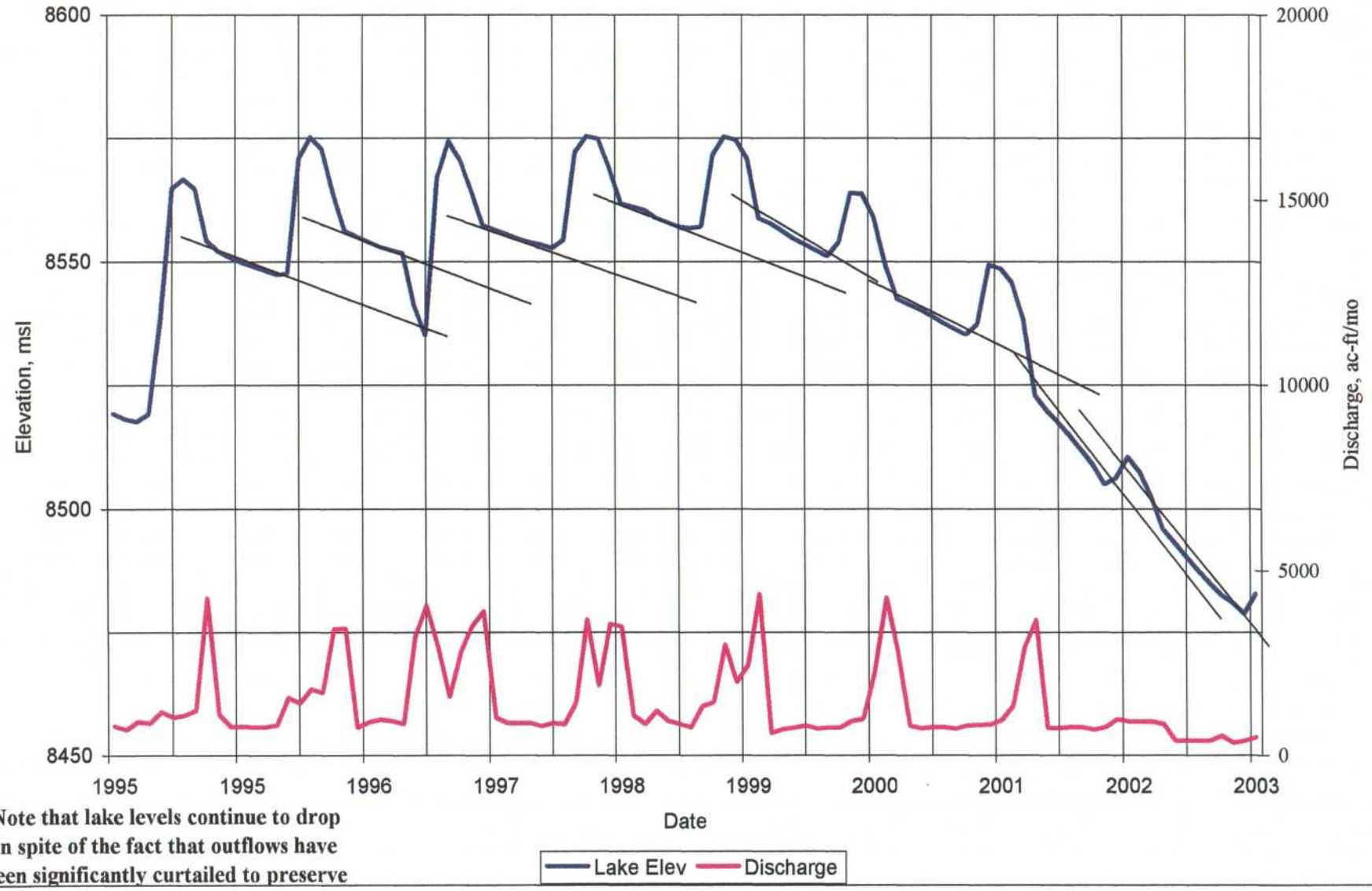


Figure 7. Comparison of Pre 2001 versus Post 2001 Summer Use Patterns in Electric Lake



Note that lake levels continue to drop in spite of the fact that outflows have been significantly curtailed to preserve

Figure 8.
Electric Lake Discharge History

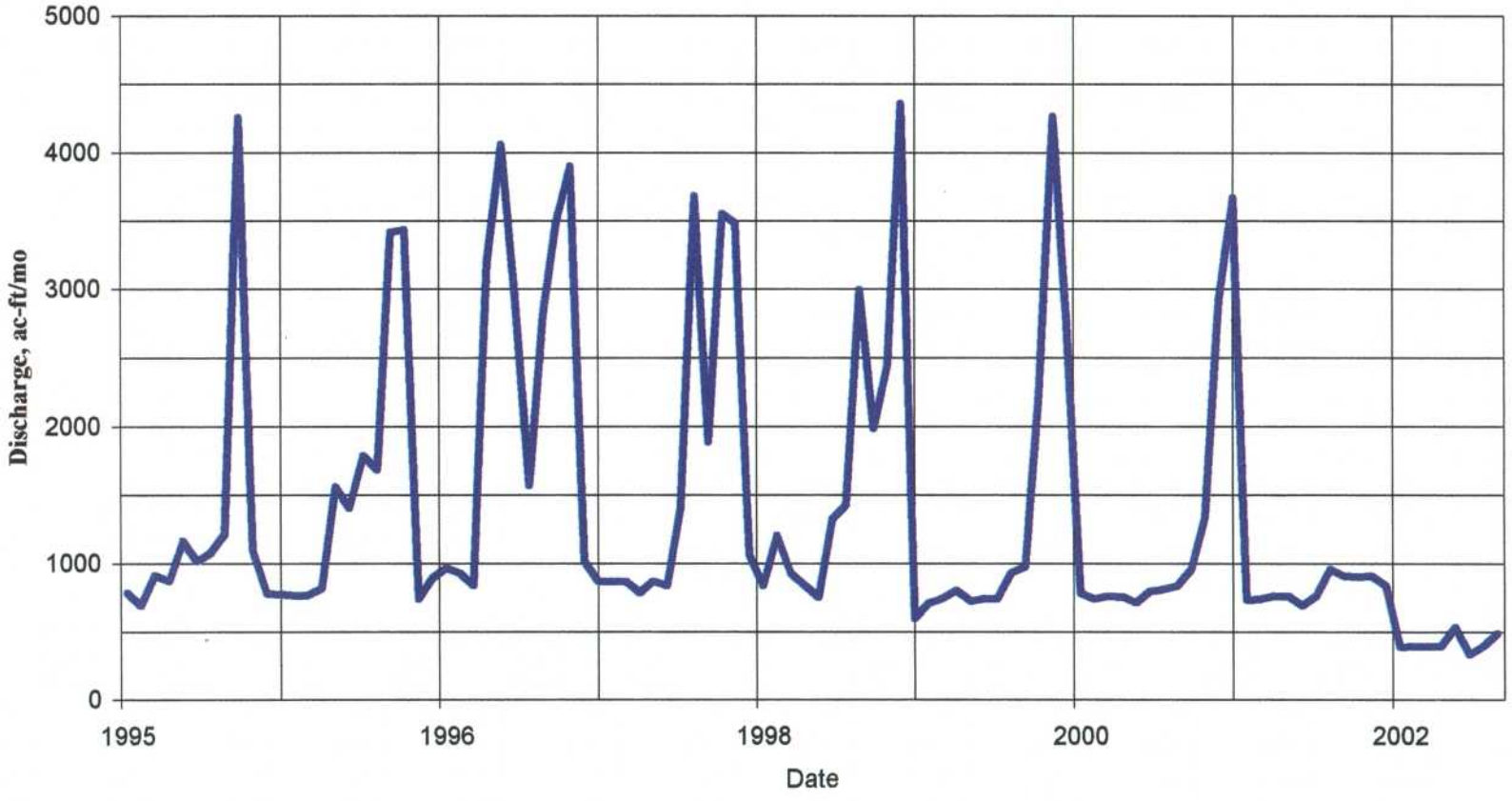


Figure 9
Palmer Drought Index
Utah - Region 5 - Updated 1/13/03

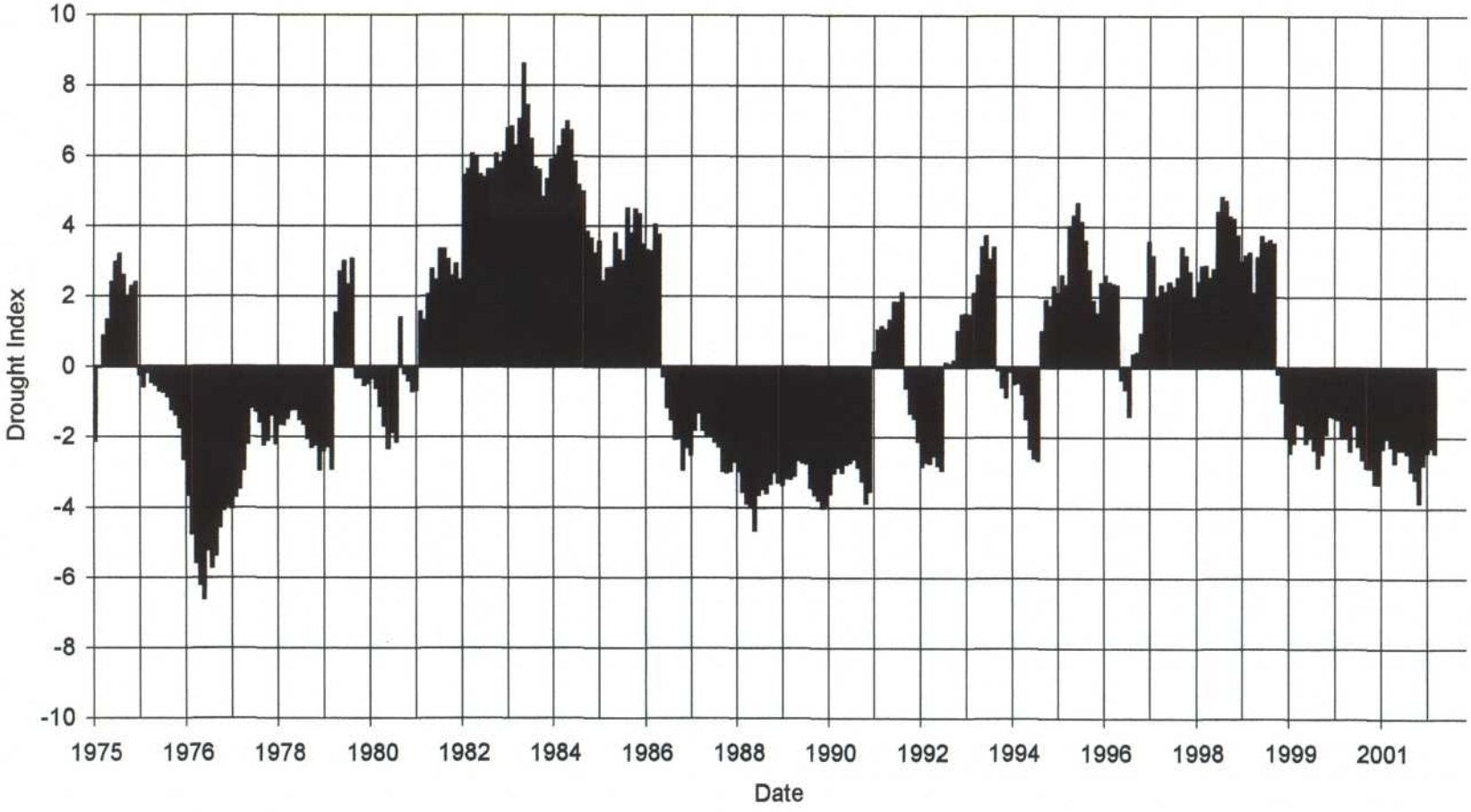


Figure 10
Scofield Reservoir - Inflow and Outflow

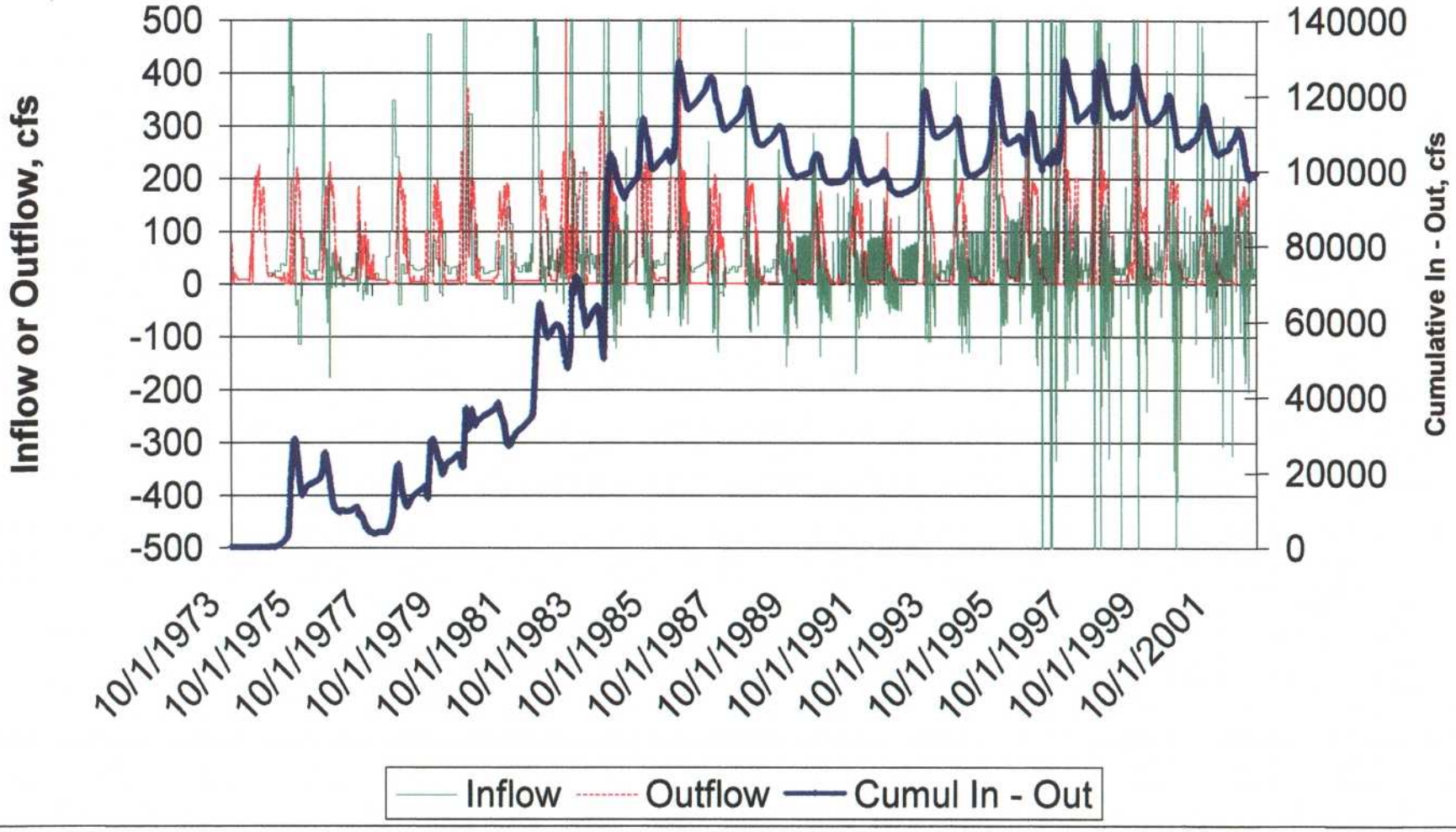


Figure 11
Scofield Reservoir - Stage and Storage

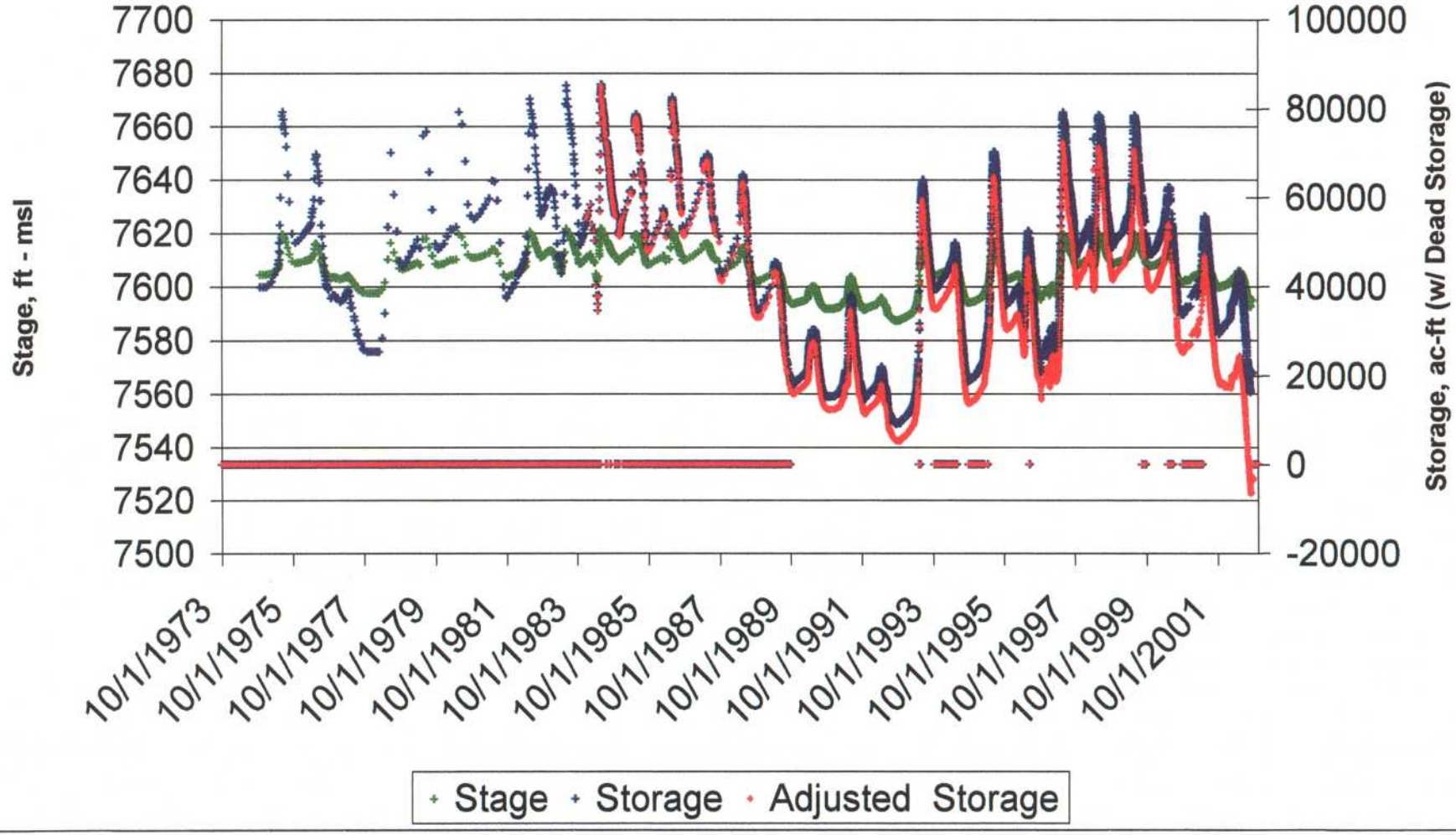


Figure 12
Historic vs Adjusted Storage w/o Mine Discharges and Usage Trends

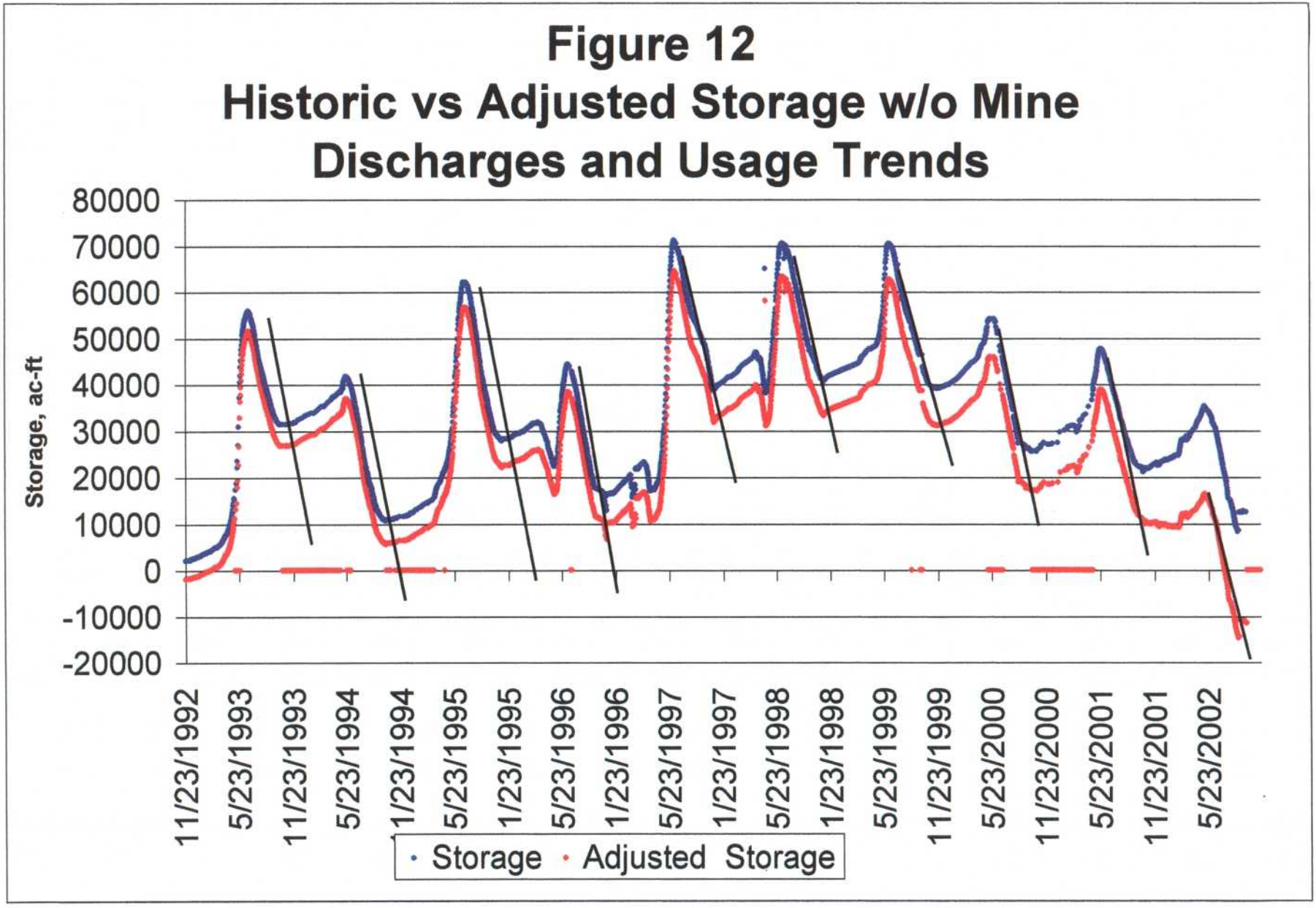


Figure 13
Joes Valley Reservoir - Inflow and Outflow

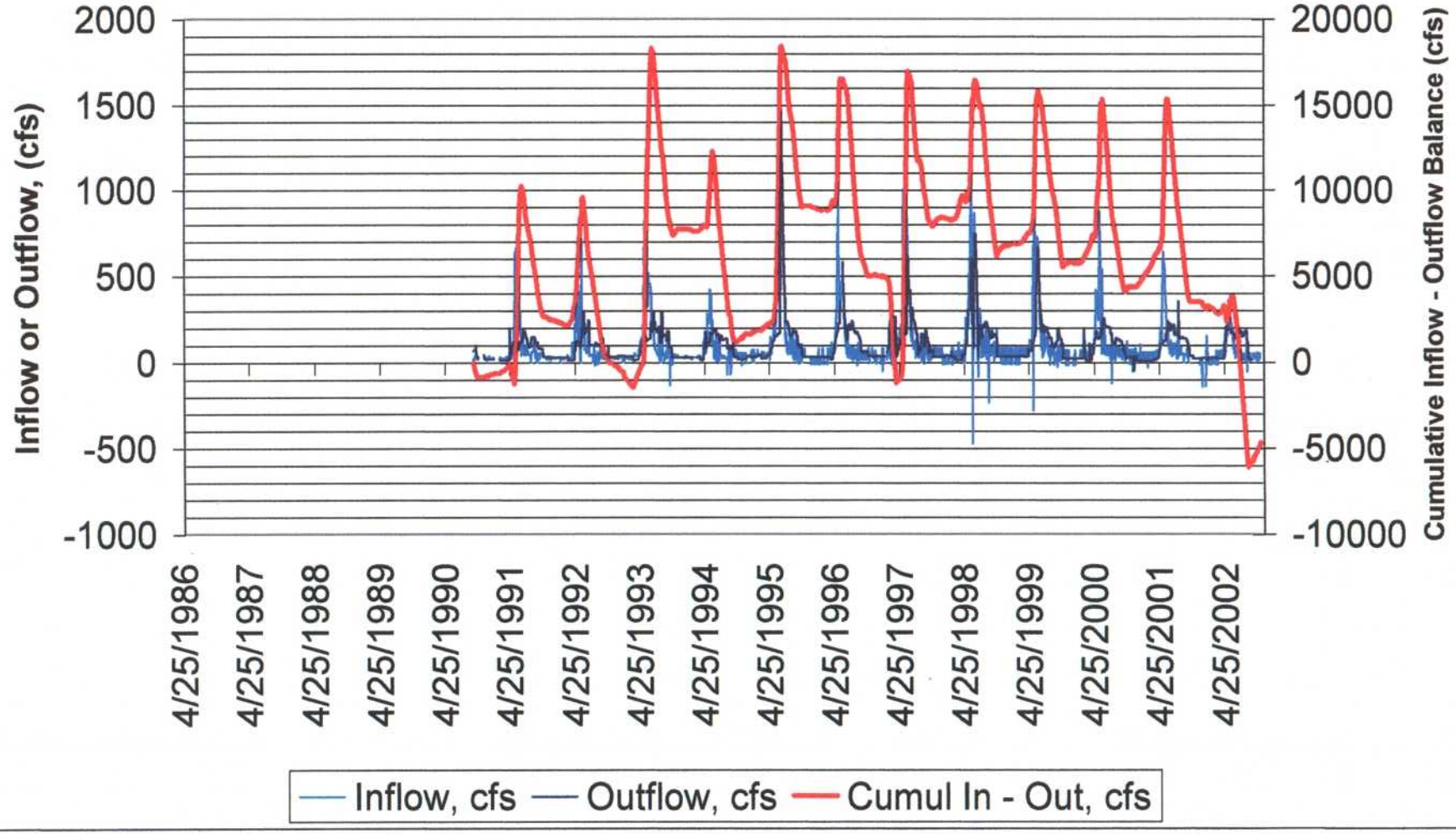


Figure 14
Joes Valley Reservoir - Comparison of Use Patterns

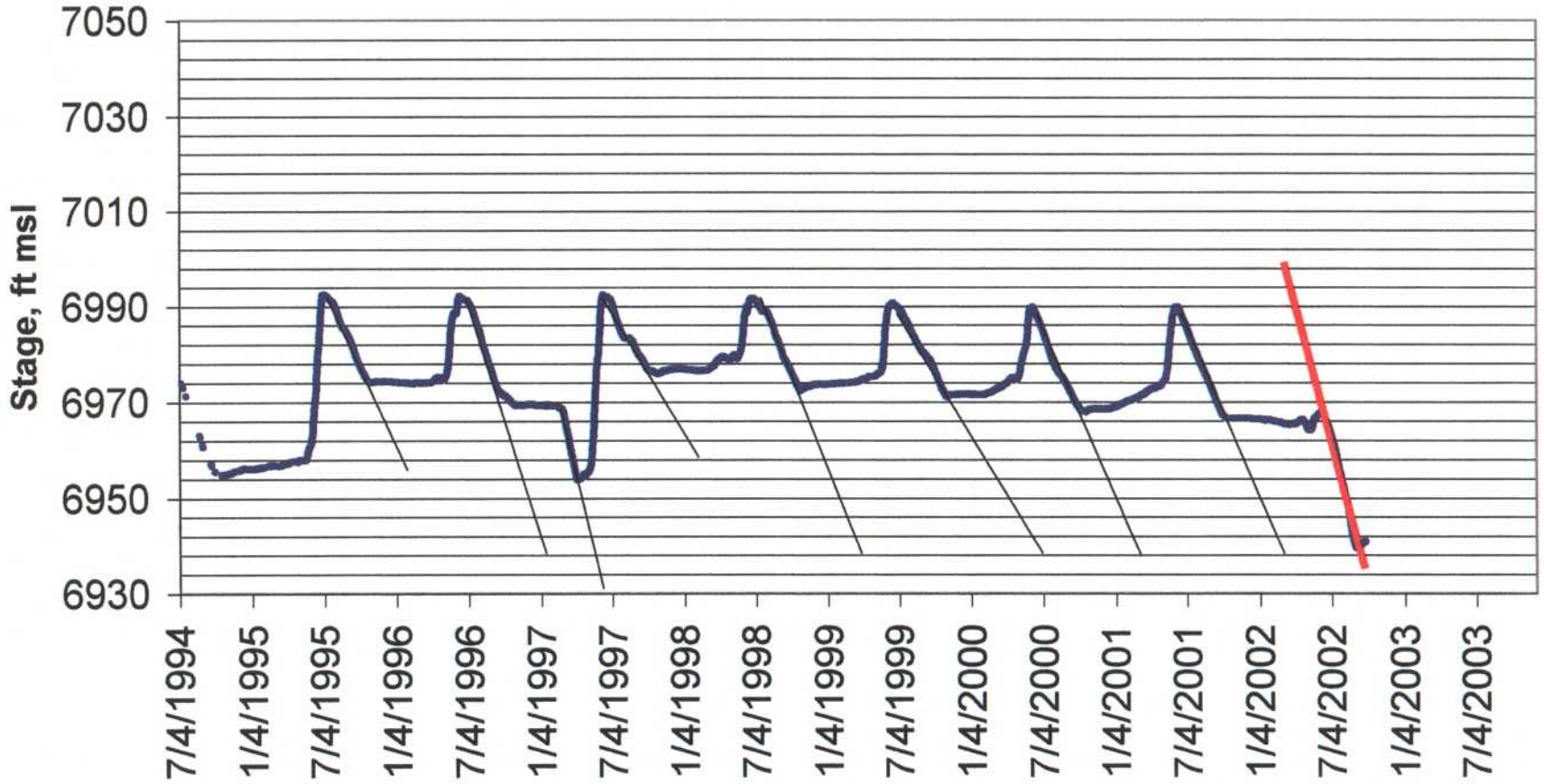


Figure 15
Combined Mine Discharges

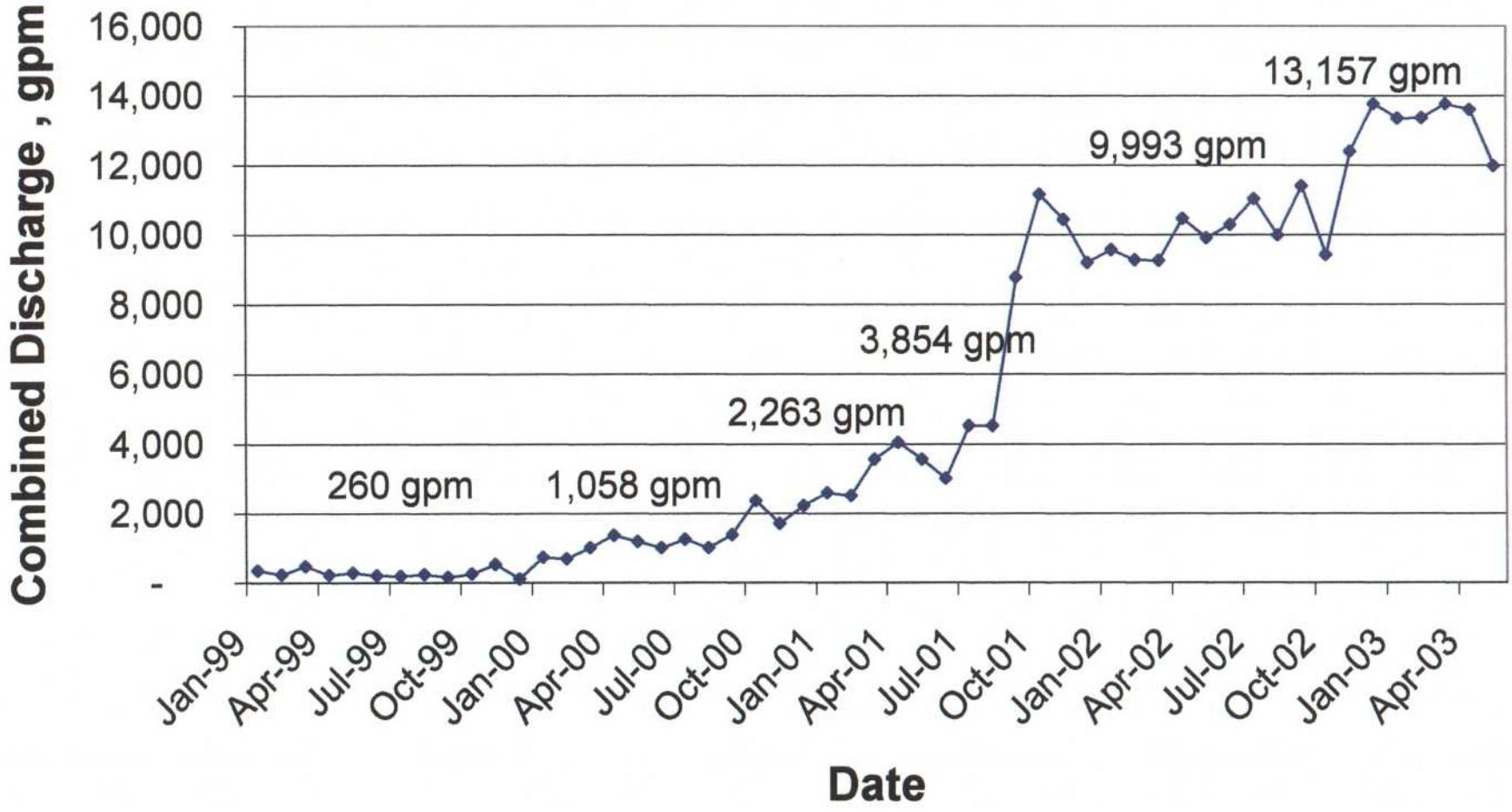
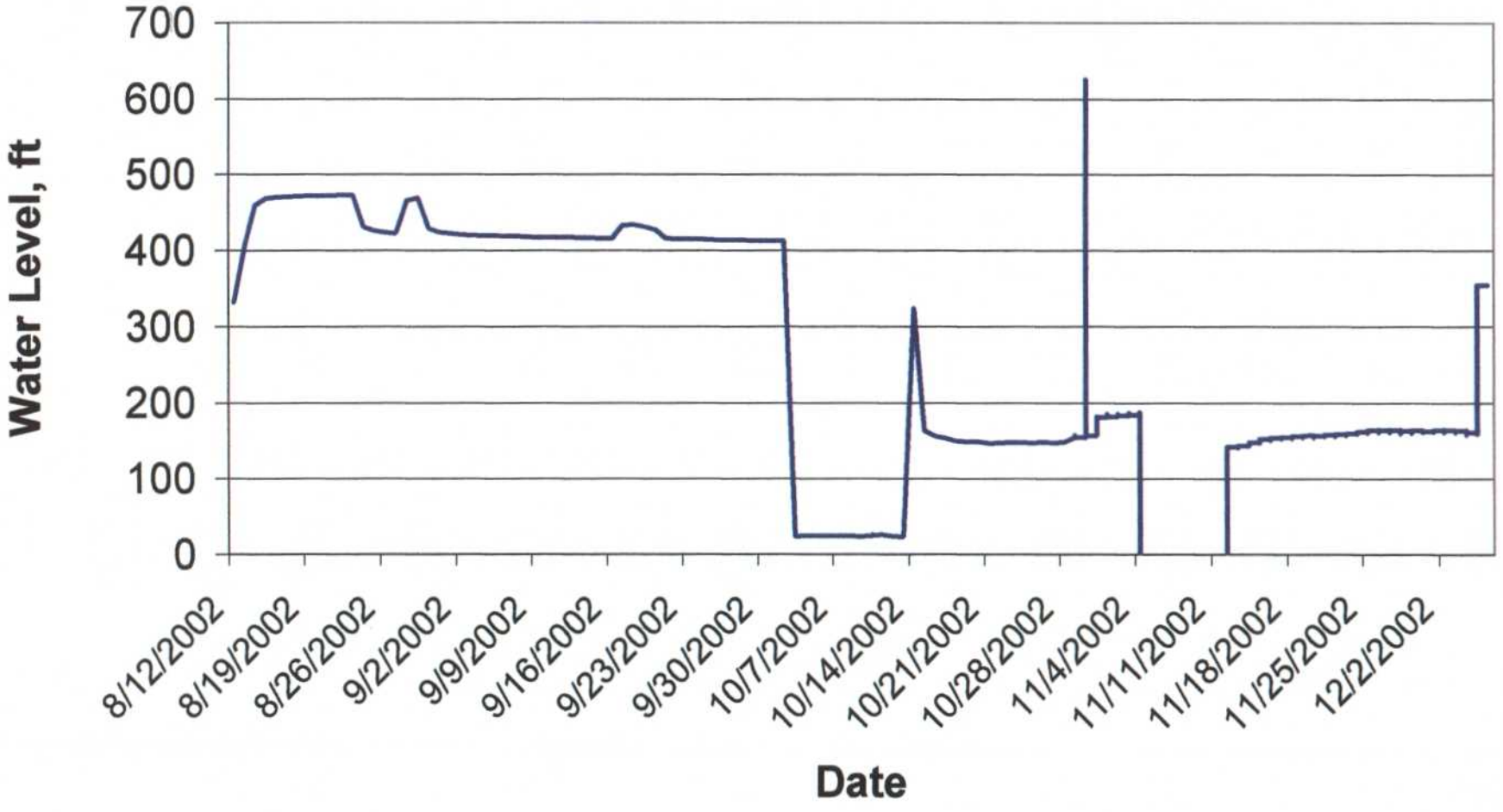


Figure 16
Well JC-1 Water Levels



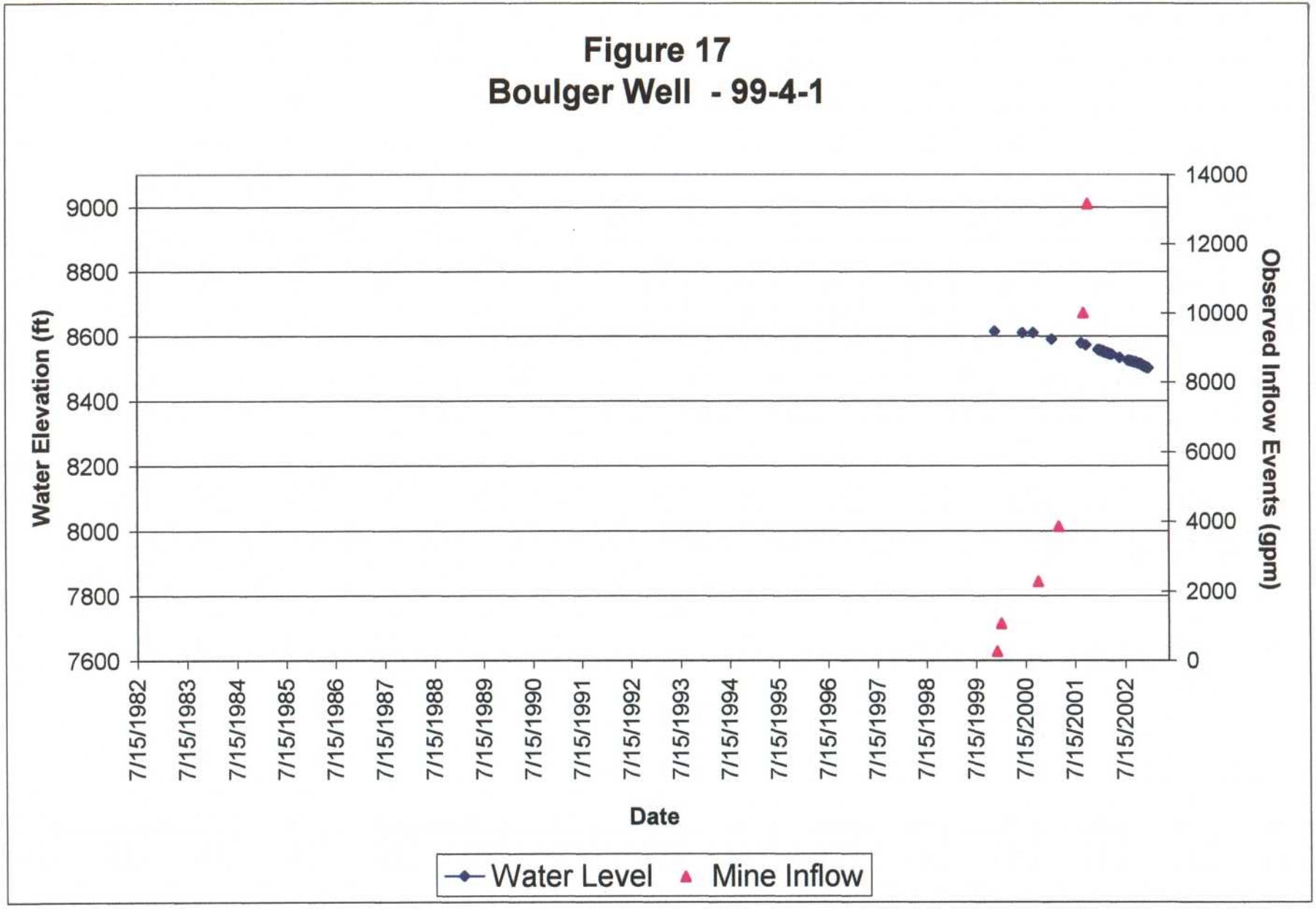
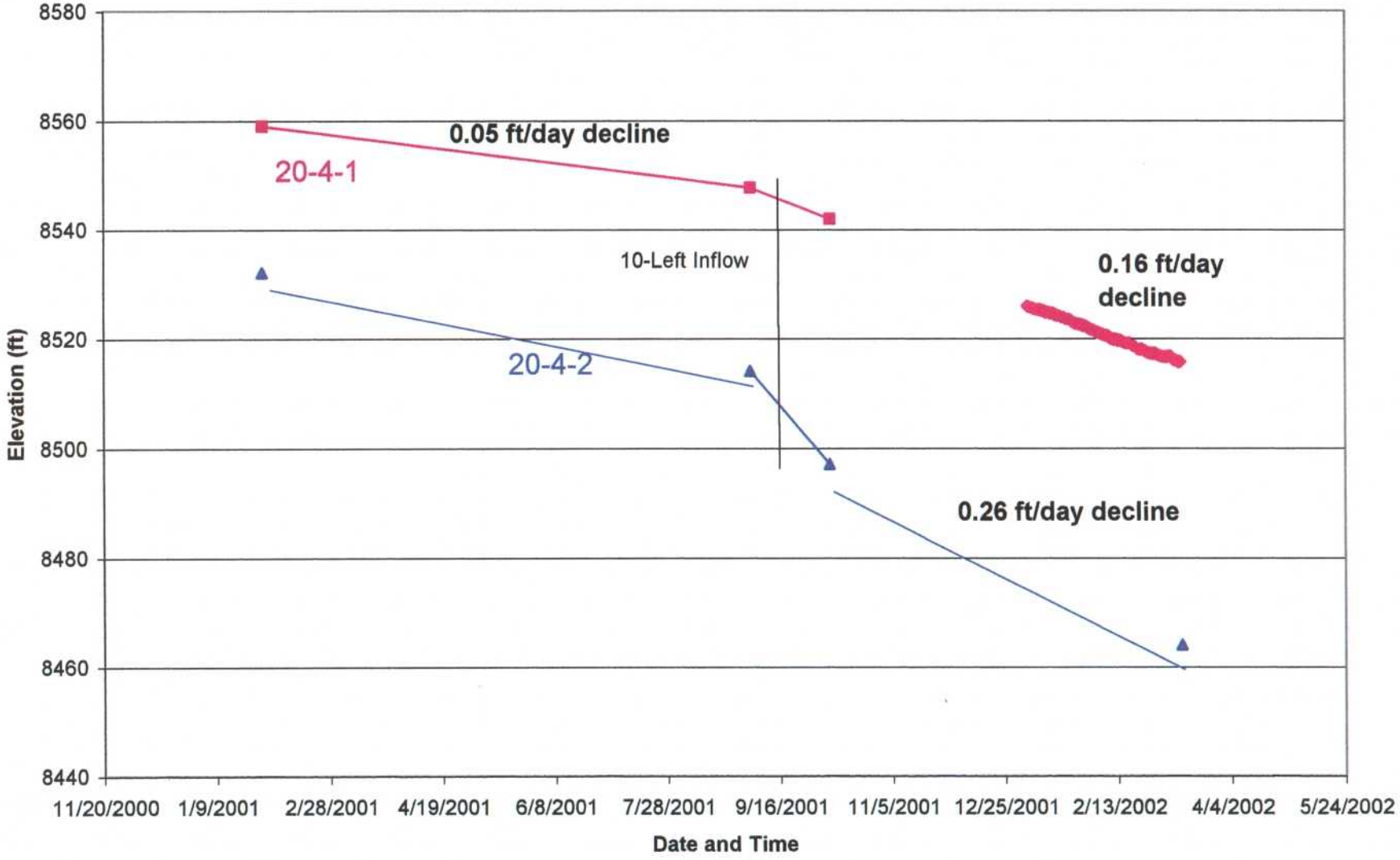


Figure 17
Boulger Well - 99-4-1
Water Elevation (ft)
9000
8800
8600
8400
8200
8000
7800
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date
Water Level
Mine Inflow

Figure 18
Water Levels in Monitoring Wells 20-4-1 and 20-4-2



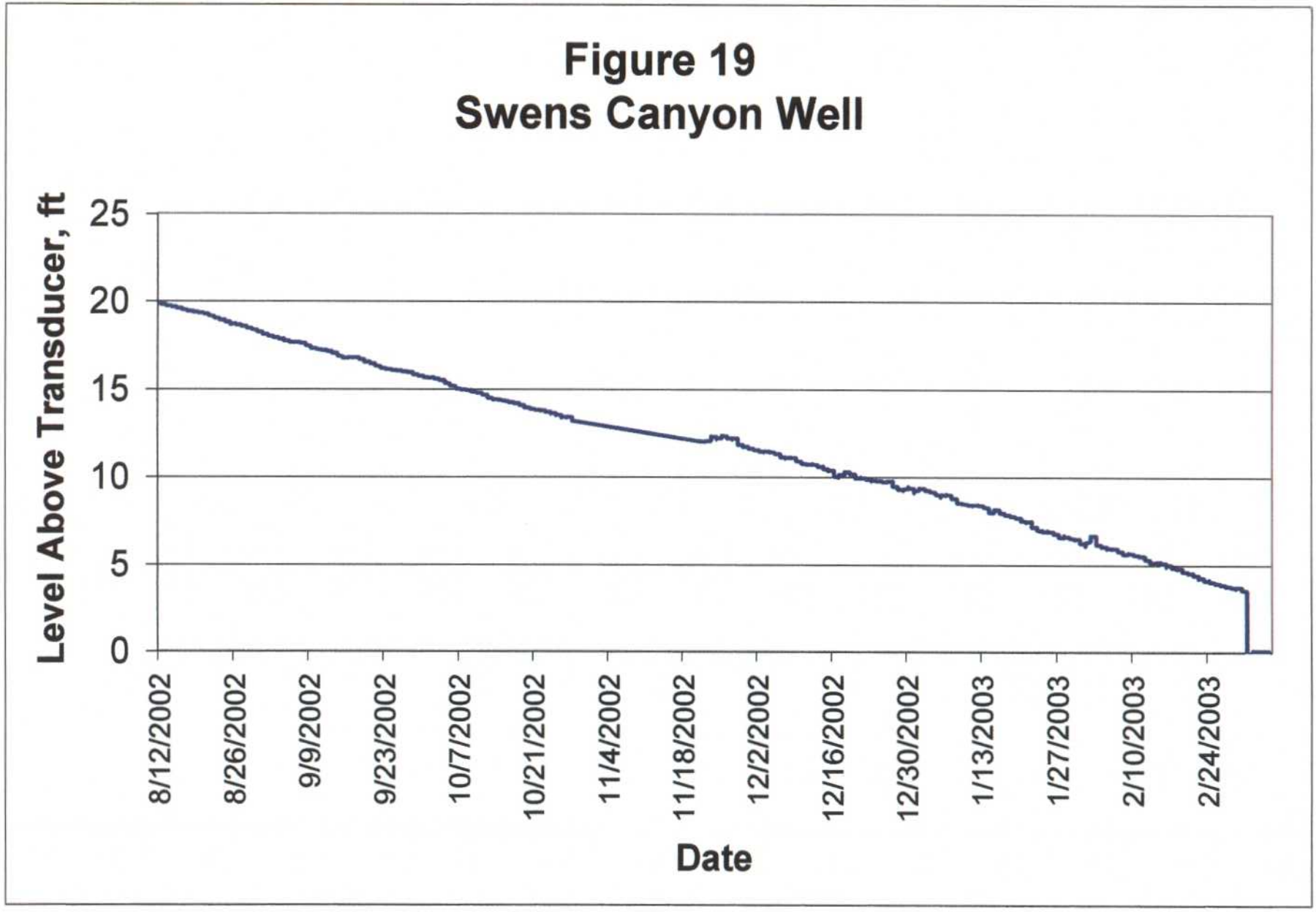


Figure 19
Swens Canyon Well
Level Above Transducer, ft
25
20
15
10
5
0
8/12/2002
8/26/2002
9/9/2002
9/23/2002
10/7/2002
10/21/2002
11/4/2002
11/18/2002
12/2/2002
12/16/2002
12/30/2002
1/13/2003
1/27/2003
2/10/2003
2/24/2003
Date

Figure 20
Well Water Levels

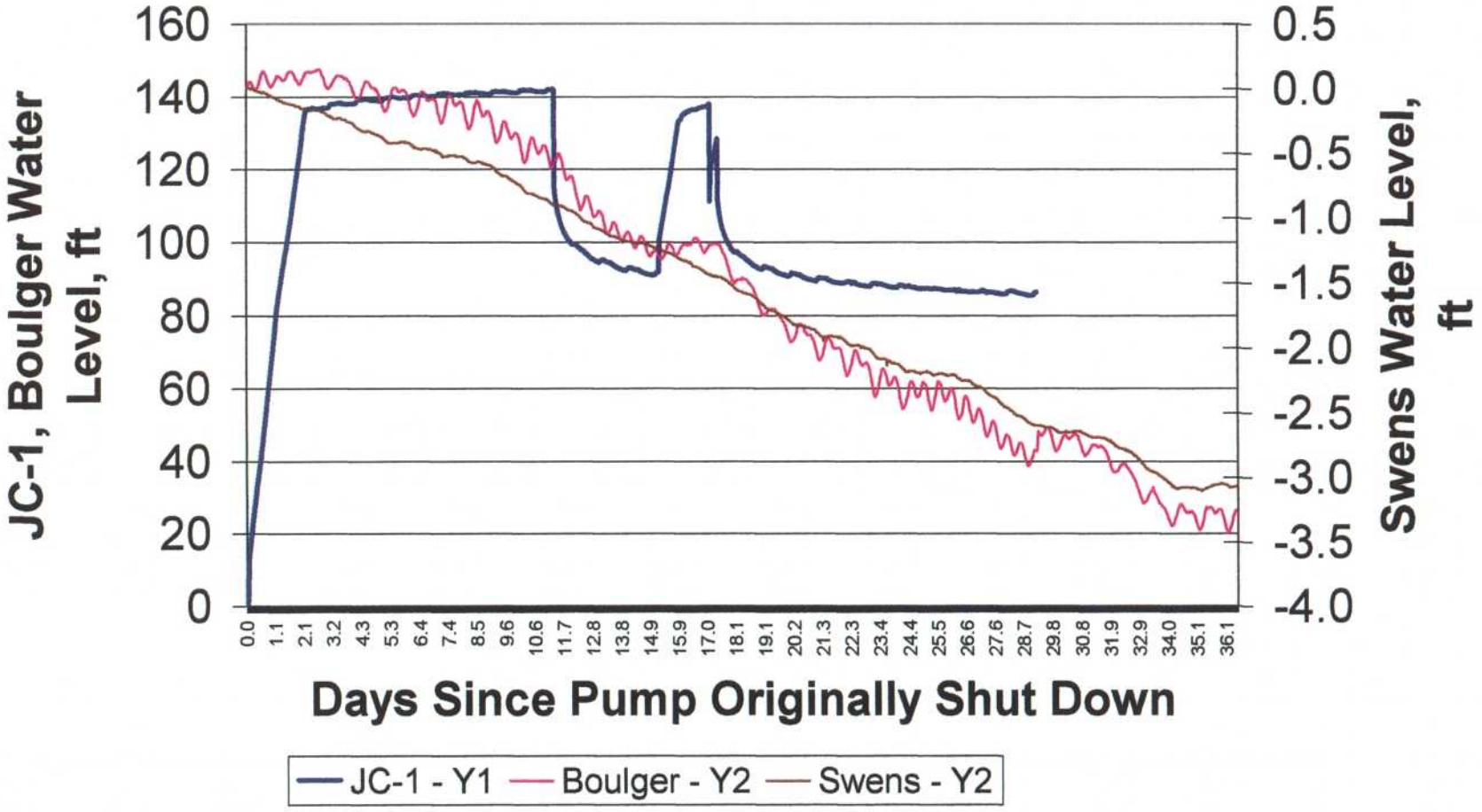


Figure 21
W2-1 JAMES CANYON SO. RIDGE - Transducer Data

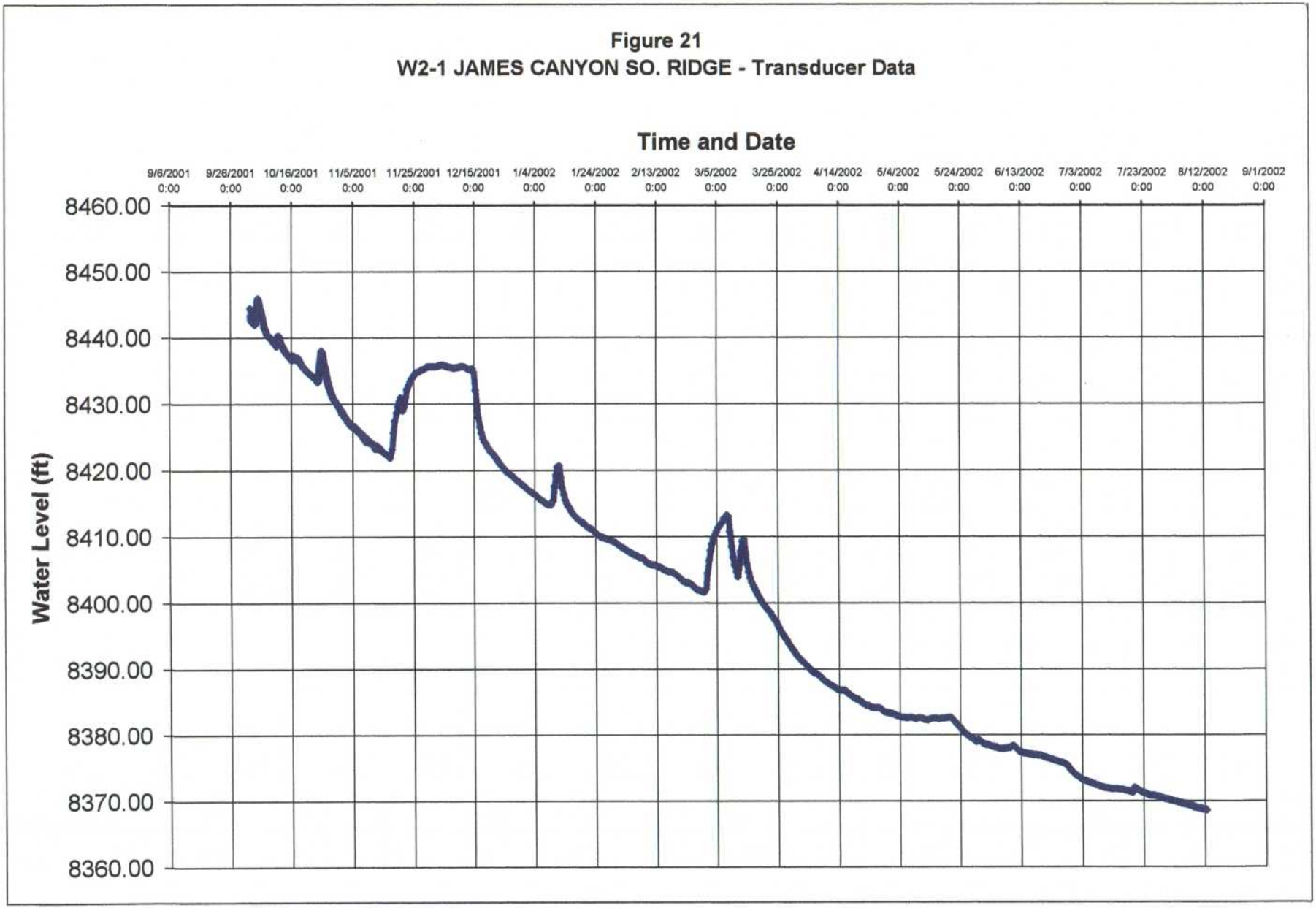


Figure 21a

HISTORIC WATER LEVELS - Well W2-1, W79-35-1A

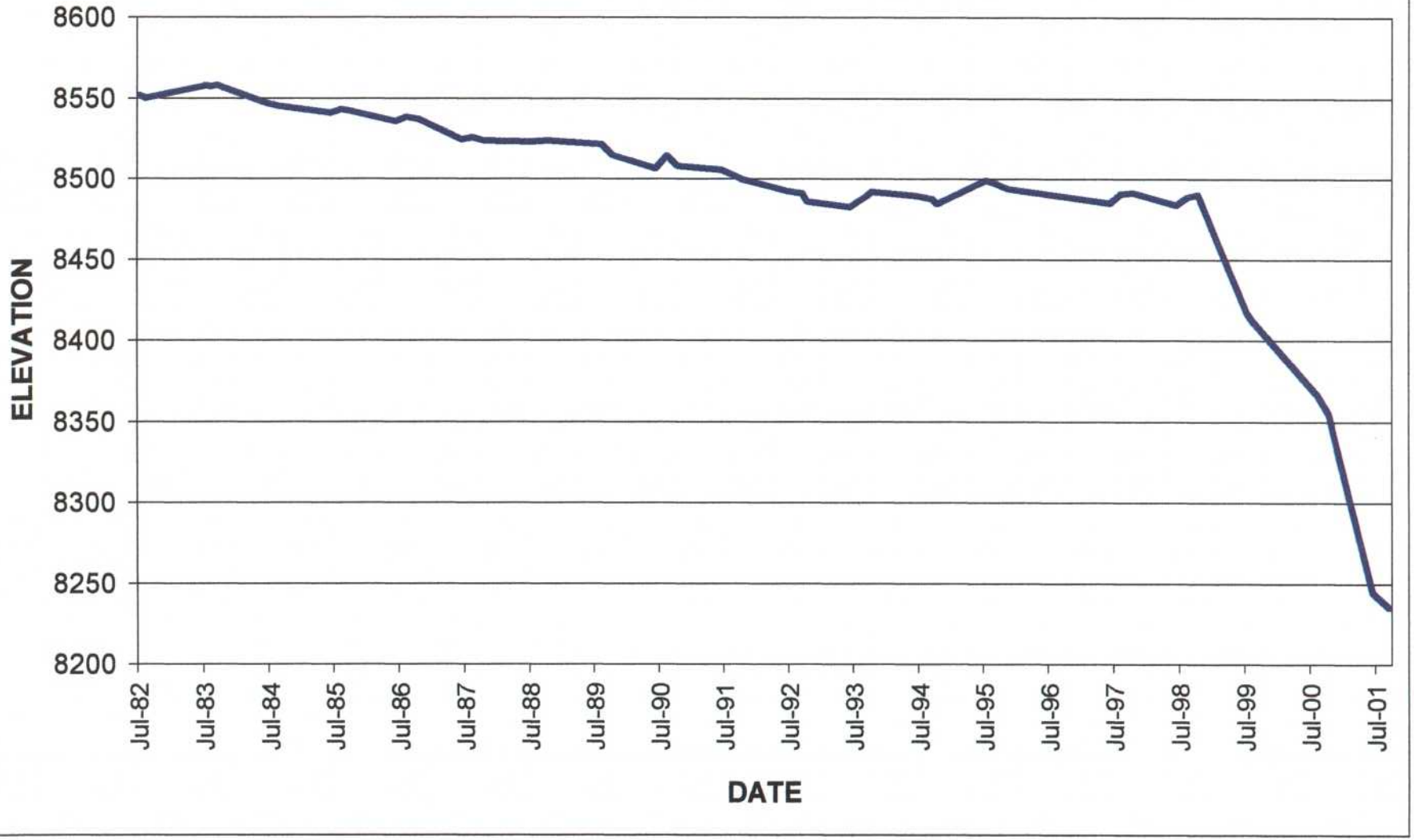


Figure 22
W79-35-1A BURNOUT CANYON - Transducer Data

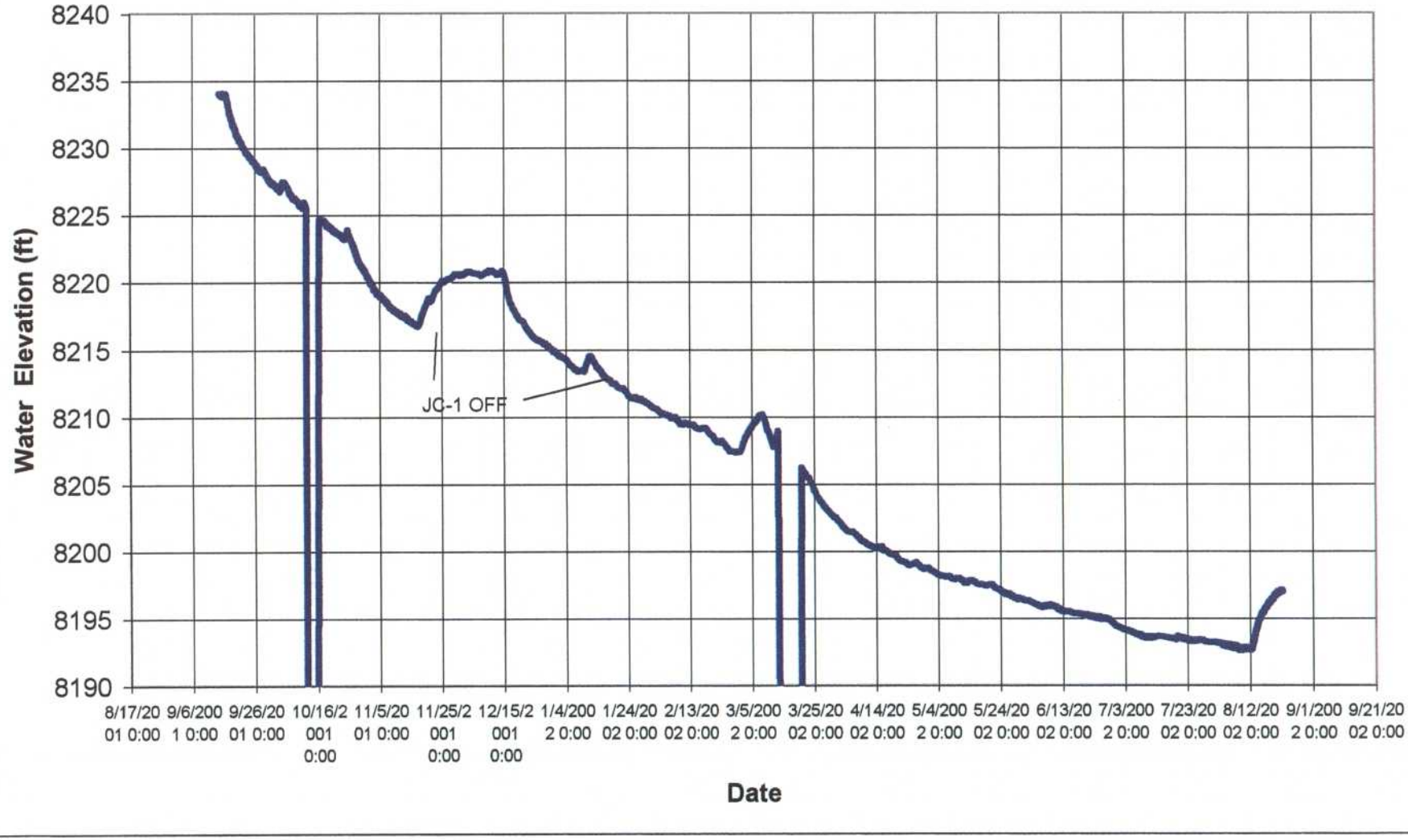


Figure 23
Electric Lake Comparison of Computed Vs. Measured Inflows

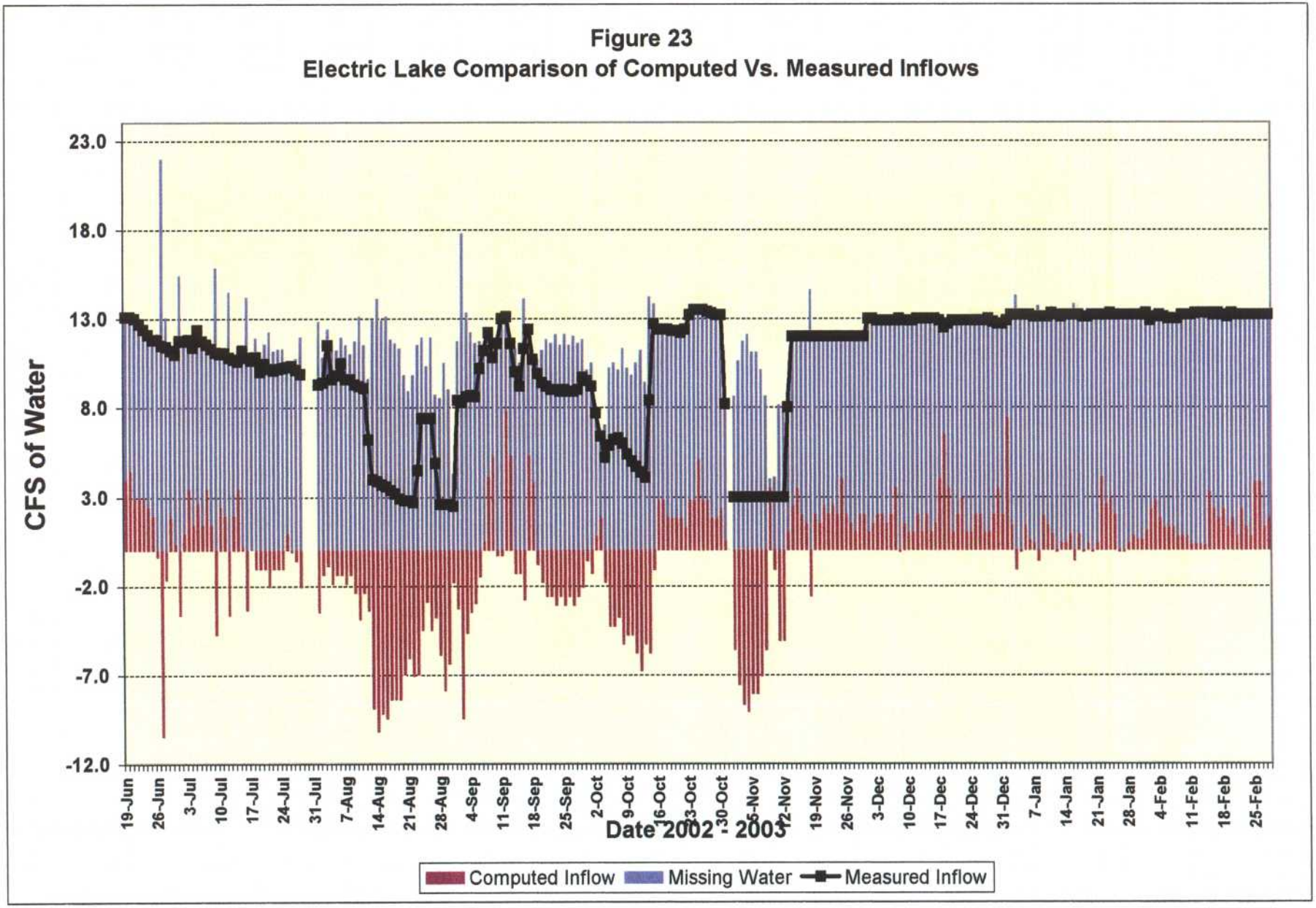
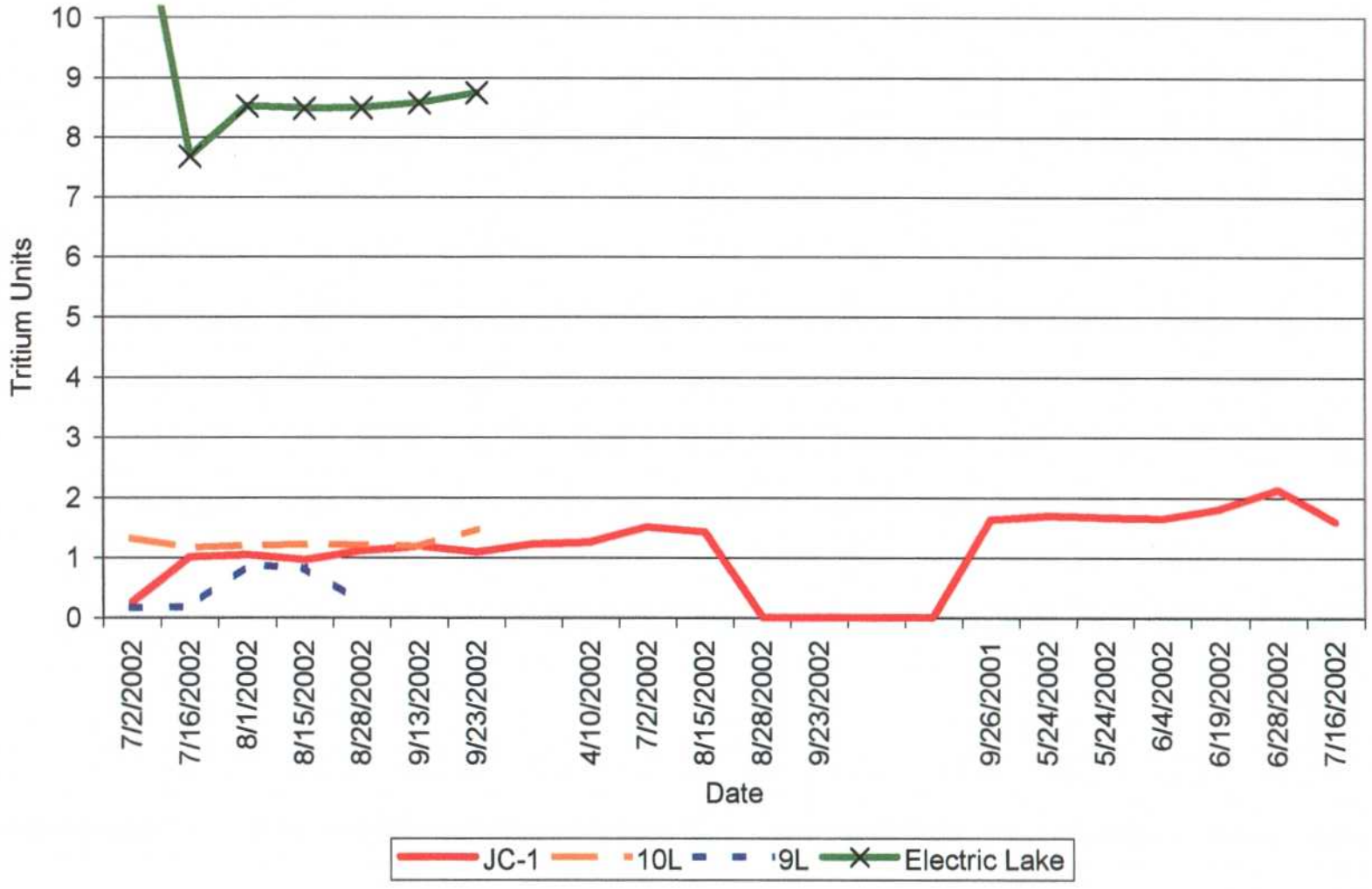


Figure 24
Tritium Analyses



Apppendix B

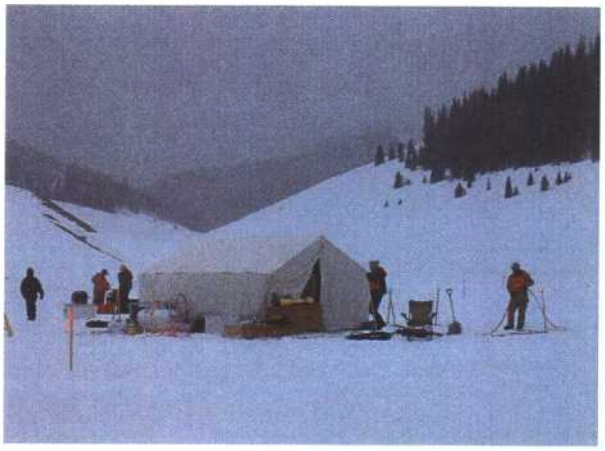
Diving Investigation Mapping

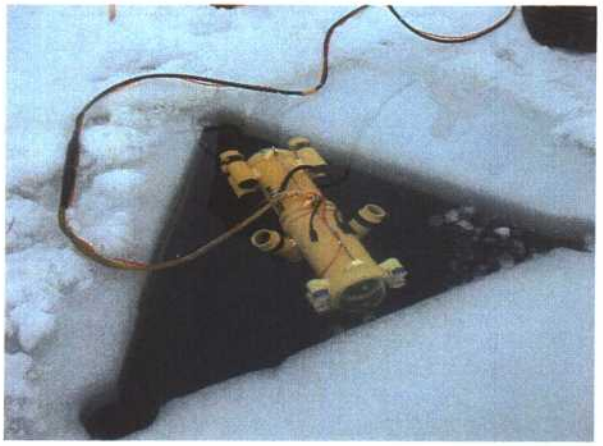
DRAFT

CONFIDENTIAL

ELECTRIC LAKE DIVE INSPECTION

SUMMARY REPORT





FEBRUARY 13- 21, 2003

PacifiCorp has been investigating the Electric Lake reservoir for water loss since May 2002. The Skyline coal mine that is adjacent to the reservoir on its eastern shore intercepted large quantities of water in October 2001. The water was flowing into the mine through a fault system in the mine floor at a rate of approximately 8,000 GPM. This flow continues at a fairly constant rate to this day. In addition to this, two other sections in the mine intersected the same fracture system and are flowing at the rate of approximately 1,000 GPM each. The fractures are part of the diagonal fault system that also intersects Electric Lake approximately ½ mile to the south of where it intersects the mine. PacifiCorp's water balance information regarding the reservoir indicates that approximately 650 acre-feet of water a month is leaking from the reservoir. It is believed that the leaking water is conveyed primarily along the Diagonal and Connelsvilles fault systems from the reservoir into the mine.

In July and August 2002, PacifiCorp contracted two geophysical companies to conduct surveys that may characterize the nature of the leak. The first survey was a pole-dipole resistivity survey conducted by GeoWestern and the second was an Aquatrack survey conducted by Sunrise Engineering. Both of these surveys indicated that a water saturated zone along both the Connelsville and Diagonal faults existed from the reservoir to the mine. It appeared from the survey that the water-bearing zone was at a shallower depth near the reservoir and became progressively deeper as the water migrated toward the mine.

Because of the data collected by geologic mapping and the geophysical surveys, PacifiCorp contracted a diving company to inspect the bottom of the lake along these two faults. At the time of the dive, the water was extremely turbid due to a heavy period of precipitation just prior to the dive and algae that was in the water. Because of the turbid waters, the dive was very limited and identified only one area where a venturi type hole was present. Because of the poor visibility, only the Connelsville fault was inspected. It was felt that a second dive should be conducted when the reservoir was iced over and the algae was dormant. This dive was completed in mid-February 2003.

The dive was contracted to Advanced Diving Services Inc. after they were the successful bidder. The company mobilized the equipment on February 12th and moved the equipment onto the ice on February 13th. The equipment, including a remote operated vehicle (ROV), air compressors, generators, warming tent and diving equipment was tested and prepared for use on that day.

Underwater investigation began on February 14th and was completed on February 21st. The objective of the investigation was to characterize and document the nature of the leak zone at the bottom of the reservoir. It was not the intent to map every feature in detail, but to collect data that would show the nature and extent of the leak zones. For the most part, the investigation was completed by the ROV. This unit, called a Sea Lion, was equipped with a high-resolution video camera, four high-intensity lights, and thrusters that provided full control of roll, pitch and yaw of the ROV. The ROV was connected to the surface by a 500 foot-long umbilical that provided power to the ROV and video feed from the ROV to the monitors and video recorders on the surface. The ROV traveled on sweeping lines approximately 20 feet apart to map out the features on the bottom of the reservoir. When features were viewed on the monitor, the operator would stop the ROV on the bottom and record the image on videotape. The ROV would then be forced in a forward direction causing its skids to move sediments into suspension in front of the

ROV. The movement of water into the holes could be documented by watching the suspended sediment being drawn into the holes by the water current. Initially, a 3/8-inch neoprene line that was affixed to the umbilical was used to pump dye down to the ROV to identify water movement into the holes. However, freezing conditions on the surface made the use of the dye impractical and it was found that agitating the sediment on the lake bottom was equally effective.

As features were identified, an operator on the surface would walk along the ice carrying a magnetometer to precisely locate the position of the ROV on the bottom. The operator would then record the exact location using a hand-held Magellan Global Positioning Unit. The location was then marked with a wood lath and the station number was recorded on the lath. This process proved to be a tedious but effective way to map out the features on the bottom of the lake.

The process described above was used to map features on the bottom of the lake in the areas of suspected leakage. In general, the ice covering the water in the lake was measured at 11 to 19 inches in thickness. Several holes in the ice were noted along the trace of the Connelsville, Diagonal and a third fault near the dam. It was discovered that these holes were formed by gas that was being liberated from the bottom of the lake along fractures associated with these faults. An analysis of a sample of the gas being liberated from the bottom of the lake proved it to be 75% methane. Because the methane gas that is being liberated is probably occurring along the same fractures which are allowing water to be lost from the lake, an under-water reconnaissance was conducted at all three locations (see Map 1 in appendix).

The first area to be inspected was the Connelsville fault trace. The mapping of lake bottom features along this fault required four days to complete (February 14th through February 17th). The inspections were made by cutting two access holes in the ice with a chain saw that enabled the ROV and divers to access the lake. Numerous features were mapped on the bottom of the lake in this area. These features included numerous venturi-shaped holes that averaged about ½ to 1 inch in diameter. These holes were observed to vent methane and enable water to flow from the lake. It was common to find these holes in clusters and aligned along trends. As the location of these features was identified on the ice using the wood laths, it became apparent that they were located along trends that ran in a N 45°E direction. It appears that the holes in the bottom of the lake are located along individual fractures or jointing associated with the Connelsville fault. These linear features suggest the presence of an en-echelon faulting pattern. Map 2 (see appendix) shows the details of the features mapped on the lake bottom in the area of the Connelsville fault. This map shows the waypoint (GPS) location of the features mapped. Also shown are symbols that document methane venting (magenta square) and negative water flow (cyan triangle) at various locations. The data collected at each waypoint is shown on the Dive Data Tabulation found in the appendix.

At two locations along the Connelsville fault, fluoroscein dye was implanted in the lake bottom sediments to facilitate the tracing of the water connectivity with the Skyline mine. At each location, the dye was in powder form in one-pound plastic-canisters. Numerous holes ¼ inch in diameter were drilled into the canisters to allow the lake water to penetrate the canisters and allow the dye to dissolve. The canisters were taped to a steel weight (2 one-pound canisters at each location) to insure negative buoyancy and were placed in the lake sediments by a diver. The dye canisters were

buried about six inches into the sediment. The dye was implanted along this fault at waypoints 16 and 19 on February 17, 2003.

The trace of the Connelsville fault crosses the lake in such a way that along the lakes southwest shore, the fault trace is above the current water line for a distance of approximately 100 feet. The submerged portion of the fault trace to the south of this was surveyed on February 20th, after the completion of the mapping of the Diagonal fault. Some fracturing of the lake sediments were noted in the southern most area of the Connelsville fault trace that was surveyed in addition to numerous venturi-shaped holes.

The Diagonal fault trace was mapped on February 18th and 19th. Similar conditions were identified along this fault as on the Connelsville fault. The holes in the bottom of the lake were aligned in a N 45°E direction. Numerous fractures were found near the northern end of the Diagonal fault. These fractures were trending on two near perpendicular trends. The fractures were approximately ½ to 1 inch in width and were observed to have water flowing out of the lake along them. The fractures appeared to be tension fractures. The features mapped in the area of the Diagonal fault are shown on Map 2 (see appendix). The area of fractures is depicted on this map as magenta lines. The data represented on the map is summarized in the Dive Data Tabulation in the appendix.

Fluoroscein dye was placed at two locations on the lake bottom along the trace of the Diagonal fault. These locations were the fractured area (waypoint 20) and holes venting gas (waypoint 28). At each of these locations two pounds of dye were implanted on February 19, 2003.

The last area to be surveyed was 1-½ miles to the south of the Connelsville and Diagonal faults along a fault that trends in a northwest-southeast direction (see map 1 in appendix). The ice in the area of this fault showed numerous holes associated with the venting of methane gas from the lake bottom. The underwater survey of this area was completed on February 21st. In this area, the ROV was maneuvered along the lake bottom and recorded features on videotape. This area was found to have an abundance of venturi shaped holes as along the other two faults investigated. These holes were shown to be venting methane and allowing water to flow from the lake. This un-named fault intersects both the Diagonal fault and the Connelsville fault about 1 mile to the south of the north end of Electric Lake. It is apparent that the loss of water along this fault is allowed to occur because of the connectivity of this fault with the other investigated faults. The details of the area mapped along this fault are depicted on map 3.

In all three areas that were surveyed, the features indicative of water loss and methane venting appear to be confined to a zone about 100 to 150 feet from each side of the faults mapped. Outside of this zone, the bottom of the lake appeared to be normal. This indicates that the areas affected by water loss are in zones 300 feet in width along each of these faults. It should be expected that other faults and fractures that intersect these three faults surveyed might also show similar features. In the case of the fault near the dam, the lake bottom was well within the area of dead-water storage in the bottom of the lake. This suggests that a repair of the holes in this area would require a total draining of the lake, including the pumping of dead storage.

The methane venting from the lake bottom is likely a result of the groundwater level drawdown. Methane is held in the pores of the coal and surrounding sandstone by the hydrostatic pressure exerted by the groundwater. As the groundwater level is drawn

down to a lower level by the water flowing into the mine, the methane stored within the pores of the rock is allowed to escape. This gas then migrates upward along the same fractures that the water is moving downward from the lake into the strata below and the mine. As the groundwater level is drawn down, the venting of methane should be expected to continue. As the methane is released and migrates to the surface, it is displaced by the water that is flowing downward from the lake.

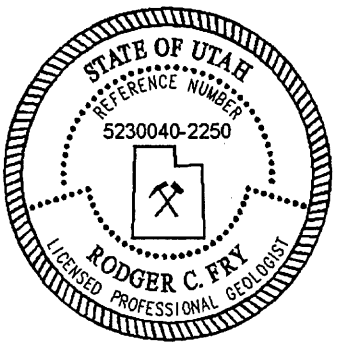
The mapping of the lake bottom using the ROV and utilizing divers characterized the loss of water from the lake to be associated with thousands of holes, each with a subtle but significant water loss from the lake. The zones around each fault appear to be about 300 feet in width along the entire length of each trace within the area of the high-water level of the lake. Because at least three faults are involved that cover a significant portion of the lake, the repair of the leaks will likely be an extensive and complex project. The fractures in the bedrock are covered by up to 30 through 60 feet of alluvium that has been demonstrated to readily conduct water flow. This will require that any repair address the sealing of the fractures and the overlying alluvium.

Professional Certification

I, Rodger C. Fry being a Licensed Professional Geologist in the state of Utah, attest that the data represented herein has been collected by me or under my direction. The interpretation of this data has been done using industry accepted methods and is accurately documented to the best of my knowledge.

Signature: Rodger C Fry Date: March 19, 2003

Licensed Professional Geologist
No: 5230040



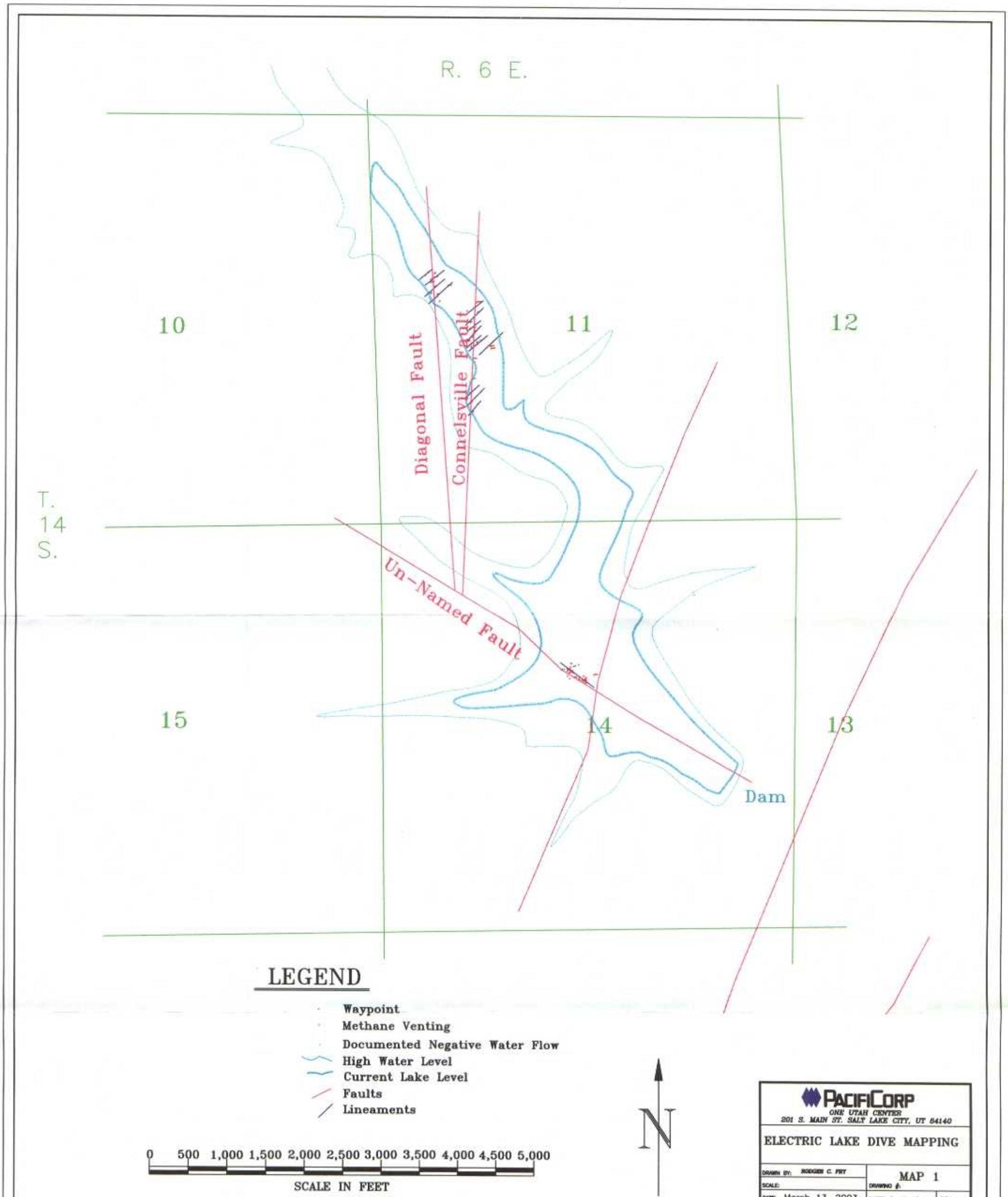
APPENDIX

DIVE DATA TABULATION

DATE	TIME	WAYPOINT	LATITUDE DEGREES	LATITUDE MINUTES	LONGITUDE DEGREES	LONGITUDE MINUTES	DEPTH	ELEVATION	FEATURE	TAPE	FROM	TO
									4 Holes, 1-2" Diameter	1	0:00:00	0:02:43
2/14/2003	11:10	A	39	37.023	111	13.414			1 Hole w/minor negative flow	1	0:04:10	0:06:28
	11:50	B	39	37.019	111	13.436			1 hole;Gas Venting;No apparent flow	1	0:06:29	0:08:29
	12:19	C	39	37.022	111	13.448			1 hole; No Mag	1		
	13:01	D	39	37.016	111	13.442			Minor negative water flow	1	0:08:30	0:10:44
	13:33	E	39	37.009	111	13.442			Gas venting; neg. water flow; mag	1	0:10:45	0:13:08
	14:17	F	39	37.015	111	13.424			Minor neg water flow; Mag	1	0:13:09	0:14:26
	14:49	G	39	37.011	111	13.433			130'@108Deg.;Gas venting;	1	0:14:26	0:16:18
	15:29	H	39		111				1 hole;Minor neg. water flow;Mag.	1	0:16:15	0:14:37
	15:44	I	39	37.022	111	13.416			Series of holes	1	0:19:38	0:24:04
	16:11	J	39		111				Several holes	1	0:24:04	0:26:17
2/15/2003	11:03	K	39	37.019	111	13.426			Gas venting; neg. water flow; mag	1	0:26:17	0:35:24
	11:09	9	39	37.019	111	13.426			Several holes;100'@249deg;No vis.flow	1		
	11:57	L	39		111				Holes; venting gas; no vis. Flow; no mag	1	0:35:40	0:43:00
	12:04	10	39	37.029	111	13.444			Gas venting:no neg. flow observed	1	0:43:00	0:47:34
	12:55	11	39	37.026	111	13.442			Several holes; minor neg water flow	1	0:50:34	0:51:35
	13:38	12	39	37.091	111	13.44			Several holes; minor neg water flow	1	0:51:35	0:53:15
	13:43	12	39	37.091	111	13.44			No Visible flow	1	0:54:35	0:56:42
2/16/2003	10:18	13	39	37.041	111	13.438			Gas venting; no visible flow	1		
	13:40	14	39	37.081	111	13.429			No Visible flow	1	0:09:02	1:00:17
	14:53	15	39	37.053	111	13.437	22	8459.5	5'@190deg from WPT15;large hole	1	1:00:18	1:03:55
	15:00		39		111		22	8459.5	25'@170deg from WPT15;Sev. Holes	1	1:03:56	1:05:27
	15:06		39		111		22	8459.5	30:@170deg from WPT15;no vis flow	1	1:05:29	1:07:01
	15:11		39		111		22	8459.5	Holes; venting gas; good vis.flow; Flouroscene placed	1	1:07:03	1:17:25
	15:17	16	39	37.05	111	13.437			No Visible flow;mag	1	1:17:30	1:19:17
2/17/2003	10:03	17	39	37.049	111	13.451	23	8458.5	16'@350 from WPT17;Gas Venting;Minor Neg Flow	1	1:19:17	1:23:12
	10:33		39		111		22	8459.5	Gas Venting; Good Neg Flow; Mag	1	1:23:12	1:31:06
	10:47	18	39	37.061	111	13.051	20	8461.5	20'@350 from WPT18;Gas vent w/neg flow	1	1:31:06	1:37:07
	11:26		39		111		20	8461.5	Large Vent 6";Gas & neg Flow;Flouroscene Die Placed	1	1:37:07	1:40:15
	11:37	19	39	37.07	111	13.444	20	8461.5	Flouroscene Die Placement	2	0:00:00	0:16:28
		19	39	37.07	111	13.444			Locating WPT 16	2	0:16:28	0:18:48
			39		111		22	8459.5	Flouroscene Die Placement@WPT16	2	0:18:48	0:21:11
		16	39	37.05	111	13.437	14	8467.5	Several Fractures;Flouroscene Die Implanted; no mag	2	0:21:19	0:30:29
2/18/2003	10:12	21	39	37.169	111	13.57			Network of fractures; good negative water flow	2		
	11:03		39	37.16	111	13.578	14	8467.5	One hole; venting gas w/neg. water flow	2	0:30:29	0:34:19
	12:10	22	39	37.153	111	13.561	14	8467.5	Holes venting gas; visible negative water flow	2	0:34:20	0:41:15
	12:41	23	39	37.165	111	13.551	8	8473.5	Several holes venting steady gas; visible neg. water flow;	2	0:41:16	1:12:28
	13:31	24	39	37.155	111	13.553	12	8469.5	Several holes venting gas; visible negative water flow	2		
	14:13								5'@155 deg from WPT24; holes no visible flow	2	1:17:49	1:25:04
	14:22						12	8469.5	20'@155 deg from WPT24; Holes w/visible neg flow	2	1:25:04	1:26:45
	14:25	25	39	37.146	111	13.554			Series of holes present; Gas Venting; Visible flow	2	1:26:45	1:31:09
	15:20	26	39	37.135	111	13.552	15	8466.5	Venting gas; visible neg water flow	2	1:31:09	1:32:18
	16:03	27	39	37.159	111	13.544	8	8473.5	Series of Holes; Visible negative flow present; mag	2	1:32:18	1:36:39
	16:42						13	8468.5	Near WPT 20; Numerous fractures w/neg water flow	2	1:36:39	1:40:50
2/19/2003	12:05	28	39	37.107	111	13.553	16	8465.5	One hole; venting gas w/neg. water flow; Mag	3	0:00:00	0:02:05
	12:10	29	39	37.11	111	13.552	25	8456.5	Numerous Holes (20-30) w/good neg water flow;Mag	3	0:02:05	0:04:05
	13:39	30	39	37.114	111	13.546	16	8465.5	Numerous holes w/good neg water flow; Mag	3	0:04:05	0:07:01
	14:04	31	39	37.121	111	13.542	15	8466.5	Large vent 2" dia;good neg water flow;gas discharge	3	0:07:01	0:10:39
	14:50	32	39	37.136	111	13.549			No video; no gas venting; one hole			
	15:08	33	39	37.123	111	13.561	22	8459.5	Hole venting gas; neg water flow;mag	3	0:10:40	0:15:54
	15:55	34	39	37.146	111	13.561			Midway between WPT's 22 & 25;Sev. Holes Venting Gas	3	0:15:55	0:18:12
2/20/2003	11:02	35	39	36.897	111	13.461	32	8449.5	One hole w/minor negative water flow	4	0:00:00	0:03:17
	11:35	36	39	36.909	111	13.453	31	8450.5	Several holes; w/minor neg. water flow;mag	4	0:03:17	0:06:18
	12:00								One Beer Can		0:06:18	0:06:26
	13:29	37	39	36.911	111	13.423	35	8446.5	Several holes w/minor neg. water flow;mag	4	0:06:24	0:08:58
	13:50						25	8456.5	Several holes 10'@160 deg from WPT37;Neg water flow	4	0:08:59	0:10:11
	14:14	38	39	36.885	111	13.432	23	8458.5	Cluster of holes w/minor neg flow;mag	4	0:10:12	0:10:27

DIVE DATA TABULATION

DATE	TIME	WAYPOINT	LATITUDE DEGREES	LATITUDE MINUTES	LONGITUDE DEGREES	LONGITUDE MINUTES	DEPTH	ELEVATION	FEATURE	TAPE	FROM	TO
	14:29						23	8458.5	3'@160 deg from WPT38;No video			
	14:53	39	39	36.869	111	13.13.445	29	8452.5	Fracture;neg flow present;	4	0:11:26	0:15:01
	15:12						29	8452.5	Network of fractures;within 10 feet of WPT 39; neg flow	4	0:15:01	0:24:32
	15:32	40	39	36.89	111	13.448	26	8455.5	One hole venting gas;mag	4	0:24:33	0:27:05
2/21/2003	10:00	41	39	36.329	111	13.186	49	8432.5	Base camp point reference			
	10:13						49	8432.5	70'@80 deg from WPT41;hole venting gas	4	0:27:05	0:32:25
	10:23	42	39	36.33	111	13.166			One hole	4	0:32:23	0:34:55
	10:37								Fractures;neg water flow	4	0:34:56	0:36:06
	11:05	43	39	36.03	111	13.166			Gas venting at 2 min intervals	4	0:36:06	0:43:58
	11:33						52	8429.5	Several holes w/no observed water flow; 70'@90 deg	4	0:43:58	0:46:46
	11:52								Two vent holes with neg water flow 70'@107 deg WPT41	4	0:46:47	0:49:24
	12:04						54	8427.5	Two Holes 110'@160 deg from WPT41	4	0:49:27	0:51:24
	12:11						54	8427.5	One hole 110@160 deg from WPT41	4	0:51:25	0:52:38
	12:16						50	8431.5	Cluster of holes w/minor neg flow;venting gas	4	0:52:38	0:59:52
	12:26						50	8431.5	One hole venting gas; 200'@115 deg from WPT41	4	0:59:54	1:01:55
									Recording by mistake		1:01:55	1:04:52
	12:33								One hole minor negative water flow no location or depth	4	1:04:52	1:07:18
	12:37						50	8431.5	Several holes venting gas;160'@125 deg from WPT41	4	1:07:14	1:10:13
	12:40						50	8431.5	One hole w/neg water flow;venting gas 160'@125 deg	4	1:10:14	1:11:00
	12:44						50	8431.5	Small fracture near vent:venting gas;120'@120deg	4	1:11:01	1:12:10
	12:50						50	8431.5	One hole w/minor neg flow; 115'@125 deg	4	1:12:13	1:13:40
	13:43						50	8431.5	Nine holes;venting gas;neg flow; 130'@60 deg	4	1:13:45	1:16:13
	13:47								Cluster of holes w/neg flow;near last loc	4	1:16:13	1:17:36
	13:49						50	8431.5	Several Holes w/minor neg. water flow;60'@130 deg	4	1:17:36	1:18:16
	13:55						50	8431.5	Large hole covered up by ROV 165'@60 Deg	4	1:19:15	
	13:59						50	8431.5	1 hole w/neg flow; 170'@60 deg	4		1:21:25
	14:02						50	8431.5	1 large hole venting gas 190'@60 deg	4	1:21:26	1:22:48
	14:07						50	8431.5	Cluster of holes within 1' of last site; Neg water flow; gas	4	1:22:48	1:25:36
	14:12						50	8431.5	Cluster of holes venting gas same heading as last site	4	1:25:36	1:26:57
	14:16						50	8431.5	One hole venting gas same heading as last site	4	1:26:57	1:27:34
	14:18						50	8431.5	Several holes venting gas w/neg water flow 200'@60 deg	4	1:27:39	1:28:32
	14:20						50	8431.5	Continuous video	4	1:28:32	1:30:54
	14:23						50	8431.5	One hole venting gas w/minor neg water flow ; 235'@60	4	1:30:59	1:32:54
	14:26						50	8431.5	Cluster of small holes w/minor neg flow;240'@60 deg	4	1:32:59	1:34:48
	14:34								Continuous video	4	1:34:48	1:44:32


R. 6 E.
10
11
12
T.
14
S.
15
14
13
Diagonal Fault
Connelsville Fault
Un-Named Fault
Dam
LEGEND
Waypoint
Methane Venting
Documented Negative Water Flow
High Water Level
Current Lake Level
Faults
Lineaments
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000
SCALE IN FEET
N
PACIFICORP
ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140
ELECTRIC LAKE DIVE MAPPING
DRAWN BY: RODGER C. PRY
SCALE:
DATE: March 13, 2003
MAP 1
DRAWING #:
SHEET 1 OF 1
REV.:

Diagonal Fault

Connelsville Fault

N

LEGEND

- WAYPOINT
- VENTING METHANE
- NEGATIVE WATER FLOW
- CURRENT WATER LEVEL
- FAULT TRACE
- HIGH WATER LEVEL
- LINEAMENT

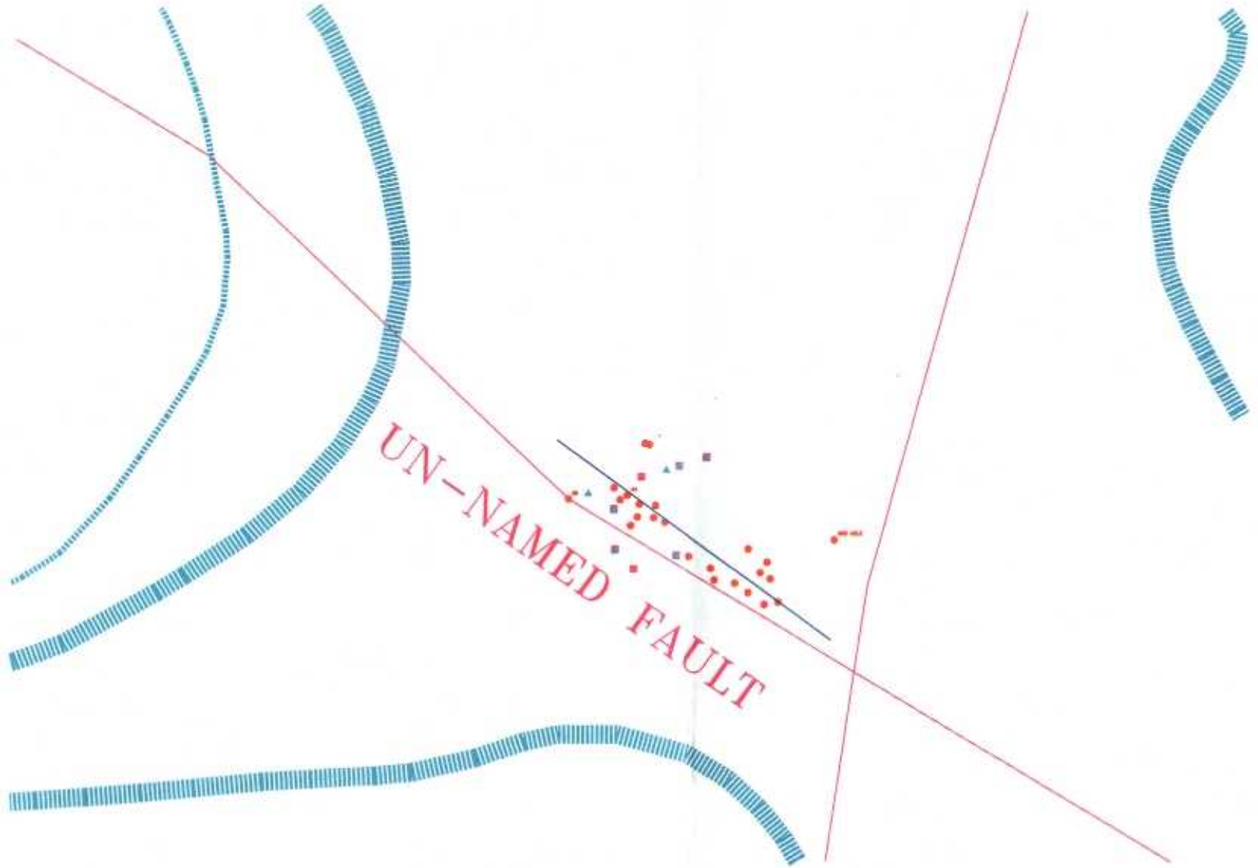
0 500 1,000 1,500 2,000

SCALE IN FEET

PACIFICORP
ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

ELECTRIC LAKE DIVE MAPPING

DRAWN BY: RODGER C. FRY	MAP 2
SCALE:	DRAWING #:
DATE: March 13, 2003	SHEET 1 OF 1 REV.:



LEGEND

WAYPOINT

VENTING METHANE

NEGATIVE WATER FLOW

HIGH WATER LEVEL

CURRENT WATER LEVEL

FAULT

LINEAMENT

N

PACIFICORP
ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

ELECTRIC LAKE DIVE MAPPING

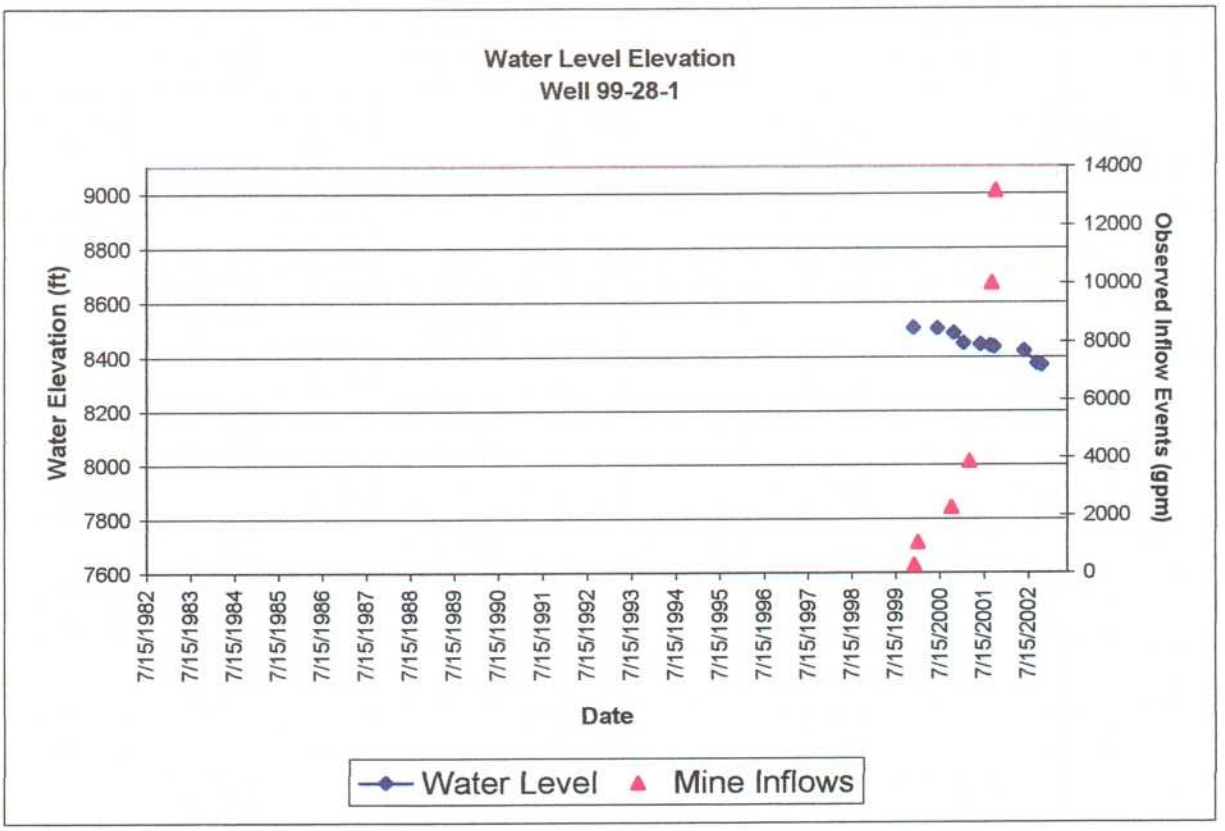
DRAWN BY: RODGER C. FRY	MAP 3	
SCALE:	DRAWING #:	
DATE: March 13, 2003	SHEET 1 OF 1	REV.:

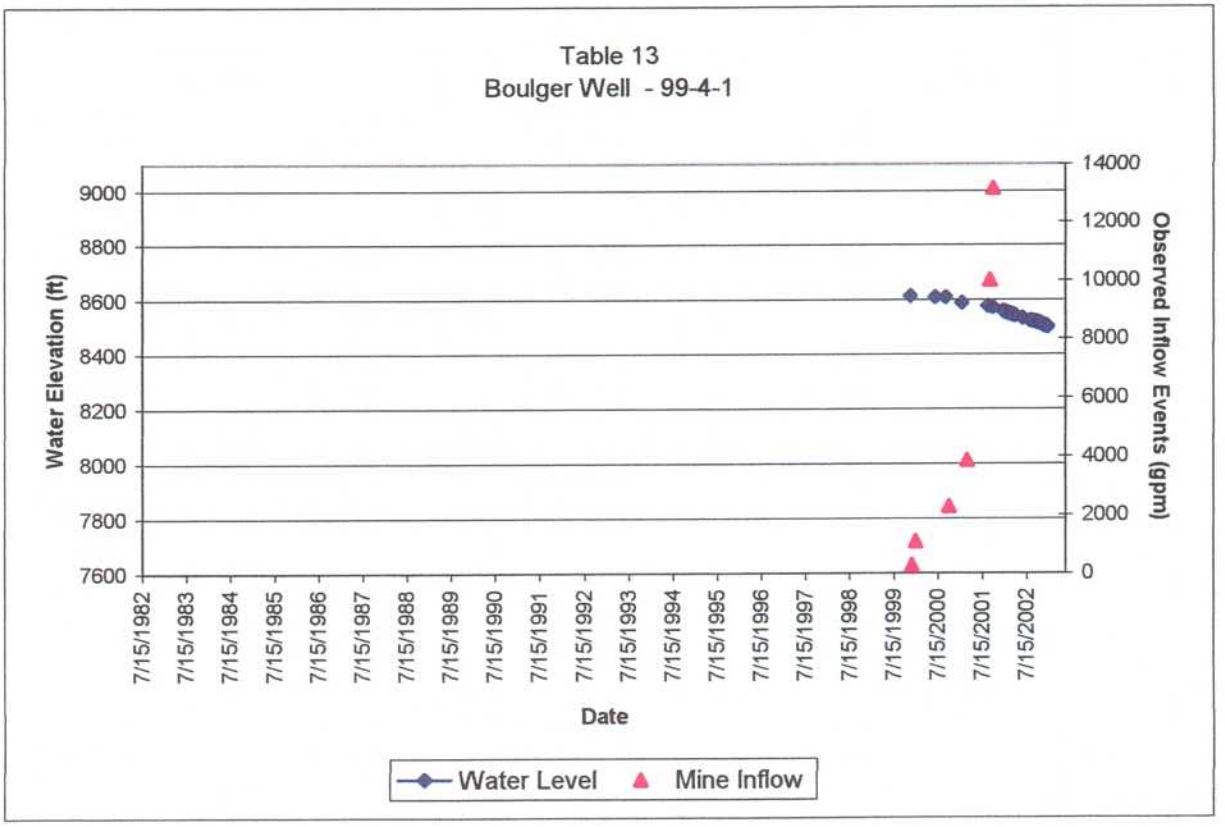
0 500 1,000 1,500 2,000 2,500

SCALE IN FEET

Appendix C

Well Water Level Plots


Water Level Elevation
Well 99-28-1
Water Elevation (ft)
9000
8800
8600
8400
8200
8000
7800
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date
Water Level
Mine Inflows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Boulger Well - 99-4-1
Water Elevation (ft)
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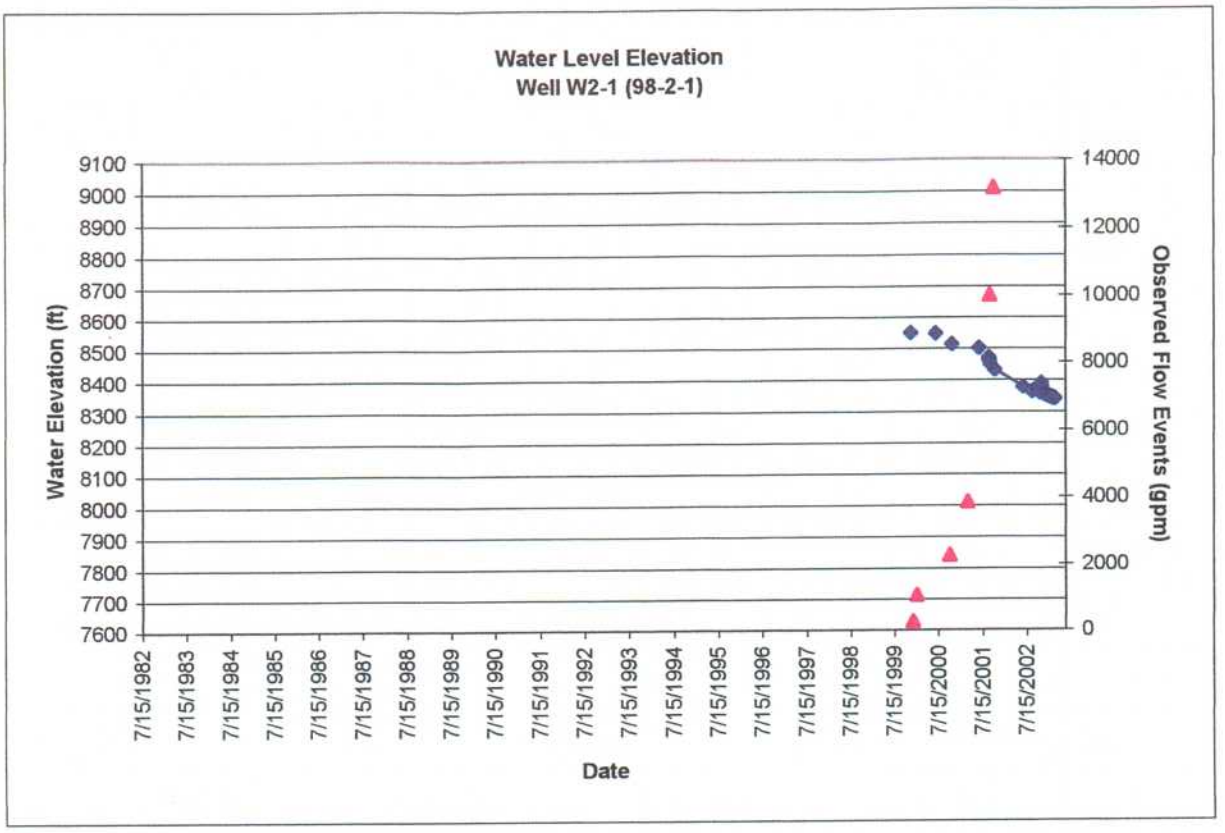
8800
8600
8400
8200
8000
7800
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date
Water Level
Mine Inflow


Water Level Elevation
Well W2-1 (98-2-1)
Water Elevation (ft)
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9000
8900
8800
8700
8600
8500
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8200
8100
8000
7900
7800
7700
7600
Observed Flow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
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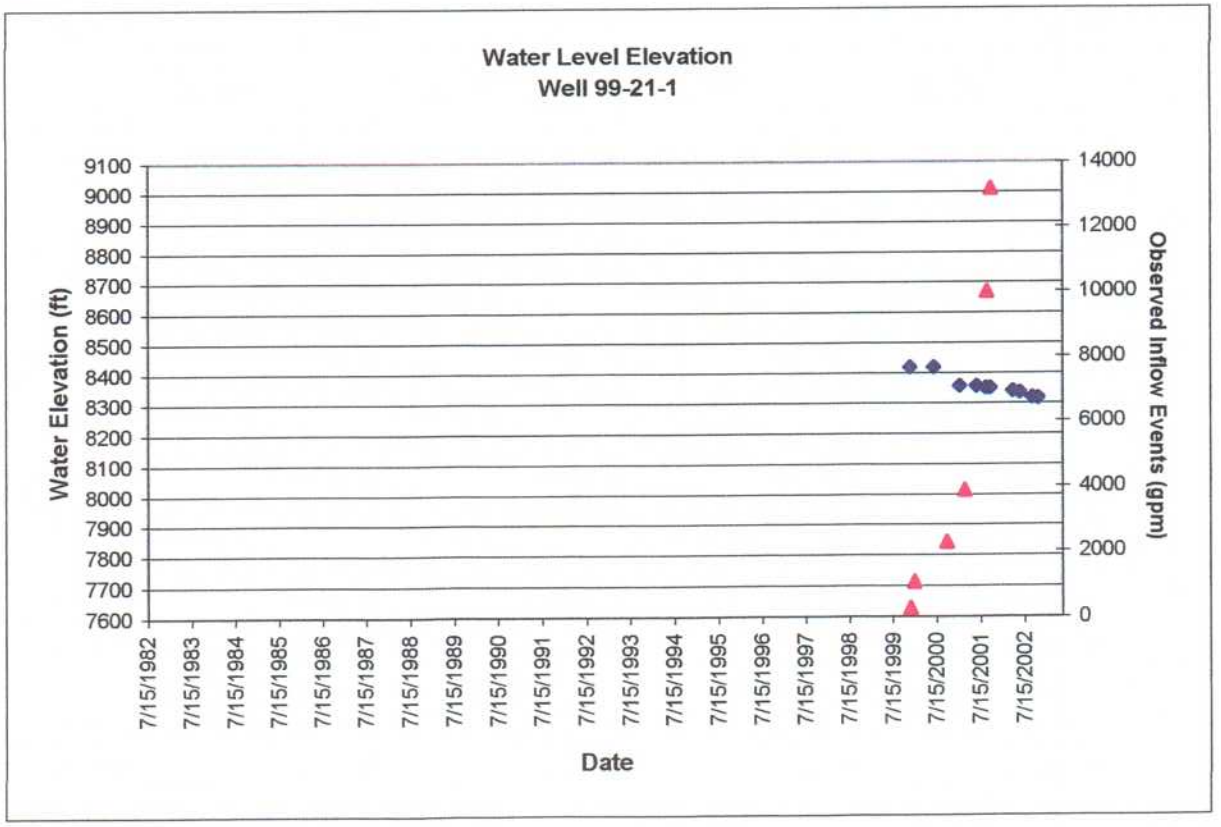
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date


Water Level Elevation
Well 99-21-1
Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
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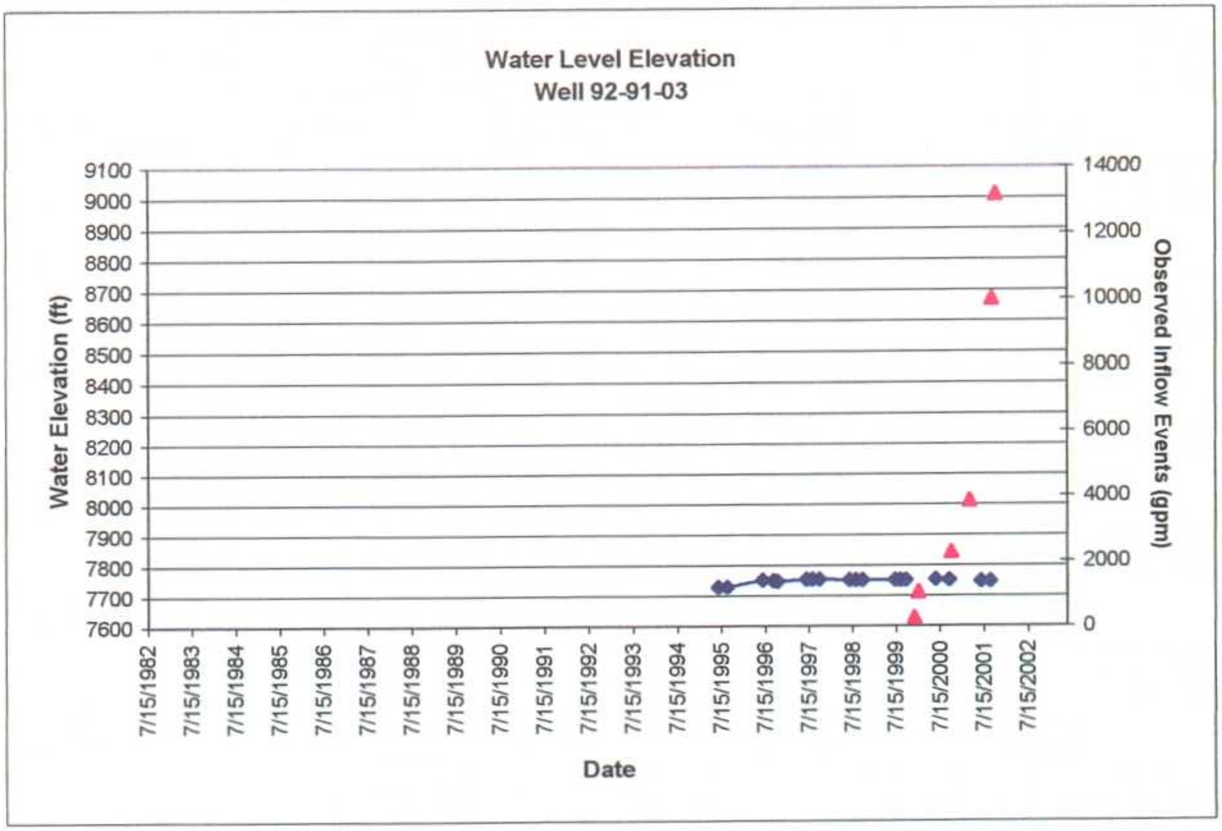
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date


Water Level Elevation
Well 92-91-03
Water Elevation (ft)
Observed Inflow Events (gpm)
Date
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9000
8900
8800
8700
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8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
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7/15/1997
7/15/1998
7/15/1999
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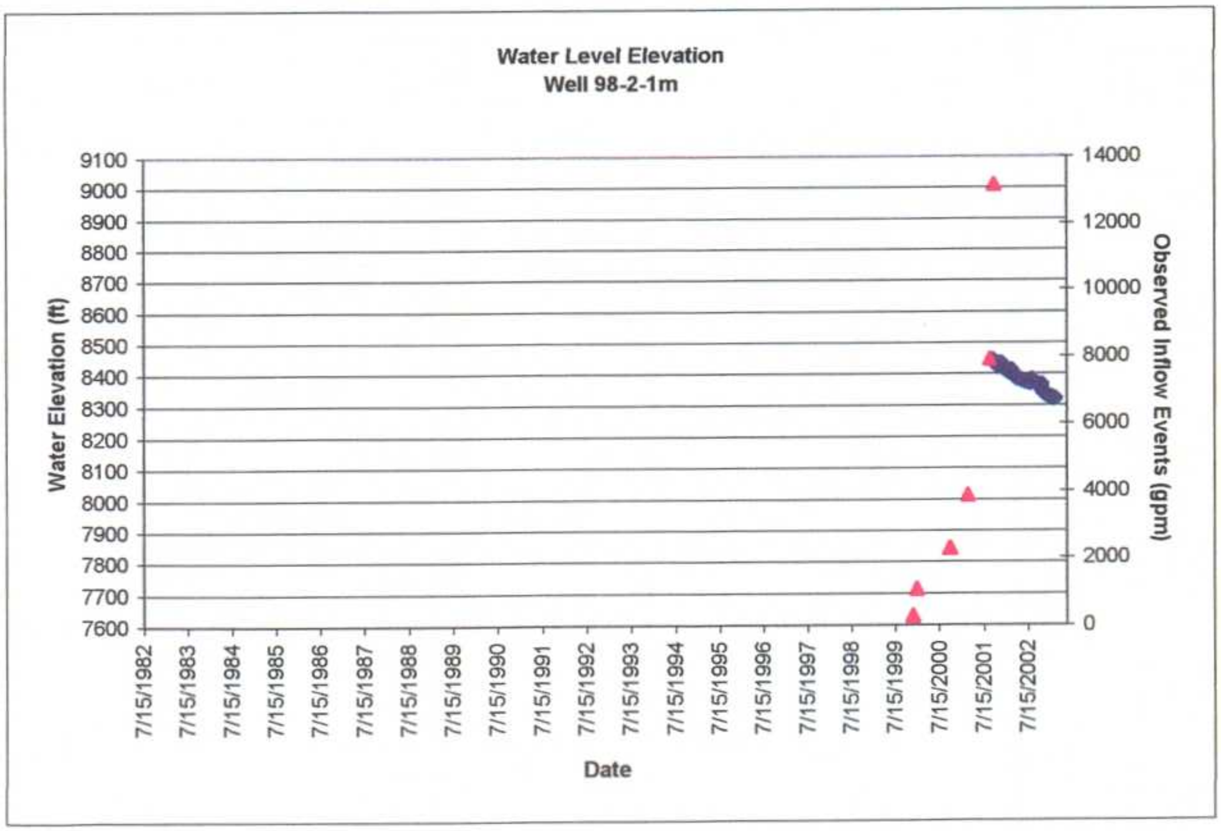
7/15/2001
7/15/2002


Water Level Elevation
Well 98-2-1m
Water Elevation (ft)
Observed Inflow Events (gpm)
Date
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9000
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8800
8700
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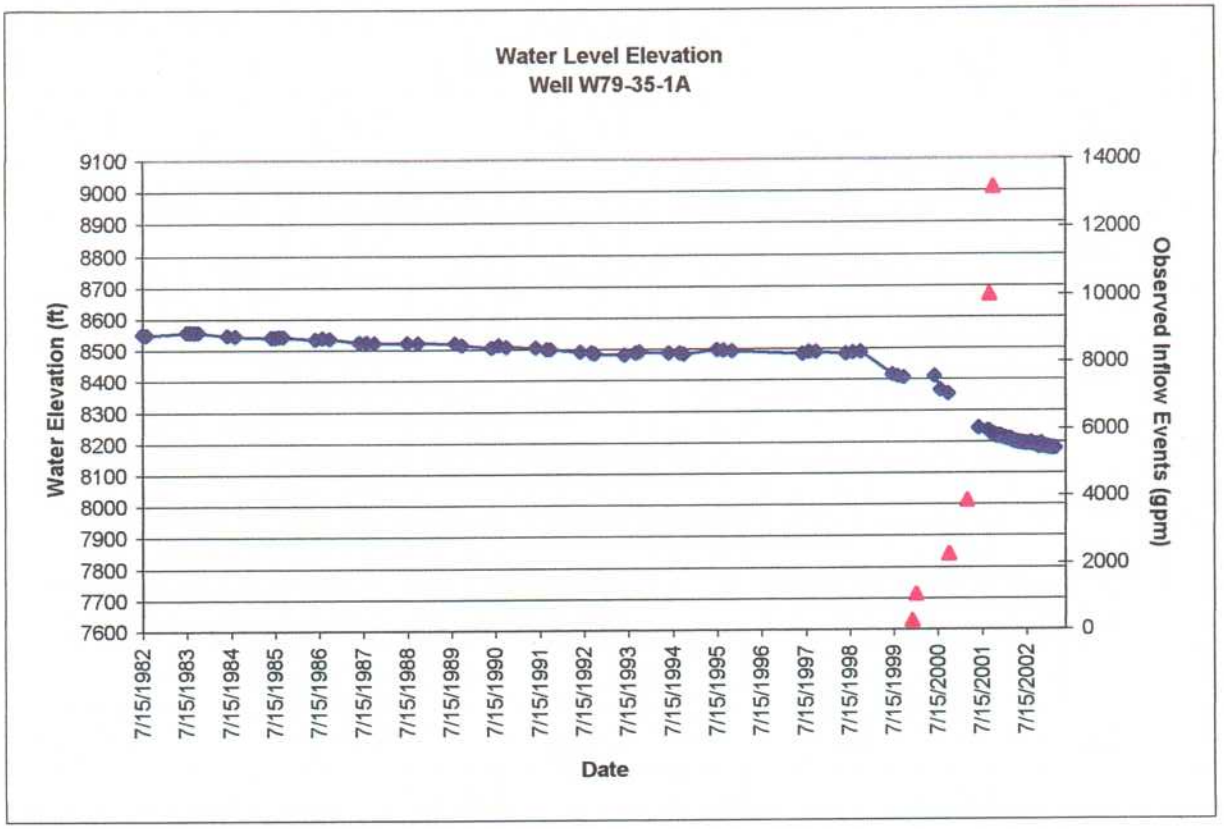
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002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Well W79-35-1A
Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
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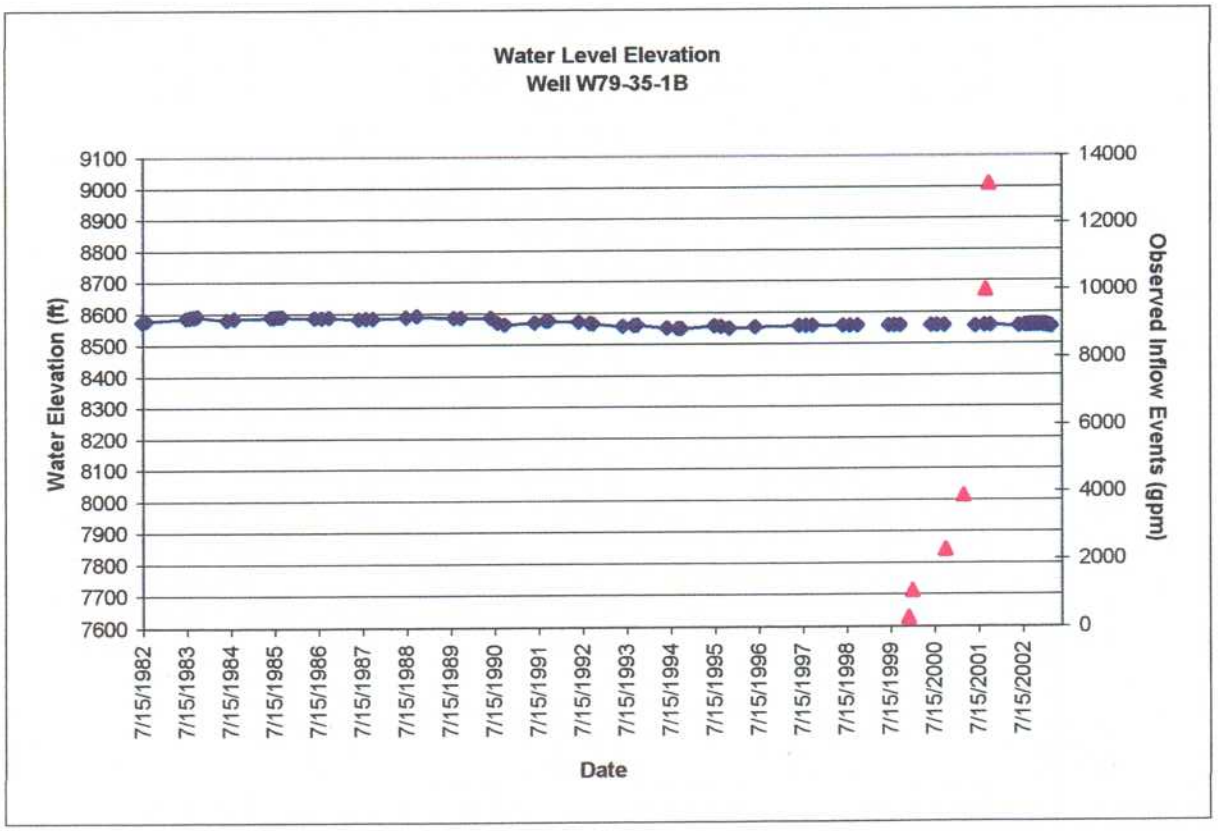
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date


Water Level Elevation
Well W79-35-1B
Water Elevation (ft)
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9000
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8800
8700
8600
8500
8400
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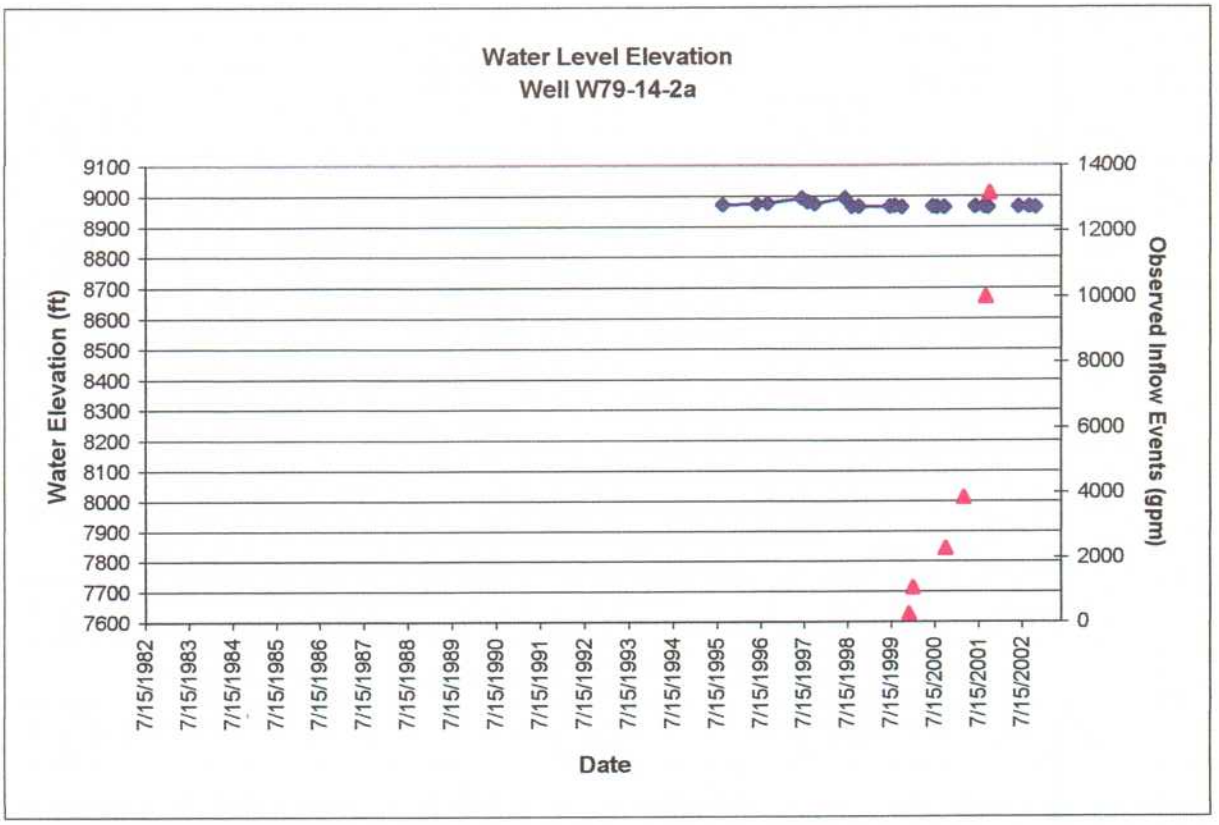
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date


Water Level Elevation
Well W79-14-2a
Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
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8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
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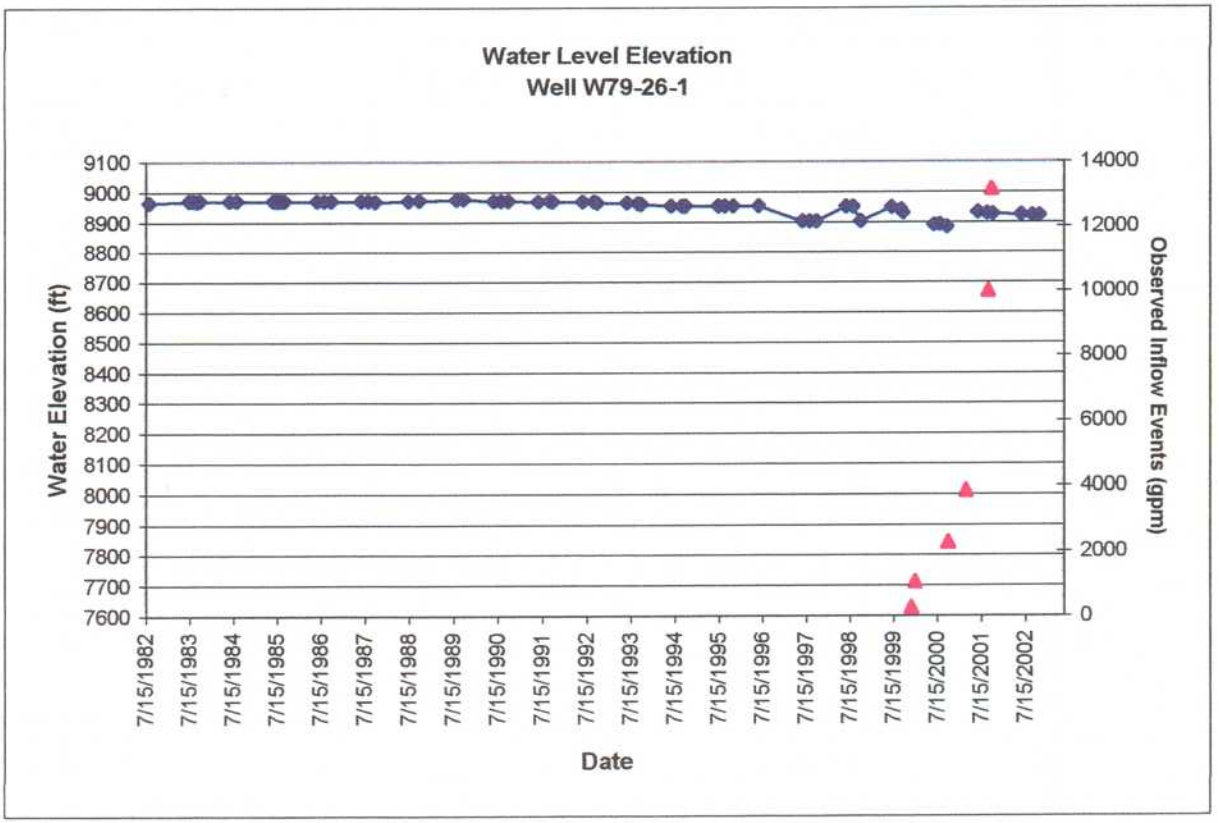
7/15/2002
Date


Water Level Elevation
Well W79-26-1
Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
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7/15/1994
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7/15/2002
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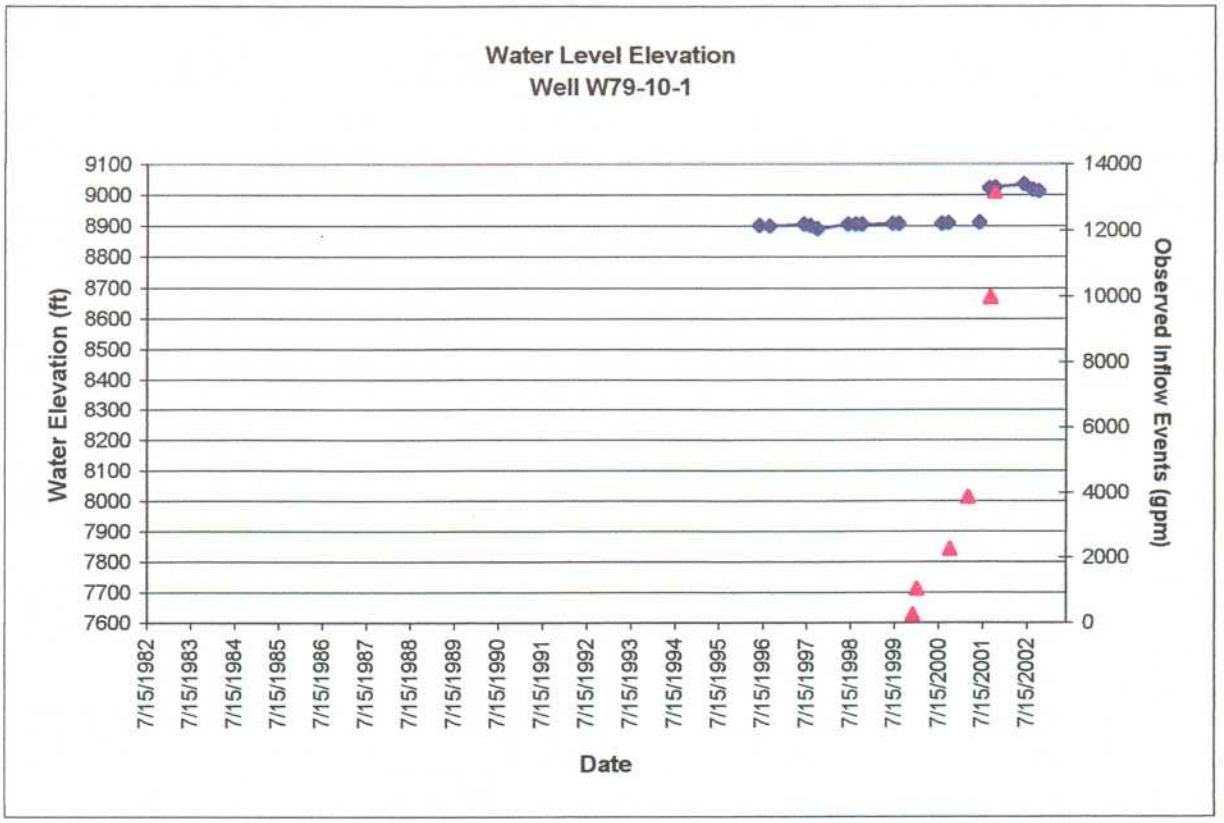
Water Level Elevation
Well W79-10-1
Water Elevation (ft)
9100
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8900
8800
8700
8600
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
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7/15/1994
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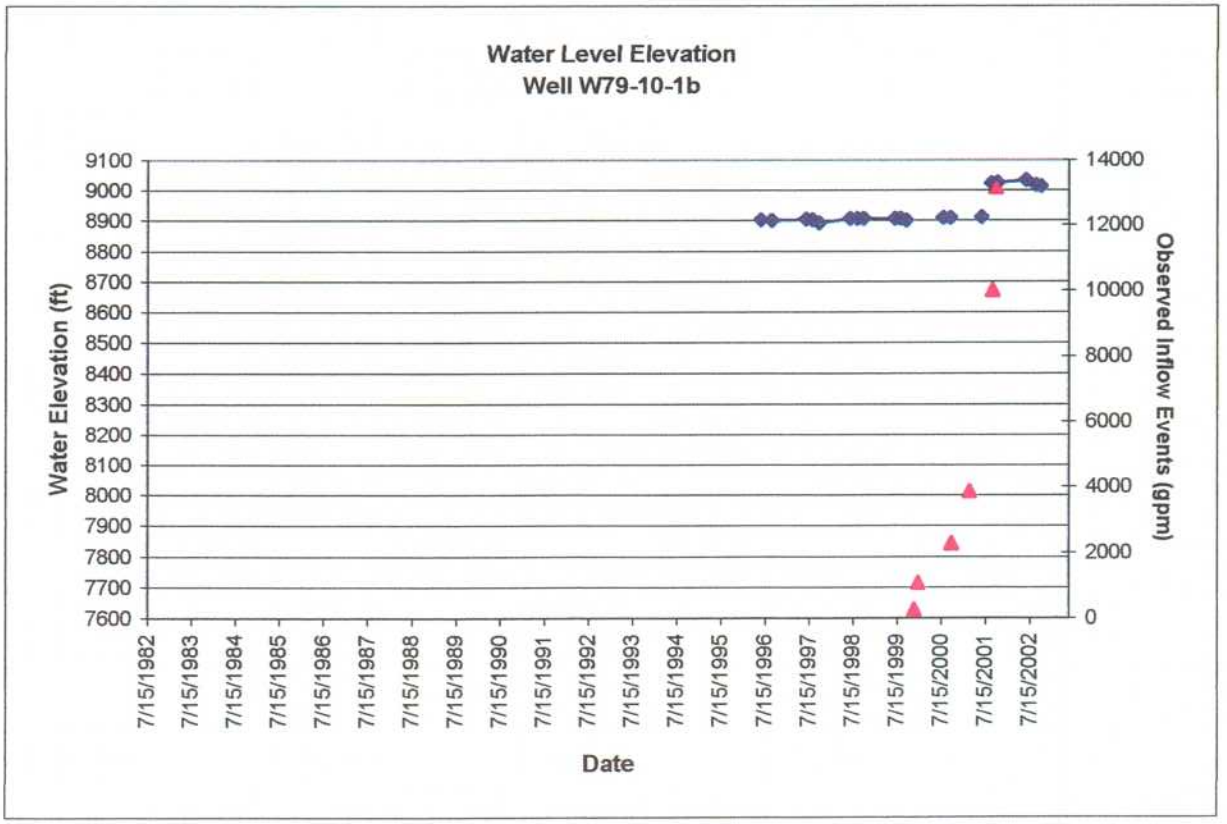
7/15/2002
Date


Water Level Elevation
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Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
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8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
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7/15/1994
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7/15/1997
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7/15/1999
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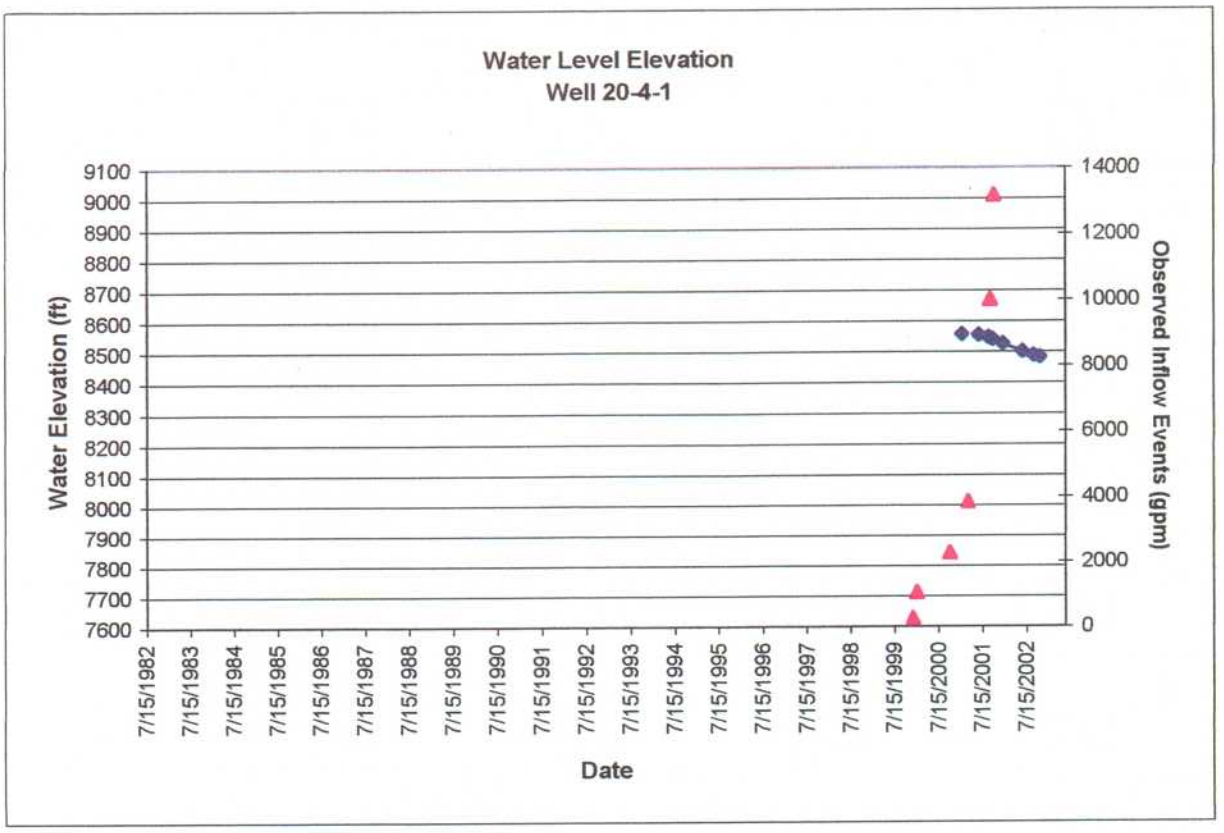
7/15/2002
Date


Water Level Elevation
Well 20-4-1
Water Elevation (ft)
9100
9000
8900
8800
8700
8600
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
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7/15/1994
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7/15/2002
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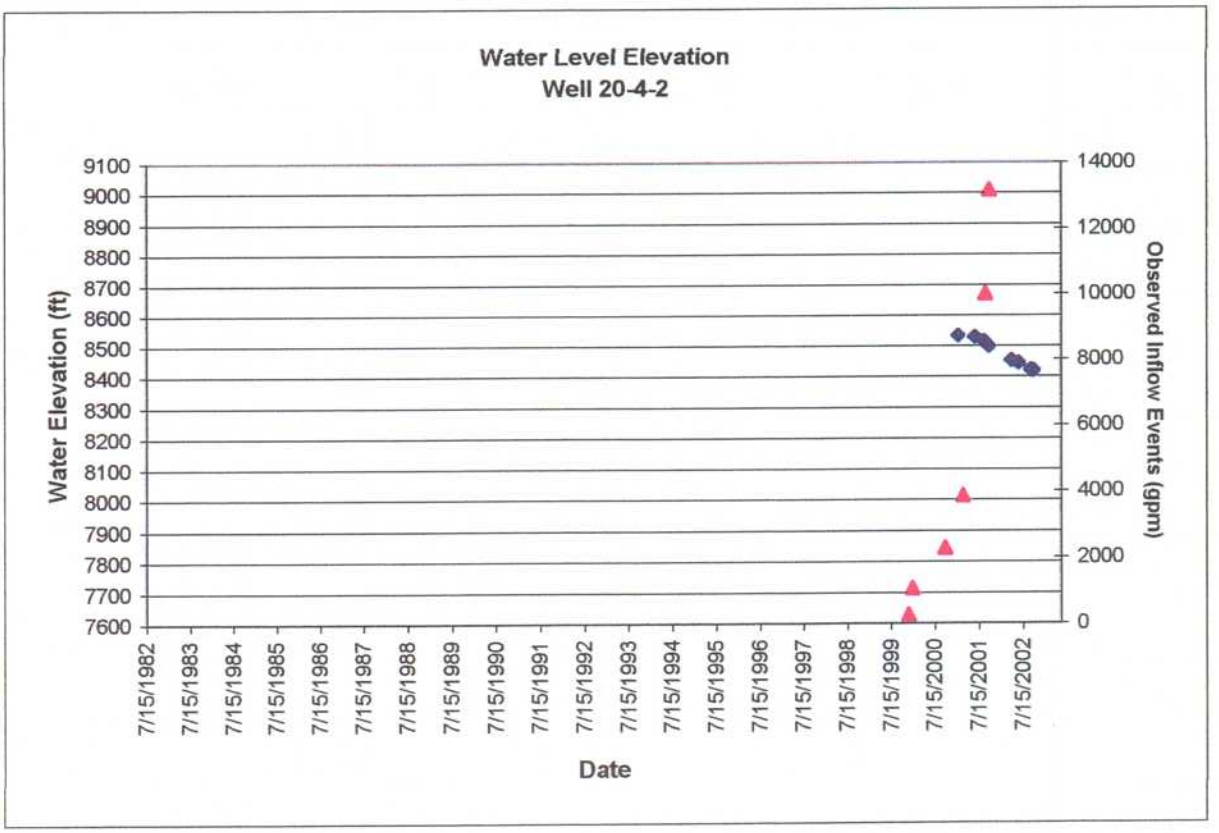
Water Level Elevation
Well 20-4-2
Water Elevation (ft)
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8900
8800
8700
8600
8500
8400
8300
8200
8100
8000
7900
7800
7700
7600
Observed Inflow Events (gpm)
14000
12000
10000
8000
6000
4000
2000
0
7/15/1982
7/15/1983
7/15/1984
7/15/1985
7/15/1986
7/15/1987
7/15/1988
7/15/1989
7/15/1990
7/15/1991
7/15/1992
7/15/1993
7/15/1994
7/15/1995
7/15/1996
7/15/1997
7/15/1998
7/15/1999
7/15/2000
7/15/2001
7/15/2002
Date

Appendix D

Resistivity Survey Cross Sections

Map(s) is kept with this report located in the Public Information Center of our Salt Lake City office.

FRACTURES BASED ON RESISTIVITY JULY, 2002

LINE JRC1 JULY , 2002

LINE JRC 2 JULY, 2002

LINE JRC 3 JULY, 2002

LINE JRC 4 JULY, 2002

LINE JRC 5 JULY, 2002

LINES JRC 1- JRC 5 JULY, 2002

Appendix E

Aquatrack Survey

AQUATRACK SURVEY

Electric Lake
Emery County, Utah

Prepared for:

PacifiCorp - Huntington Plant
P.O. Box 680
Huntington, UT 84528

Prepared by:

Sunrise Engineering, Inc.
12227 South Business Park Drive, Suite 220
Draper, UT 84020

Phone: 801-523-0100
Fax: 801-523-0990

SUNRISE ENGINEERING, INC.

12227 South Business Park Drive, Suite 220 • Draper, Utah 84020
tel 801.523.0100 • fax 801.523.0990

OFFICES IN
UTAH
IDAHO
ARIZONA
WYOMING

October 24, 2002

Rodger C. Fry
Exploration Administrator
Interwest Mining Company
201 So. Main Street
One Utah Center, Suite 2000
Salt Lake City, Utah 84140-0020

Re: AquaTrack Survey
Electric Lake
Sunrise Project No. 00885

Dear Mr. Fry:

Sunrise Engineering, Inc. (Sunrise) has completed an AquaTrack survey at the above referenced site. The survey was conducted in general accordance with our proposal dated July 15, 2002 and subsequent change orders dated September 5, 2002.

Our services consist of professional opinions and recommendations made in accordance with generally accepted geophysical and hydrogeological principles and practices at the time of execution. This warranty is in lieu of all other warranties either expressed or implied. The information in this report relates only to the subject site and should not be extrapolated or construed to apply to any other areas.

We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please feel free to contact us at (801) 523-0100 or (435) 743-6151.

Sincerely,
SUNRISE ENGINEERING, INC.

Prepared by:

Dao Yang, P.E.
Hydrogeologist

Reviewed by:

Val Kofoed, P.E.
Principal Engineer

Jerry Montgomery, Ph.D.
Chief Geophysicist

EXECUTIVE SUMMARY

Sunrise Engineering, Inc. (Sunrise) has completed an AquaTrack geophysical survey and interpretation for PacifiCorp at Electric Lake, Emery County, Utah. Electric Lake is located in the upper reaches of Huntington Canyon within the Manti La Sal National Forest. The reservoir is an earthen dam storage reservoir and is used for multi purposes, i.e., recreation, agricultural, and industrial usage (water supply for Huntington Power Plant). The reservoir is located in the mountains at an elevation of approximately 8,500 feet above mean sea level. Recently, the water leaking out of the reservoir was found to be significantly more than historically observed and/or recorded. Some have postulated that the leaking water is flowing down into the Skyline Mine located northeast of and below the reservoir. Others believe there is no relationship between the mining operations and the water leaking from the reservoir.

Skyline Mine drilled a dewatering well in what is called James Canyon to dewater mining operations. The James Canyon Well had been installed and continuously pumped at a high rate in an attempt to intercept water infiltrating mining operations. Some have suspected that the well is connected with the reservoir through groundwater preferential pathways associated with fractured bedrock or faults northeast of the reservoir. The leaking water from the reservoir could cause an enormous economic loss to PacifiCorp. Characterization of the preferential groundwater pathways out of the reservoir is essential to develop and implement a successful remediation plan for the water-leaking problem at Electric Lake.

Sunrise was hired by PacifiCorp to track and map the leaking water from the reservoir. The primary tool used in the survey was AquaTrack, a geophysical technology that uses electrical current injected into the subsurface to track, map and monitor groundwater. As the current flows through the subsurface, it follows the path of the least resistance, which in most cases is the groundwater or water bearing strata. The groundwater acts as a subsurface conductor. AquaTrack employs electrons as tracers to follow the subsurface continuous conductor. As the current flows through the groundwater, the current creates a magnetic field characteristic of the injected audio-frequency current. This magnetic field can then be detected and surveyed from the ground surface using a special magnetic receiver.

The measured magnetic field can then be normalized and plotted on a horizontal plane. The mapped magnetic field mirrors where the electrical current is flowing. It is assumed that where the electrical current is flowing is where groundwater is located. The end

result provides a map showing the most probable groundwater flow pattern(s) or footprint of groundwater for the area of investigation.

The findings of the investigation are summarized below:

- A hydrogeologic data review indicates that there is a regional bedrock aquifer in the study area. The Skyline Mine James Canyon Well penetrates into this regional aquifer.
- The AquaTrack geophysical survey investigation identified a preferential groundwater pathway connecting Electric Lake and the Skyline Mine James Canyon Well. This preferential pathway is likely along fault lines or fractured rock zones.
- Electric Lake recharges the regional aquifer through faults, joints and/or fractured bedrock. Under a hydrodynamic balance condition, the water loss from the reservoir through recharge may not be very significant.
- The AquaTrack data indicates that the subsurface mine has intercepted water from the regional aquifer by mining through the recharging pathways, i.e., faults, joints and/or fractured bedrock. Thus, an artificial subsurface drain has been "created" in the mine and broken the hydrodynamic balance of the aquifer system, causing significantly more water loss from the reservoir. The more the water is pumped from the mine, the higher the hydrodynamic force is derived, resulting in more water loss from the lake, until a new balance is reached.

TABLE OF CONTENTS

PAGE NO.

Figures

Appendix

AQUATRACK SURVEY

Electric Lake
Emery County, Utah
October 24, 2002

1.0 INTRODUCTION

Sunrise Engineering, Inc. (Sunrise) has completed an AquaTrack survey for PacifiCorp at Electric Lake, Emery County, Utah. The purpose of this survey was to characterize groundwater flow pathways and geologic conditions that may exist between Electric Lake and the Skyline Mine James Canyon Well (**Figure 1**).

1.1 Background

Electric Lake is located in the upper reaches of Huntington Canyon within the Manti La Sal National Forest. The reservoir is an earthen dam storage reservoir and is used for multi purposes, i.e., recreation, agricultural, and industrial usage (water supply for Huntington Power Plant). The reservoir is located high in the mountains at an elevation of approximately 8,500 feet above mean sea level. Recently, the water leaking out of the reservoir was found to be significantly more than historically observed and/or recorded. Some have postulated that the leaking water is flowing down into the Skyline Mine located northeast of and below the reservoir. Others believe there is no relationship between the mining operations and the water leaking from the reservoir.

Skyline Mine drilled a dewatering well in what is called James Canyon to dewater mining operations. The James Canyon Well had been installed and continuously pumped at a high rate in an attempt to intercept water infiltrating mining operations. Some have suspected that the well is connected with the reservoir through groundwater preferential pathways associated with fractured bedrock or faults northeast of the reservoir. The leaking water from the reservoir could cause an enormous economic loss to PacifiCorp. Characterization of the preferential groundwater pathways out of the reservoir is essential to develop and implement a successful remediation plan for the water-leaking problem at Electric Lake.

1.2 Scope of Work

To address the issues outlined above, Sunrise proposed and was requested to:

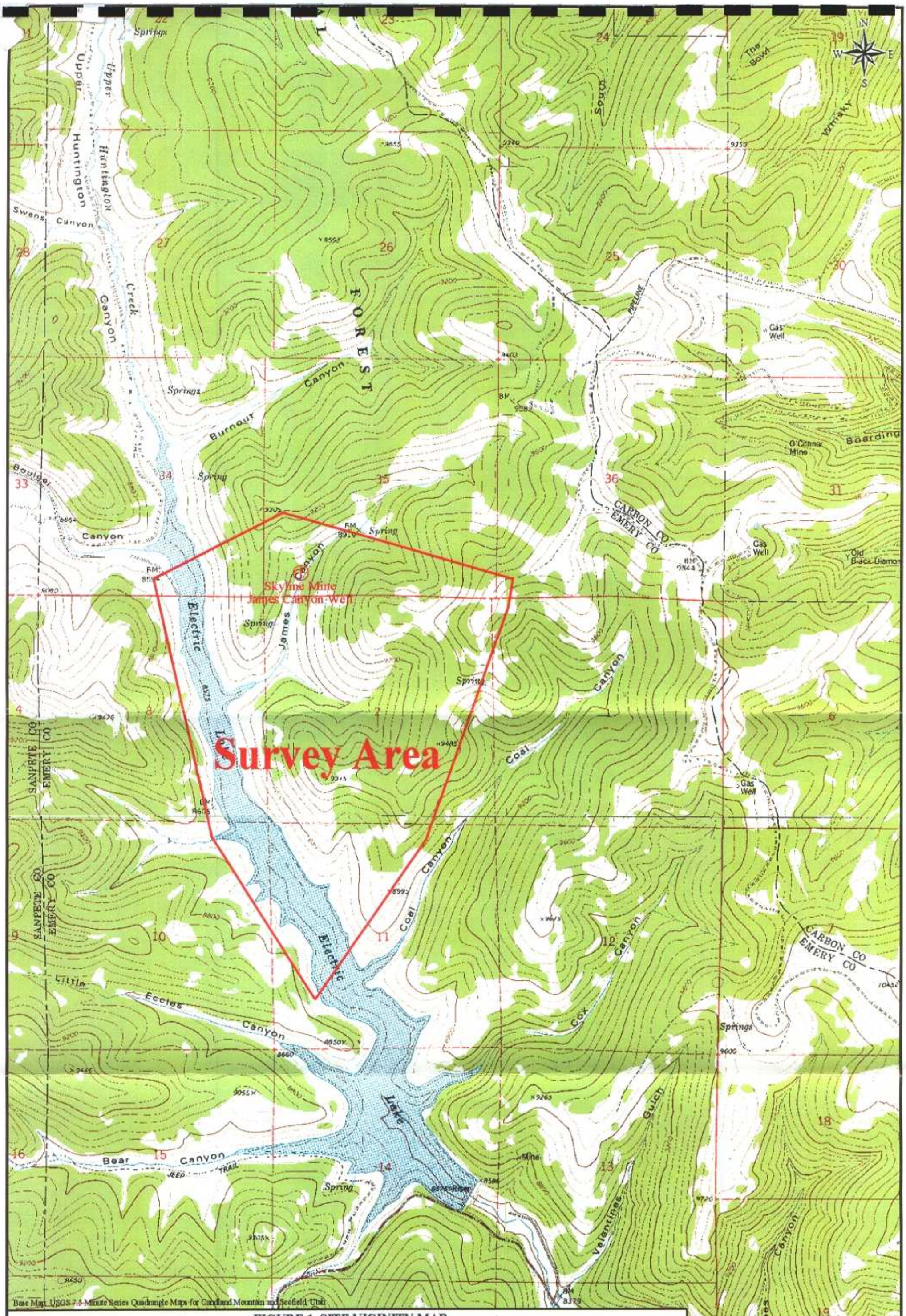


FIGURE 1. SITE VICINITY MAP

AquaTrack Survey at Electric Lake
Emery County, Utah

Sunrise Project No.: 00885	Scale = 1" : 2000' Drawn by: Dao Yang	Date: September 10, 2002	SUNRISE ENGINEERING INC.

1. Conduct an AquaTrack survey using the existing James Canyon Well and Electric Lake to characterize groundwater flow paths and geologic conditions that may exist between Electric Lake and the well.
2. Survey a total of 672 stations along 16 survey lines with a total lineal length of approximately 48,900 feet.

2.0 METHODOLGY

2.1 General Description

AquaTrack is a geophysical technology that uses electrical current injected into the subsurface to track, map and monitor groundwater. Understanding the location and extent of groundwater can be a complex matter. However, when there is a need to know where groundwater is located, the right tool results in the greatest insight. AquaTrack is that tool.

The greatest benefit of this patented technology is its ability to reduce the cost of subsurface investigations and remediation. AquaTrack provides the ability to direct electricity into specific aquifers, thereby tying the results of the survey to existing sources of groundwater.

Traditional electromagnetic and electrical survey equipment does not have the range or capability that AquaTrack can provide. These types of geophysical technologies are limited to less than 100 feet. The AquaTrack technology has the horizontal range between 1,000 and 5,000± feet depending on subsurface conditions. Thus, AquaTrack technology can provide better and more accurate information about the location and flow pattern of groundwater under the ground surface. Using the AquaTrack technology requires an in-depth knowledge of geophysical, geological and hydrogeological principles, methods and practices for correct interpretation of the survey data.

The method of mapping and monitoring groundwater and subsurface aqueous systems used in AquaTrack is protected by Patent 5,825,188, and other patents pending.

2.2 Theory and Scientific Principles

The AquaTrack technology uses a low-voltage, low-amperage and audio-frequency electrical current. Electrodes are placed strategically in wells, springs or surface water bodies and emit an audio-frequency electrical current into the groundwater being investigated. The distance between electrodes can vary from tens to thousands of feet, depending upon the access to groundwater and the aquifer characteristics and the area to be investigated.

One of the basic principles utilized in this technology is Ohm's Law. As the current flows through groundwater, according to Ohm's Law, it follows the path of the least resistance. In most cases, the path of the least resistance is the water bearing strata or paths. The few exceptions are ore bodies, buried metal pipes and wires. The groundwater acts as a subsurface conductor. AquaTrack employs the electrical current as the tracer to follow the subsurface continuous conductor. As the current flows through the groundwater, the current creates a magnetic field characteristic of the audio-frequency current. This magnetic field runs perpendicular to the electrical current and can be described by the Bio-Savart Law. This magnetic field can then be detected and surveyed from the ground surface using a magnetic receiver specially designed and manufactured for the audio-frequency of the electrical current.

The measured magnetic field can then be normalized and plotted on a horizontal plane. The mapped magnetic field mirrors where the electrical current is flowing. It is assumed that where the electrical current is flowing is where groundwater is located. The end result provides a map showing the most probable groundwater flow pattern(s) or footprint of groundwater for the area of investigation.

2.3 Magnetic Field Measurement

A magnetic receiver, consisting of a magnetic sensor, filters and amplifiers, measures the magnetic field, filters out magnetic signals of unwanted frequencies, amplifies the signal and converts the information into an electrical current that can be measured and recorded. For example, overhead power lines carry a 60-hertz electric current and can generate a magnetic field surrounding the lines. However, this magnetic field has a frequency of 60 hertz. The magnetic receiver used in the AquaTrack survey does not respond to the 60-hertz magnetic signal. The 60-hertz signal is filtered out. The receiver only responds to the 400-hertz magnetic signal generated from the current emitted from the AquaTrack transmitter. Because the magnetic field is a three-dimensional vector, like the speed of an airplane flying in the air, quantification of the magnetic intensity at a specific point can be accomplished by measuring its magnitude and direction, or magnitudes of different components in three normal directions like X, Y and Z. In application of the AquaTrack technology, the magnetic receiver has been designed to measure the magnetic field in a horizontal plane (X-Y plane) and the vertical direction (Z-direction). In the horizontal plane, the receiver can detect the maximum and minimum magnetic values in two normal directions on the plane. For each survey station, the maximum and minimum magnetic values on the horizontal plane, the vertical magnetic value, location relative to the designated survey origin, and survey time are recorded. These recorded data are called raw or field data.

Surveys are normally conducted on a grid system or parallel survey lines. The survey design is dependent on the size of aquifer being investigated, the complexity of the system being mapped and area accessibility. It is possible to miss important features, or anomalies, by gridding or spacing stations too sparsely. A site-specific survey design can be typically established from a hydrogeological assessment of the area and the type of investigation being performed. Normally, a survey starts with a coarse grid and tightening of the grid occurs in areas where additional information is required based on field preliminary analyses of collected data.

Magnetic field surveys are subject to variation throughout the day due to a variety of natural and manmade electromagnetic interference. Repeated base station readings throughout the survey are made and used to track and correct possible variations resulting from outside interference.

2.4 Data Normalization

The field data contains magnetic interference generated from the environment such as the AquaTrack antenna wire, power sources with a frequency close to 400 hertz, transmitter, receiver, or even special local geology setting (such as ore bodies or iron rich volcanic rock) and interference from nature (earth and sun). Because the readings cannot all be taken at the same time, temporal interference and variations exist in the raw data. Therefore, data normalization needs to be performed on all the readings to remove any significant interference before the final presentation of analyzed data.

2.5 Data Interpretation

AquaTrack survey data is interpreted in much the same way as traditional magnetic surveys. The normalized data shows relative highs and lows when it is plotted. These are referred to as anomalies that represent areas of different physical conditions. If the study area is relatively flat, a high horizontal magnetic reading represents a high conductivity, while a low horizontal magnetic reading represents a low conductivity. These highs and lows are traceable from one profile to another. The normalized data can also be transferred to a contour map showing areas with highs and lows.

The changes in conductivity represent an increase or decrease in the presence of groundwater. At this point in the development of the AquaTrack technology, it is not possible to determine the quantity or quality of water present. The AquaTrack technology simply identifies the highest probability of where groundwater is present in the area of investigation.

Survey results can be mapped using a computer program helping identify the location of groundwater reservoirs, aquifers and/or flow patterns of the study area.

3.0 DESCRIPTION OF STUDY AREA

3.1 Project Location

The study area is depicted on **Figure 1**, consisting of a portion of U.S. Geologic Survey (USGS) 7.5-Minute Topographic Quadrangle Maps for Candland Mountain, Utah (USGS, 1979) and Scofield, Utah (USGS, 1979). The survey area of the project is located in the southeastern quarter of Section 34, the southern half of Section 35 and southwestern quarter of Section 36, Township 13 South, Range 6 East, Salt Lake Base and Meridian (SLBM), and the northwestern quarter of Section 1, Section 2, the eastern half of Section 3, the northeastern quarter of Section 10 and Section 11, Township 14 South, Range 6 East, SLBM. Electric Lake is an artificial impoundment constructed on Huntington Creek that cuts through the east flank of the Wasatch Plateau.

3.2 General Geology and Hydrogeology

The Wasatch Plateau is a flat-topped mass about 80 miles long and 25 miles wide, and it appears as a huge upland that trends about North 20 degrees East, separating Sanpete Valley on the west from Castle Valley on the east. The top of the plateau is at an altitude of approximately 11,000 feet. The elevation of Electric Lake is approximately 8,500 feet.

Figure 2 shows the surficial geology of the project area. **Figure 2** indicates that six primary bedrock formations crop out in the project area. These formations are: North Horn Formation (Tkn) of Tertiary and Mesozoic sedimentary rocks; Price River Formation (Kpr), Castlegate Sandstone (Kc), Blackhawk Formation (Kbh), Star Point Sandstone (Ksp) and the upper part of the Mancos Shale (Kmbu) of Mesozoic Sedimentary rocks. Electric Lake is basically underlain by the Blackhawk Formation.

According to Montgomery (1993), there is a regional aquifer consisting of the coal-bearing Blackhawk Formation and the underlying Star Point Sandstone. The Star Point Sandstone is underlain by the basically impervious Mancos Shale that inter-fingers with the overlying sandstone units. Within the mountain masses, groundwater is accumulated in storage within the pervious rock units, their bedding planes, and within all fractures, joints and permeable fault planes. Some water is perched or held up by non-pervious or low-permeability rock beds, such as shale or siltstone. Most of water is stored in the regional aquifer. Towards and within the bottom of the overall groundwater system, all interconnected, pervious rock units and fracture openings are filled and saturated with groundwater. Those low-permeability rock units may be saturated or partly saturated

FIGURE 2. GEOLOGIC MAP

AquaTrack Survey at Electric Lake
Emery County, Utah

Sunrise Project No.: 00885	Scale = 1" : 5000' Drawn by: Dao Yang	Date: September 11, 2002	SUNRISE ENGINEERING INC.

(where interconnection is poor) with groundwater, but do not yield much water, if any, to penetrating drill holes or coal-mine excavations, whereas adjacent or nearby rock units may yield appreciable water quantities beneath the overall groundwater surface. Near the edges of deeply incised canyons, those parts of the rock units above the groundwater surface have and continue to be drained naturally through all available permeability, mostly readily through open faults, joints and bedding planes.

The recharge to this groundwater system is from snowmelt, rainfall and surface impoundments. The higher mountainous areas receive more precipitation and thus provide greater groundwater recharge. The extensive, high Wasatch Plateau above all of the stream drainage, springs and coal mines of the Huntington Canyon and adjacent coal mining and water producing areas cover hundreds of square miles and receive an average annual precipitation of 16-40 inches, with the greatest part of it resulting in stream runoff. Because of the higher storage capacity of the regional aquifer within the lower part of the groundwater system, its yield to springs, coal-mine interceptions and base flow to streams is consistent and less susceptible to seasonal precipitation and drought fluctuations, compared to local perched aquifers.

Because of the abundance of joints, fractures and faults present within the groundwater system, the permeability varies appreciably within various rock units and at different structural positions. Almost all springs in the area discharge from either joints or faults, and depending upon their length, width, degree of sediment or gouge filling, their interconnection and relation to adjacent rock units and nearby large faults, and their position within the aquifer system, will determine the amount of spring yield. The near-vertical faults generally trend northerly with some local exceptions, and the near-vertical joints trend widely from southwest to northeast.

This is the Blackhawk Formation from which all of the various coal beds of the area are mined, which is approximately 800-2,000 feet thick and is composed of interbedded sandstone, shale, siltstone, mudstone and coal.

Coal mining in the area is taking place within the higher slopes. Once the coal mining has penetrated into the mountain to intersect the groundwater surface of the regional aquifer system, water has been intercepted and produced in the mines. This is the present condition of Skyline Mine where the Skyline Mine James Canyon Well is located, as shown in **Figure 1**.

The Star Point Sandstone members have a total thickness of 350-700 feet and consist of interbedded sandstone and shale with gradations of both into three distinct sandstone and shale members. The upper unit is the cliff-forming Spring Canyon Member, 50-100 feet

thick; the middle unit is the semi-cliff-forming Storrs Member, 45-100 feet thick; and the basal unit is the cliff-forming Panther Member, 50-80 feet thick. Below the Panther Member, additional marine sandstone in the Star Point Sequence has been identified from gas wells in the area. These sandstones are up to 700 feet in thickness. Since the Panther Sandstone Member is interfingered and underlain by the main body of the Mancos Shale, composed of impervious bentonitic clay and silt, it is the bottom of the groundwater system of the region. Any groundwater not exiting naturally at some higher position as springs and seeps, or intercepted by coal mining operations, will eventually exit from the aquifer system, except for that water retained in crevices of the rock material against the force of gravity. Thus, commencing at the land surface where precipitation infiltrates into the subsurface, on-down through the various soil and rock units and fracture-fault systems, groundwater recharge to the regional aquifer is an accumulation of it all, less that which spills naturally as seeps and springs, and is intercepted by coal mining operations. These overlying geologic formations of the area successively upward above the Blackhawk Formation are as follows: Castlegate Sandstone, approximately 250 feet thick; Price River Formation of interbedded sandstone and shale approximately 700 feet thick; North Horn Formation of shale, mudstone and interbedded sandstone approximately 800 feet thick; and the alluvium of variable thickness.

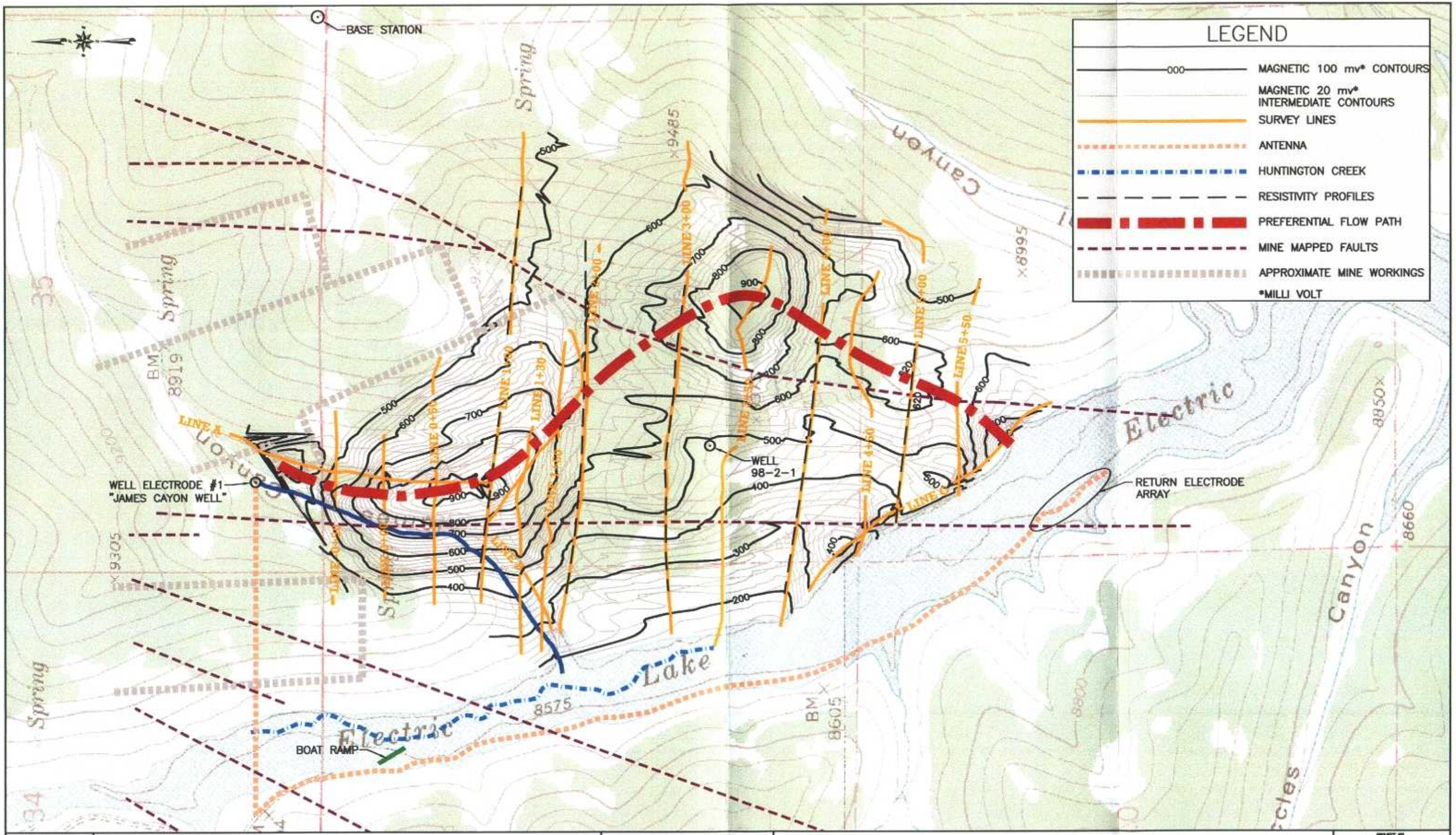
According to the lithologic log of the Skyline Mine James Canyon Well provided to Sunrise, the well was drilled to a total depth of 1,030 feet with the screen interval from 880 to 940 feet. The well log indicates that the screen interval coincides with the fractured Storrs member of the Star Point Sandstone Formation. Therefore, the well penetrated into the regional aquifer.

3.3 Mechanism of Water Leaking from Electric Lake

Electric Lake recharges the regional aquifer through faults, joints or fractured bedrock. Under a hydrodynamic balance condition, the water loss from the reservoir through recharge may not be very significant. However, once the mine intercepts water from the aquifer by mining through the recharging paths (faults, joints or fractured bedrock), an artificial subsurface drain is "created" in the mine and the hydrodynamic balance of the aquifer system is broken, causing significantly more water loss from the reservoir. The more the water is pumped from the mine, the higher the hydrodynamic force is derived, resulting in more water loss from the lake, until a new balance is reached.

4.0 FIELD RECONNAISSANCE/DATA COLLECTION

The fieldwork was conducted during August 12-29, 2002. Survey was conducted along 16 lines as displayed in **Figures 3a** through **3c**.



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SUNRISE ENGINEERING, INC.
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SUNRISE ENGINEERING, INC. Aqua Track

ELECTRIC LAKE
PACIFICORP – HUNTINGTON PLANT

FIGURE 3a

PROJECT NO.	
00695	
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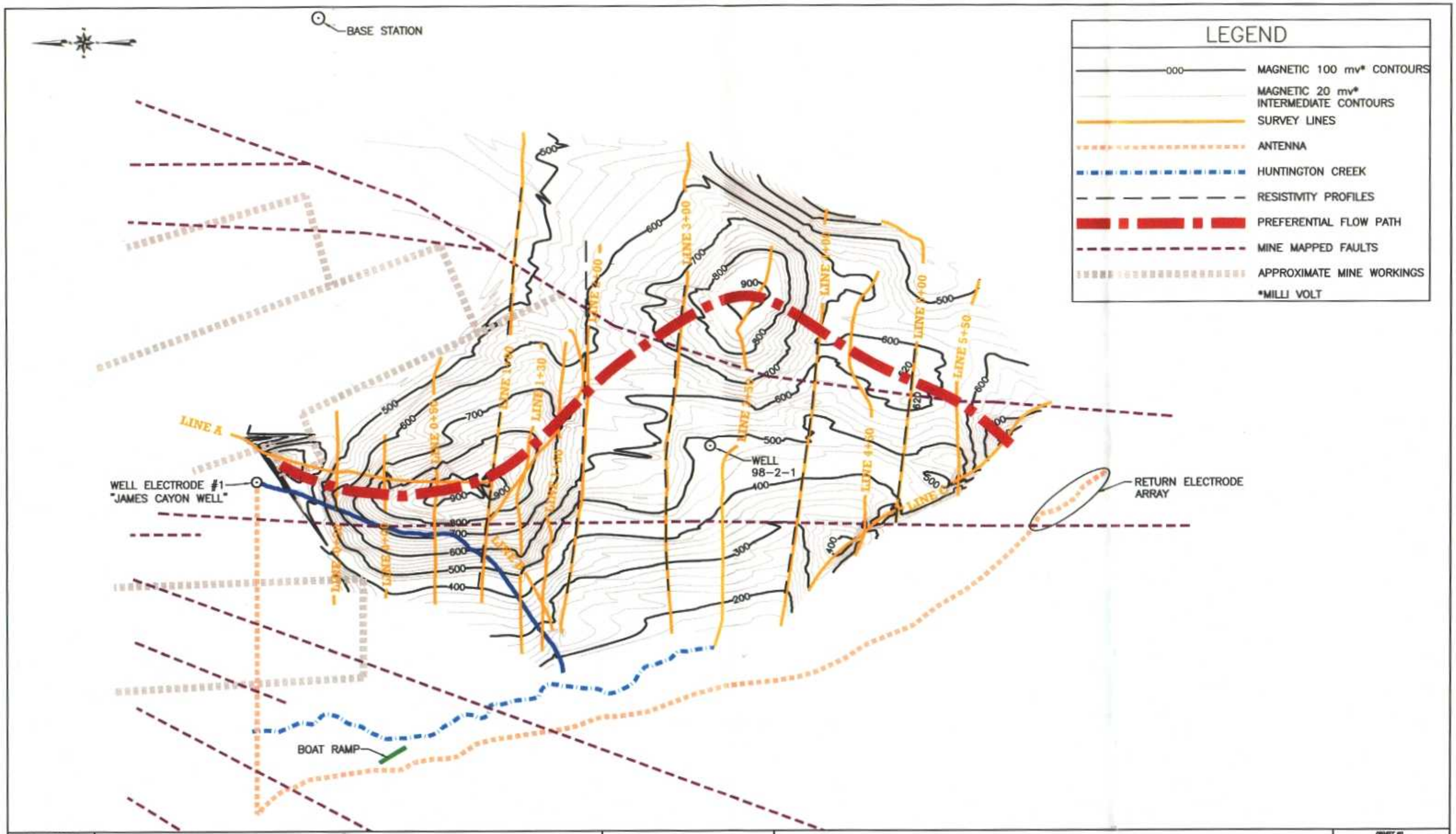
DRAWN RDD	
DATE 9-23-02	DRAWING NO. M1
SCALE 1" = 900'	SHEET NO. 1 OF 1



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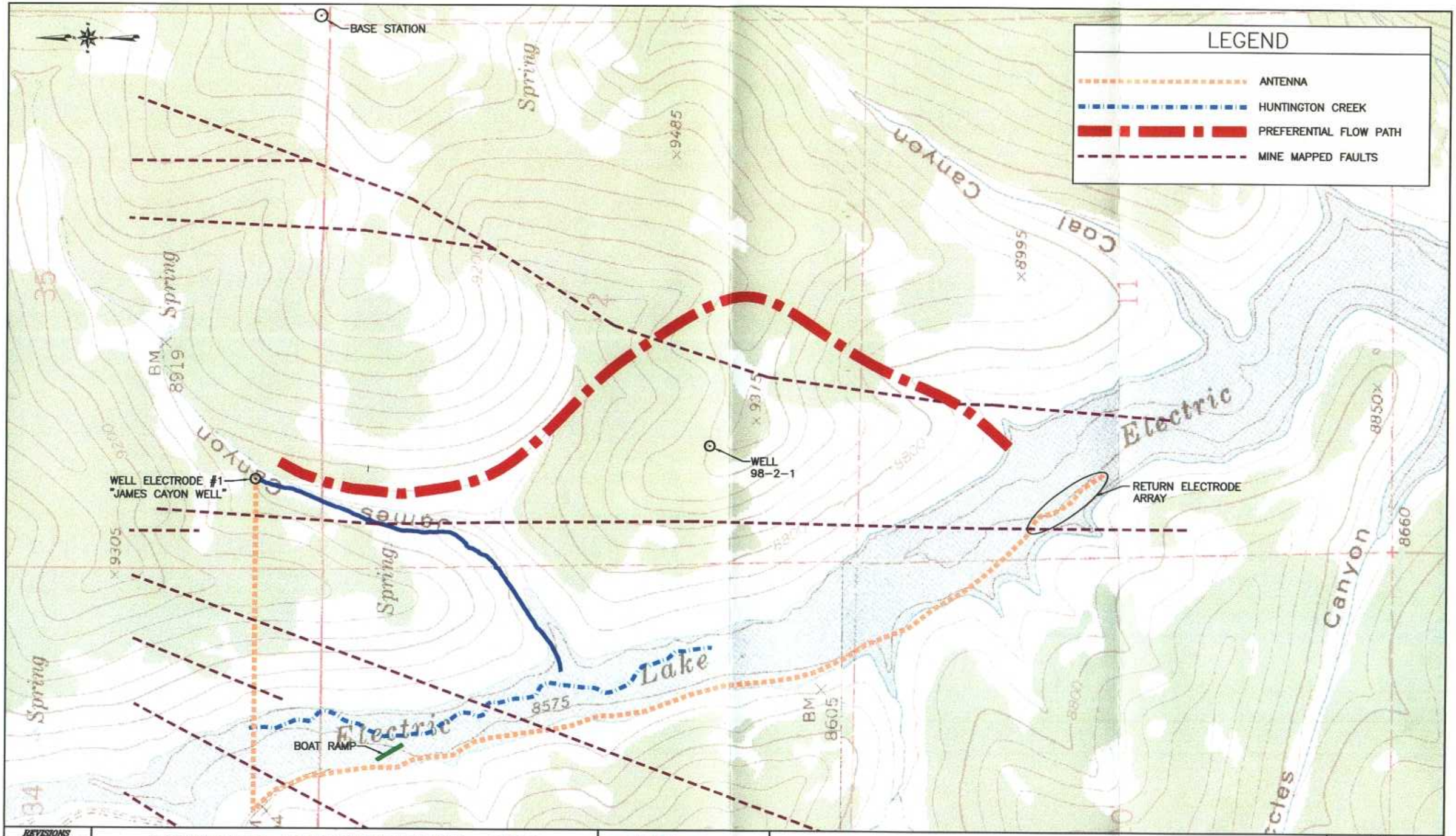
FUGURE 3b

PROJECT NO.	
00685	
DESIGNED: JRM	CHECKED: NRM
DRAWN: RDD	
DATE: 9-23-02	DRAWING NO.: M1
SCALE: 1" = 900'	SHEET NO.: 1 OF 1



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ELECTRIC LAKE
PACIFICORP – HUNTINGTON PLANT

FIGURE 3c

PROJECT NO.	
00685	
DESIGNED JRM	CHECKED NRM
DRAWN RDD	
DATE 9-23-02	DRAWING NO. M1
SCALE 1" = 900'	SHEET NO. 1 OF 1

4.1 Equipment and Setup

The equipment used during the field survey consisted of a transmitter, a receiver, two electrodes, wires, a global positioning system (GPS) and other tools used for distance measurements.

4.1.1 Transmitter

The transmitter consists of a power source, an ELGAR (Model 501SL) power supply and an impedance matching circuit.

The power source for this project was from the pump power outlet of the James Canyon Well. The ELGAR power supply receives 60-hertz power from the generator and provides a 400-hertz 130-volt sinusoidal signal. The accuracy of the frequency is within one part in 10,000.

The ELGAR power supply feeds power to an impedance matching circuit. This circuit is designed to provide the best impedance match between the ground and the audio frequency (400-hertz) power supply. The voltage in the impedance matching circuit is adjustable from 0 to 400 volts with the maximum current output of 2 amperes. The optimal power and impedance match is 200 watts. The impedance matching circuit is connected to two electrodes used to energize the subsurface. Current is measured as part of the impedance matching circuit.

4.1.2 Receiver

The receiver consists of a magnetic sensor tuned to 400 hertz, and a receiver electronics package.

The magnetic sensor has a Q factor of 15 with an overall sensitivity of roughly 10^{-12} Tesla. The sensor itself tunes and resonates at 11,000 hertz. Sympathetic capacitive effects begin to appear in the sensor's response at 800 hertz. Thus, at 400 hertz, there is an adequate inductive response from the magnetic sensor without capacitive interference.

The receiver electronics package contains 60-, 360- and 420-hertz notch filters, several amplifiers, 400-hertz band-pass filters and other components, and filters and amplifies electrical signal from the sensor. Amplification can be set at 1, 10, 100 and 1,000 times. The electronics package has a Q factor of 200 and an electronics noise level of 1 millivolt at an output of 1,000 times. The total sensitivity of the whole package is about 10^{-15} Tesla.

The sensor output is amplified as a voltage and the electronically amplified signal output is read directly from the instrument.

4.1.3 Electrode Setup and Return Circuit

An electrode consists of a ¼-inch diameter 2-foot long steel rod. A group of nine steel electrodes were placed into Electric Lake. The steel casing of the Skyline Mine James Canyon Reservoir was used as another electrode. The well is 1,030 feet deep with a diameter of 14 inches. **Figures 3a** through **3c** show the electrode locations used in the survey. The electrodes were connected to the impedance matching circuit using an antenna consisting of a single insulated 18 gauge copper wire with 600-volt plastic installation.

4.1.4 GPS

A GPS (Trimble Pathfinder) unit was used to determine the spatial location/coordinates (X, Y and Z) of each survey station. The location information is important for data analysis. It is very efficient and effective in the field using a GPS unit to determine the coordinates of each survey station.

4.2 Survey Stations and Lines

A total of 672 stations were surveyed for this project.

A survey line consists of a number of survey stations used for data collection along a line with a certain horizontal distance or interval. For this project, the horizontal distance between stations ranged from 50 feet to 100 feet along a survey line. Sixteen lines (Lines -0+50, 0+00, 0+50, 1+00, 1+30, 1+60, 2+00, 3+00, 3+50, 4+00, 4+50, 5+00, 5+50, A, B and C) were surveyed and are represented with orange lines in **Figures 3a** through **3c**.

4.3 Raw Data Gathering

4.3.1 General Description

After a 400-hertz frequency electric current was injected into the subsurface through the electrodes in Electric Lake and the James Canyon Well, a magnetic field was generated for the circuit. A magnetic receiver was used to measure the magnetic strength at each survey station from the ground surface. The receiver was moved around from one survey station to another on the ground surface. The data from the receiver was entered directly into a portable computer. On-site communication was conducted through portable two-way radios. All field data records were re-organized and are attached in **Appendix A**.

4.3.2 Spatial Positioning Survey

For each survey station, the Trimble Pathfinder GPS unit was used to determine the spatial coordinates (X-easting, Y-northing, and Z-elevation). The horizontal coordinate system (X-Y) is presented in **Figures 3a** through **3c**.

4.3.3 Base Station Survey

To record the temporal variations in magnetic field, Sunrise used a base station. The field personnel surveyed the base station at least twice a day during the field reconnaissance. This information is called drift data and used for data normalization. The location of the base station is shown in **Figures 3a** through **3c**.

4.3.4 Antenna Survey

The antenna wire location was also surveyed. The antenna wire itself also generates a magnetic field when it was energized. This magnetic field from the antenna wire can cause significant interference with the magnetic field emanating from the energized groundwater. Other physical conditions were also investigated to identify any potential sources of interference. During the survey, no other apparent sources of potential interference were noted.

5.0 DATA NORMALIZATION AND INTERPRETATION

The field data consists of the horizontal magnetic field data, the vertical magnetic field data, and survey station locations. Interference was removed from the field data to provide representative information that reflects the actual impact of the electricity injected into the subsurface.

5.1 Data Normalization

For this project, the effects of the antenna wire were removed from the raw data. The temporal variation (drift), measured by repeating base station readings, was also removed from the field data. As stated in Section 2.3, because the magnetic field is a three-dimensional vector, like the speed of an airplane flying in the air, the magnetic receiver used in the AquaTrack survey has been designed to measure the magnetic field in a horizontal plane (X-Y plane) and the vertical direction (Z-direction). In the horizontal plane, the receiver can detect the maximum and minimum magnetic values in two normal directions on the plane (not exactly the X- or Y-directions). The maximum horizontal magnetic component is the most important in the data analysis. Therefore, the data normalization is primarily conducted on the maximum horizontal magnetic component. Once the need arises to normalize other components, the normalization procedure is the same.

5.1.1 Correction of Interference from Antenna Wire

The Biot-Savart Law was used to remove the impact from the antenna wire. According to the Biot-Savart Law, the magnetic strength vector (magnitude and direction) from the antenna wire can be calculated for any survey station based on the coordinates (X-easting, Y-northing and Z-elevation), and the current and layout of the antenna wire. The reading at each survey station is corrected by vectorially deducting the magnetic strength from the antenna wire.

5.1.2 Correction of Drift Impact

The purpose of drift correction is to synchronize the field data. Because the temporal magnetic variation is primarily attributed to the relative locations of the sun, the earth and other planets in the universe and temperature changes in the survey area, a survey domain, compared to the universe, can be generally treated as a point in synchronizing the field data. Therefore, it is reasonable to assume that the drift pattern displayed by the readings at the base station is representative of the entire survey domain and repeats at other stations within the entire survey area.

Repeated readings of magnetic strengths (B), horizontal or vertical, collected at the base station can be presented as a function of time (t) as follows:

$$B = B(t) \tag{1}$$

The goal of drift removal is to synchronize the data to the first reading (Bo) at the base station. Thus, the synchronized data at the base station should be always equal to Bo. A function $R(t)$ between the reading at time t and the first reading at the base station can be expressed as:

$$R(t) = \frac{Bo}{B(t)} \tag{2}$$

The estimated ratio function $R(t)$ at the base station is applied to other survey stations within the surveyed domain. Thus, the readings $B(p,t)$ for the other survey stations can be synchronized using the following equation:

$$B_s(p,t) = R(t) * B(p,t) \tag{3}$$

Where the undefined $B_s(p,t)$ is the synchronized data for the reading $B(p,t)$ taken at station p at time t.

5.2 Data Interpretation

To facilitate the data analysis, the normalized data were plotted as contour maps or profiles. Generally, a relatively large value of maximum horizontal magnetic strength (measured in millivolt, or mV) in a profile indicates that a higher water content exists beneath the survey station.

5.2.1 Profiles

A profile is a mathematical presentation of the survey data obtained from each station along a survey line. The numbers along the bottom of a profile are in hundreds of feet (e.g., the distance between –5 and 5 would be 1,000 feet) and signal strength on the left side of the profile is in millivolt (mV).

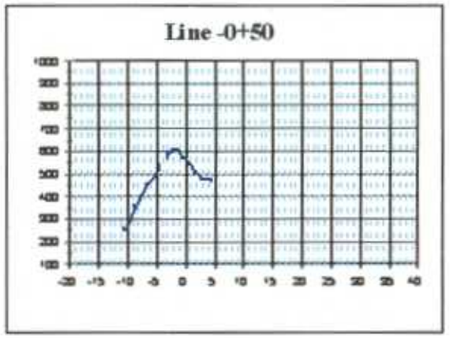
Figure 4 shows the profiles of normalized data for 14 of the 16 survey lines. Profiles for Lines A and B were not created because Line A is almost along the identified groundwater path and Line B has been presented by Lines 1+00, 1+30, 1+60 and 2+00. All the profiles run from west to east (left to right) and were created for an observer to look north. The horizontal axis represents the coordinates of easting, or X. A detailed explanation of four profiles (Lines -0+50, 0+00, 0+50 and 1+00) is given to demonstrate how the profiles are interpreted. It should be noted that the Skyline Mine James Canyon Well is located at a coordinate of (0, 0).

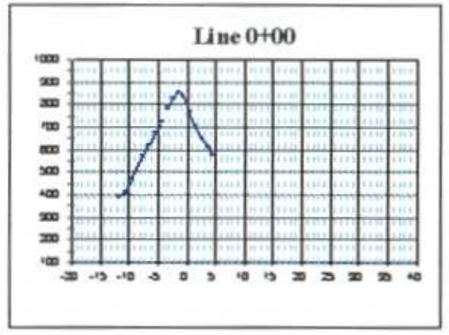
Profile Line -0+50: Profile Line -0+50 indicates that a distinct peak with a value of approximately 610 mV occurs at X = -100 feet, indicating a prominent groundwater channel exists in the vicinity and the center of the flow is at X = -100 feet.

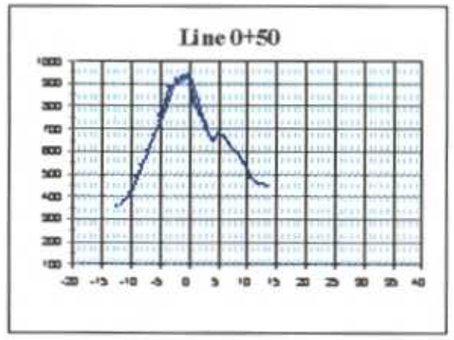
Profile Line 0+00: Profile Line 0+00 indicates that a distinct peak with a value of approximately 850 mV occurs between X = -150 feet, indicating a preferential groundwater channel exists in the vicinity and the center of the flow is at X = -150 feet.

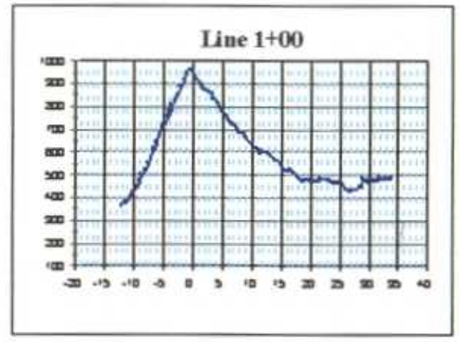
Profile Line 0+50: Profile Line 0+50 indicates that a strong flattop with a value of approximately 930 mV occurs between X = 0 and X = -100 feet, indicating a wide groundwater channel is present in the vicinity and the center of the channel is at X = -50 feet.

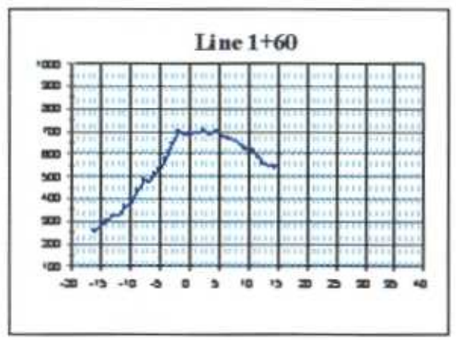
Profile Line 1+00: Profile Line 1+00 indicates that a strong peak with a value of approximately 970 mV occurs at X = -50 feet, indicating a prominent groundwater channel exists in the vicinity and the center of the channel is at X = -50 feet.

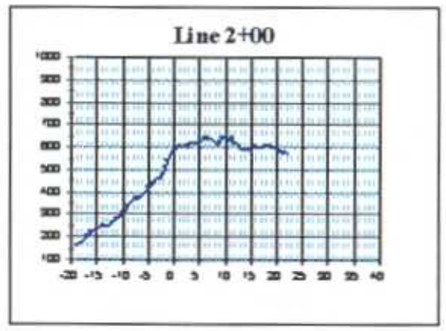


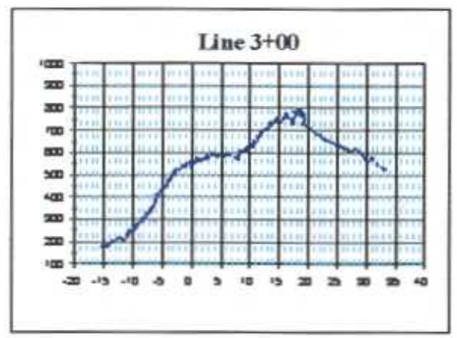


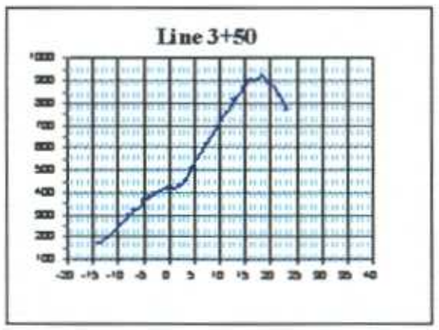


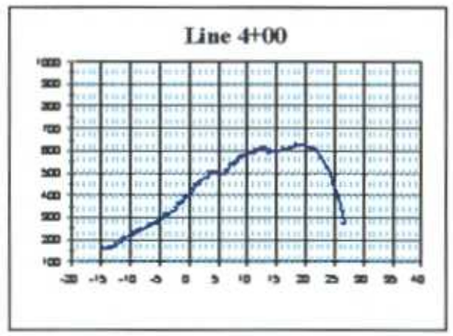


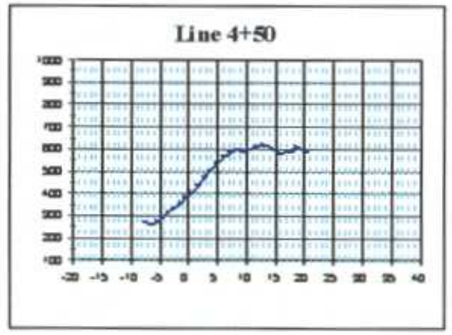


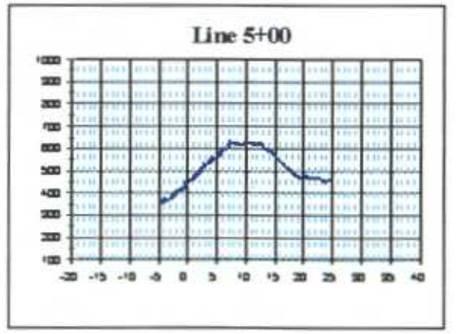


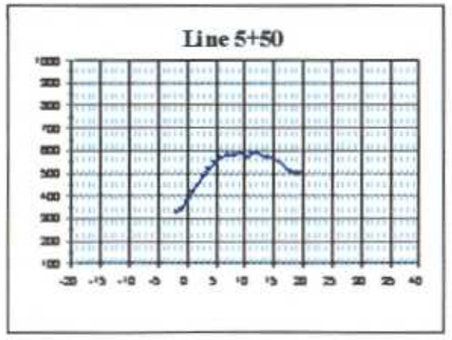












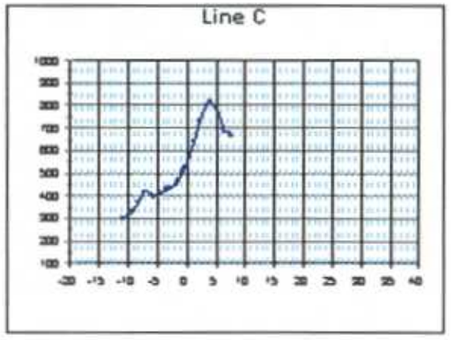


FIGURE 4. PROFILES

AquaTrack Survey at Electric Lake
Emery County, Utah

Sunrise Project No.: 00885	Generated by: Dr. Montgomery Edited by: Dao Yang	Date: September 20, 2002	SUNRISE ENGINEERING INC.

A detailed explanation of other profiles is not given here to avoid being repetitious. The findings from each of the 14 profiles are summarized in **Table 1**.

Table 1. Findings from Profiles

Survey Line #	Number of Stations	Description of Findings
-0+50	17	A groundwater channel is centered at X = -100 feet.
0+00	18	A groundwater channel is centered at X = -150 feet.
0+50	26	A wide groundwater channel is centered at X = -50 feet.
1+00	97	A groundwater channel is centered at X = -50 feet.
1+30	31	A groundwater channel is centered at X = 0 and a wide channel is centered at X = 350 feet. These two channels are likely connected.
1+60	31	An approximately 700-foot wide groundwater channel is centered at X = 150 feet.
2+00	77	An approximately 900-foot wide groundwater channel is centered at X = 250 feet.
3+00	86	A groundwater channel is centered at X = 1,650 and a wide channel is centered at X = 1,850 feet. These two channels are likely connected.
3+50	38	A groundwater channel is centered at X = 1,850 feet.
4+00	69	An approximately 1,000-foot wide groundwater channel is centered at X = 1,700 feet.
4+50	28	A groundwater channel is centered at X = 1,300 feet and a channel is centered at X = 1,850 feet.
5+00	54	An approximately 550-foot wide groundwater channel is centered at X = 1,030 feet.
5+50	23	An approximately 800-foot wide groundwater channel is centered at X = 1,000 feet.
C	25	A groundwater channel is centered at X = 400 feet.

5.2.2 Two-Dimensional Presentation

Figures 3a through **3c** show the contours (in mV) of the normalized maximum horizontal magnetic intensity and the prominent groundwater channel in the survey area. Areas with high maximum horizontal magnetic intensity are considered as the groundwater channel beneath the ground surface. A vertex-type curvature is an indication of the orientation for a water channel. On the other hand, a valley-type curvature indicates a dry zone. In **Figures 3a** through **3c**, the dashed red line represents a preferential groundwater pathway that connects the Skyline Mine James Canyon Well with Electric Lake.

5.0 CONCLUSIONS AND SUMMARY

Sunrise has completed an AquaTrack Survey for PacifiCorp at Electric Lake.

The findings of the investigation are summarized below:

- A hydrogeologic data review indicates that there is a regional bedrock aquifer in the study area. The Skyline Mine James Canyon Well penetrates into this regional aquifer.
- The AquaTrack geophysical survey investigation identified a preferential groundwater pathway connecting Electric Lake and the Skyline Mine James Canyon Well. This preferential pathway is likely along fault lines or fractured rock zones.
- Electric Lake recharges the regional aquifer through faults, joints and/or fractured bedrock. Under a hydrodynamic balance condition, the water loss from the reservoir through recharge may not be very significant.
- The AquaTrack data indicates that the subsurface mine has intercepted water from the regional aquifer by mining through the recharging pathways, i.e., faults, joints and/or fractured bedrock. Thus, an artificial subsurface drain has been "created" in the mine and broken the hydrodynamic balance of the aquifer system, causing significantly more water loss from the reservoir. The more the water is pumped from the mine, the higher the hydrodynamic force is derived, resulting in more water loss from the lake, until a new balance is reached.

6.0 GENERAL COMMENTS

This report was prepared for the exclusive use of PacifiCorp for specific application to this project and has been prepared in accordance with currently generally accepted principles and practices in the field of geophysics and hydrogeology. No warranties, expressed or implied, are intended or made. As additional information becomes available the interpretations and recommendations expressed in this report will be subject to revision.

7.0 REFERENCES

Montgomery, Bryce. 1993. Hydrogeologic Study for "Wellhead Protection Program," Drinking Water Source Protection Regulations R309-113, of Castle Valley Special Service District Water Sources.

U.S. Geologic Survey. 1979. USGS 7.5-Minute Series Topographic Quadrangle Map for Candland Mountain, Utah.

U.S. Geologic Survey. 1979. USGS 7.5-Minute Series Topographic Quadrangle Map for Scofield, Utah.

Witkind, I.J. 1995. Geologic Map of the Price 1° x 2° Quadrangle, Utah.

Appendix A

Field Data Records

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_ E__W__	MIN	MAX	VERT
1	1576657	14396052	8804	08/12/02	01:22:25pm	0-topo 0	electrode well		0	0	0
6	1575016	14391590	8508	08/12/02	06:00:19pm	0-topo 0	start of lake		0	0	0
7	1574871	14391630	8523	08/12/02	06:45:34pm	0-topo 0	disregard		0	0	0
8	1574674	14393040	8522	08/13/02	09:45:35am	0-topo 0	creek monitoring flume		0	0	0
9	1574692	14393058	8523	08/13/02	09:47:27am	0-topo 0	pump monitoring flume		0	0	0
12	1576276	14388245	8572	08/13/02	11:32:36am	0-topo 0	antenna junction		0	0	0
13	1576339	14388314	8545	08/13/02	11:35:12am	0-topo 0	antenna splits into 3 electrodes		0	0	0
14	1576372	14388436	8524	08/13/02	01:56:07pm	0-topo 0	1st electrode		0	0	0
15	1576349	14388327	8539	08/13/02	01:57:21pm	0-topo 0	2nd electrode		0	0	0
17	1576429	14388150	8533	08/13/02	02:01:21pm	0-topo 0	3rd electrode		0	0	0
18	1576527	14388034	8547	08/13/02	02:03:48pm	0-topo 0	4th electrode		0	0	0
19	1576564	14388003	8545	08/13/02	02:04:27pm	0-topo 0	5th electrode		0	0	0
20	1576671	14387870	8545	08/13/02	02:10:08pm	0-topo 0	6th electrode		0	0	0
21	1576702	14387826	8542	08/13/02	02:11:11pm	0-topo 0	7th electrode		0	0	0
22	1576753	14387767	8538	08/13/02	02:12:20pm	0-topo 0	8th electrode		0	0	0
23	1580085	14393444	9492	08/14/02	01:56:47pm	1-read 1		1 0	8	213	42
24	1580040	14393442	9472	08/14/02	01:59:23pm	1-read 1		1 .5	5	219	45
25	1579975	14393432	9425	08/14/02	02:02:18pm	1-read 1		1 1	4	231	46
26	1579943	14393446	9438	08/14/02	02:03:58pm	1-read 1		1 1.5	2	239	48
27	1579893	14393446	9425	08/14/02	02:08:11pm	1-read 1		1 2	2	255	49
28	1579846	14393443	9415	08/14/02	02:11:31pm	1-read 1		1 2.5	2	555	52
29	1579809	14393457	9391	08/14/02	02:16:57pm	1-read 1		1 3	4	550	53
30	1579768	14393447	9359	08/14/02	02:18:17pm	1-read 1		1 3.5	3	558	55
31	1579729	14393459	9344	08/14/02	02:20:05pm	1-read 1		1 4	2	572	57
32	1579681	14393448	9340	08/14/02	02:21:28pm	1-read 1		1 4.5	2	582	60
33	1579642	14393448	9328	08/14/02	02:24:09pm	1-read 1		1 5	3	580	61
34	1579609	14393451	9304	08/14/02	02:27:30pm	1-read 1		1 5.5	4	602	62
35	1579561	14393452	9292	08/14/02	02:30:40pm	1-read 1	JCR -1 41+00	1 6	3	615	56
36				08/14/02	02:47:36pm	1-read 1	JCR-1 41+00	1 6	3	579	65
37				08/14/02	02:50:52pm	1-read 1	40+50	1 6.5	3	565	68
38				08/14/02	02:55:49pm	1-read 1	40+00	1 7	4	574	65
39				08/14/02	02:57:22pm	1-read 1	39+50	1 7.5	5	583	65
40				08/14/02	02:59:15pm	1-read 1	39+00	1 8	5	588	64
41				08/14/02	03:02:58pm	1-read 1	38.5	1 8.5	4	596	64
42				08/14/02	03:08:25pm	1-read 1	38.00	1 9	5	617	67
43				08/14/02	03:10:11pm	1-read 1	37.50	1 9.5	5	653	71
44				08/14/02	03:12:41pm	1-read 1	37.00	1 10	6	670	75
45	1579131	14393504	9127	08/14/02	03:14:40pm	1-read 1	36.50	1 10.5	6	678	74
46	1579087	14393511	9117	08/14/02	03:19:05pm	1-read 1	36.00	1 11	6	685	78
47	1579030	14393519	9082	08/14/02	03:23:20pm	1-read 1		1 11.5	8	703	80
48	1579006	14393507	9073	08/14/02	03:26:19pm	1-read 1	35.00	1 12	9	721	81
49	1578962	14393520	9056	08/14/02	03:29:12pm	1-read 1		1 12.5	9	731	83
50	1578895	14393530	9053	08/14/02	03:42:09pm	1-read 1	34.00	1 13	9	750	86
51	1578849	14393531	9038	08/14/02	03:44:56pm	1-read 1	33.50 -- 10 feet off stream	1 13.5	10	762	91

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__		REPORT	N__S_	E__W__	MIN	MAX	VERT
52	1578800	14393541	9057	08/14/02	03:50:00pm	1-read	1	33.00	1	14	10	762	98
53	1578756	14393542	9070	08/14/02	03:52:38pm	1-read	1	32.50	1	14.5	8	766	103
54	1578705	14393546	9090	08/14/02	03:55:10pm	1-read	1	32.00	1	15	9	776	109
55	1578655	14393552	9088	08/14/02	03:57:09pm	1-read	1	31.5	1	15.5	3	786	116
56	1578605	14393553	9083	08/14/02	03:58:46pm	1-read	1	31.00	1	16	3	810	123
57	1578553	14393556	9086	08/14/02	04:00:32pm	1-read	1	30.5	1	16.5	6	811	130
58	1578501	14393557	9093	08/14/02	04:02:39pm	1-read	1	30.00	1	17	6	824	138
59	1578452	14393560	9100	08/14/02	04:04:43pm	1-read	1	29.5	1	17.5	10	850	142
60	1578400	14393563	9112	08/14/02	04:08:40pm	1-read	1	29.00	1	18	13	879	159
61	1578359	14393564	9114	08/14/02	04:10:53pm	1-read	1	28.5	1	18.5	15	913	166
62	1578308	14393565	9113	08/14/02	04:14:49pm	1-read	1	28.00	1	29	19	940	181
63	1578253	14393570	9117	08/14/02	04:16:24pm	1-read	1	27.5	1	19.5	21	940	190
64	1578203	14393577	9116	08/14/02	04:19:35pm	1-read	1	27	1	20	29	972	207
65	1578151	14393573	9106	08/14/02	04:21:30pm	1-read	1	28.5	1	20.5	29	1009	230
66	1578105	14393582	9107	08/14/02	04:23:18pm	1-read	1	26.00	1	21	33	1055	470
67	1578052	14393587	9098	08/14/02	04:27:56pm	1-read	1	25.5	1	21.5	38	1065	490
68	1578000	14393587	9087	08/14/02	04:29:33pm	1-read	1	25.00	1	22	41	1110	517
69	1577955	14393592	9074	08/14/02	04:31:17pm	1-read	1	24.5	1	22.5	46	1135	533
70	1577908	14393593	9064	08/14/02	04:33:10pm	1-read	1	24.00	1	23	50	1160	551
71	1577857	14393601	9055	08/14/02	04:36:51pm	1-read	1	23.50	1	23.5	51	1180	562
72	1577811	14393609	9041	08/14/02	04:38:29pm	1-read	1	23.00	1	24	53	1165	571
73	1577762	14393619	9038	08/14/02	04:42:34pm	1-read	1	22.50	1	24.5	59	1209	600
74	1577710	14393620	9017	08/14/02	04:44:15pm	1-read	1	22.00	1	25	61	1240	627
75	1577659	14393625	8998	08/14/02	04:46:34pm	1-read	1	21.50	1	25.5	63	1271	655
76	1577611	14393634	9017	08/14/02	04:48:24pm	1-read	1	21.00	1	26	65	1310	671
77	1577568	14393648	8999	08/14/02	04:50:36pm	1-read	1	20.5	1	26.5	70	1351	702
78	1577510	14393642	8998	08/14/02	04:53:39pm	1-read	1	20.00	1	27	71	1375	722
79	1577463	14393656	8960	08/14/02	05:00:01pm	1-read	1	19.5	1	27.5	73	1397	758
80	1577418	14393655	8946	08/14/02	05:02:31pm	1-read	1	19.00	1	28	75	1430	785
81	1577367	14393668	8932	08/14/02	05:04:41pm	1-read	1	18.5	1	28.5	79	1466	820
82	1577317	14393674	8926	08/14/02	05:05:56pm	1-read	1	18.00	1	29	82	1487	850
83	1577270	14393676	8906	08/14/02	05:08:49pm	1-read	1	17.5	1	29.5	85	1522	865
84	1577222	14393685	8897	08/14/02	05:10:48pm	1-read	1	17.00	1	30	87	1550	921
85	1577175	14393690	8884	08/14/02	05:14:13pm	1-read	1	16.50	1	30.5	86	1588	954
86	1577127	14393699	8867	08/14/02	05:17:47pm	1-read	1	16	1	31	89	1630	994
87	1577076	14393701	8847	08/14/02	05:19:45pm	1-read	1	15.50	1	31.5	90	1661	1035
88	1577030	14393710	8842	08/14/02	05:24:45pm	1-read	1	15.00	1	32	86	1700	1089
89	1576990	14393717	8817	08/14/02	05:26:17pm	1-read	1	14.5	1	32.5	86	1738	1135
90	1576937	14393722	8814	08/14/02	05:28:31pm	1-read	1	14.5	1	33	85	1749	1160
91	1576888	14393727	8804	08/14/02	05:31:35pm	1-read	1	14	1	33.5	78	1762	1175
92	1576840	14393740	8767	08/14/02	05:34:10pm	1-read	1	13.5	1	34	77	1761	1203
93	1576793	14393742	8758	08/14/02	05:35:57pm	1-read	1	13	1	34.5	70	1795	1241
94	1576746	14393749	8752	08/14/02	05:37:39pm	1-read	1	12.50	1	35	69	1840	1295
95	1576697	14393754	8741	08/14/02	05:39:32pm	1-read	1	12.00	1	35.50	64	1873	1321

ID	EASTING	NORTHING	ELEVA	DATE	TIME	TYPE		REPORT	N	S	E	W	MIN	MAX	VERT
96	1576648	14393759	8725	08/14/02	05:42:04pm	1-read	1	11.5	1		36		56	1908	1371
97	1576603	14393767	8713	08/14/02	05:44:14pm	1-read	1	11	1		36.5		51	1951	1415
98	1576554	14393769	8695	08/14/02	05:46:34pm	1-read	1	10.00	1		37		41	1993	1449
99	1576502	14393771	8689	08/14/02	05:48:34pm	1-read	1	9.5	1		37.5		27	2032	1491
100	1576455	14393780	8667	08/14/02	05:51:21pm	1-read	1	9	1		38		15	2052	1538
101	1576397	14393787	8660	08/14/02	05:55:15pm	1-read	1	8.5	1		38.5		4	2091	1593
102	1576357	14393792	8655	08/14/02	05:59:07pm	1-read	1	8.00	1		39		21	2124	1635
103	1576306	14393799	8635	08/14/02	06:02:01pm	1-read	1	7.50	1		39.5		43	2160	1680
104	1576259	14393801	8634	08/14/02	06:05:19pm	1-read	1	7.00	1		40		66	2200	1724
105	1576207	14393808	8623	08/14/02	06:08:41pm	1-read	1	6.5	1		40.5		95	2232	1785
106	1581202	14395445	9877	08/14/02	06:49:32pm	3-base	3		base a				41	85	15
107	1580085	14393442	9494	08/14/02	07:11:50pm	2-repeat	2		1		0		4	186	40
108	1581201	14395453	9869	08/15/02	11:43:03am	3-base	3	hill top base					6	104	520
109	1580082	14393445	9491	08/15/02	12:04:51pm	2-repeat	2		1		0		5	672	49
110	1578918	14392720	9121	08/15/02	12:23:21pm	1-read	1	34-00	2		0		5	878	92
111				08/15/02	01:00:22pm	2-repeat	2	34-00	2		0		4	888	91
112				08/15/02	01:02:48pm	1-read	1	33-50	0		.5		5	905	94
113				08/15/02	01:06:04pm	1-read	1	33-00	2		1		6	926	99
114				08/15/02	01:08:32pm	1-read	1	32-50	2		1.5		7	941	97
115	1578745	14392755	9073	08/15/02	01:12:33pm	1-read	1	32-00	2		2		9	968	108
116	1578688	14392732	9014	08/15/02	01:14:25pm	1-read	1	31-50	2		2.5		9	1002	113
117	1578648	14392742	9020	08/15/02	01:17:51pm	1-read	1	31-00	2		3		10	1020	120
118	1578590	14392745	8997	08/15/02	01:21:15pm	1-read	1	30-50	2		3.5		12	1042	131
119	1578540	14392760	8990	08/15/02	01:24:40pm	1-read	1	30-00	2		4		12	1075	145
120	1578499	14392772	8974	08/15/02	01:29:03pm	1-read	1	29-50	2		4.5		14	1089	565
121	1578449	14392782	8957	08/15/02	01:31:04pm	1-read	1	29-00	2		5		16	1105	180
122	1578403	14392788	8944	08/15/02	01:35:08pm	1-read	1	28-50	2		5.5		17	1114	210
123	1578352	14392791	8931	08/15/02	01:37:41pm	1-read	1	28-00	2		6		20	1131	565
124	1578305	14392797	8921	08/15/02	01:40:39pm	1-read	1	27-50	2		6.5		20	1145	567
125	1578253	14392806	8911	08/15/02	01:43:24pm	1-read	1	27-00	2		7		24	1168	581
126	1578198	14392812	8898	08/15/02	01:46:37pm	1-read	1	26-50	2		7.5		25	1190	581
127	1578153	14392816	8882	08/15/02	01:49:18pm	1-read	1	26-00	2		8		30	1164	545
128	1578097	14392823	8877	08/15/02	01:53:23pm	1-read	1	25-50	2		8.5		31	1189	555
129	1578053	14392825	8869	08/15/02	01:57:41pm	1-read	1	25-00	2		9		31	1203	550
130	1578010	14392821	8860	08/15/02	01:59:41pm	1-read	1	24-50	2		9.5		30	1220	565
131	1577945	14392824	8852	08/15/02	02:02:46pm	1-read	1	24-00	2		10		33	1250	597
132	1577906	14392825	8848	08/15/02	02:05:27pm	1-read	1	23.50	2		10.5		34	1305	635
133	1577849	14392819	8832	08/15/02	02:09:26pm	1-read	1	23	2		11		34	1343	672
134	1577802	14392826	8839	08/15/02	02:14:45pm	1-read	1	22-50	2		11.5		41	1405	698
135	1577747	14392822	8834	08/15/02	02:18:16pm	1-read	1	22-00	2		12		44	1423	704
136	1577699	14392811	8831	08/15/02	02:22:55pm	1-read	1	21-50	2		12.5		45	1426	710
137	1577644	14392815	8809	08/15/02	02:41:01pm	1-read	1	21-00	2		13		51	1490	769
138	1577594	14392821	8808	08/15/02	02:43:15pm	1-read	1	20-50	2		13.5		54	1499	780
139	1577551	14392817	8806	08/15/02	02:49:59pm	1-read	1	20-00	2		14		56	1475	801

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__		REPORT	N__S_	E__W__	MIN	MAX	VERT
140	1577497	14392826	8809	08/15/02	02:54:12pm	1-read	1	19-50	2	14.5	63	1472	817
141	1577447	14392820	8826	08/15/02	02:57:03pm	1-read	1	19-00	2	15	64	1550	870
142	1577398	14392825	8828	08/15/02	03:00:28pm	1-read	1	18-50	2	15.50	65	1590	910
143	1577347	14392826	8825	08/15/02	03:02:07pm	1-read	1	18-00	2	16	65	1620	955
144	1577296	14392844	8821	08/15/02	03:03:57pm	1-read	1	17.50	2	16.5	70	1655	980
145	1577244	14392838	8828	08/15/02	03:06:40pm	1-read	1	17-00	2	17	71	1680	1001
146	1577195	14392847	8829	08/15/02	03:08:56pm	1-read	1	16-50	2	17.5	70	1680	1004
147	1577144	14392848	8832	08/15/02	03:11:29pm	1-read	1	16-00	2	18	67	1683	1015
148	1577092	14392849	8834	08/15/02	03:13:29pm	1-read	1	15-50	2	18.5	66	1716	1072
149	1577042	14392854	8843	08/15/02	03:15:33pm	1-read	1	15-00	2	19	67	1755	1112
150	1576986	14392854	8847	08/15/02	03:18:01pm	1-read	1	14-50	2	19.5	65	1800	1160
151	1576936	14392865	8851	08/15/02	03:20:34pm	1-read	1	14-00	2	20	58	1780	1145
152	1576889	14392869	8872	08/15/02	03:26:58pm	1-read	1	13-00	2	20.5	50	1840	1215
153	1576838	14392870	8885	08/15/02	03:28:21pm	1-read	1	13-00	2	21	42	1875	1272
154	1576790	14392865	8888	08/15/02	03:31:13pm	1-read	1	12-50	2	21.5	39	1934	1332
155	1576744	14392869	8898	08/15/02	03:34:04pm	1-read	1	12-00	2	22	25	1952	1383
156	1576698	14392870	8889	08/15/02	03:36:52pm	1-read	1	11-50	2	22.5	18	1965	1397
157	1576643	14392864	8903	08/15/02	03:38:50pm	1-read	1	11	2	23	10	2020	1435
158	1576589	14392874	8890	08/15/02	03:41:31pm	1-read	1	10-50	2	23.5	7	2060	1510
159	1576534	14392875	8885	08/15/02	03:44:25pm	1-read	1	10-00	2	24	6	2080	1529
160	1576492	14392885	8879	08/15/02	03:50:22pm	1-read	1	9-50	2	24.5	17	2040	1549
161	1576441	14392884	8872	08/15/02	03:52:27pm	1-read	1	9-00	2	25	24	2000	1545
162	1576395	14392901	8860	08/15/02	03:56:58pm	1-read	1	8-50	2	25.5	27	2010	1570
163	1576346	14392914	8847	08/15/02	03:59:57pm	1-read	1	8-00	2	26	40	2070	1670
164	1576289	14392915	8834	08/15/02	04:03:31pm	1-read	1	7.5	2	26.5	49	2100	1760
165	1576249	14392927	8823	08/15/02	04:05:26pm	1-read	1	7	2	27	60	2140	1845
166	1576199	14392929	8810	08/15/02	04:08:53pm	1-read	1	6-50	2	27.5	83	2199	1945
167	1576154	14392935	8799	08/15/02	04:11:32pm	1-read	1	6-00	2	28	80	2236	2004
168	1576108	14392944	8782	08/15/02	04:17:06pm	1-read	1	5-50	2	28.5	97	2245	2050
169	1576060	14392951	8771	08/15/02	04:20:01pm	1-read	1	5-00	2	29	102	2255	2102
170	1576007	14392958	8754	08/15/02	04:23:32pm	1-read	1	4-50	2	29.5	300	2285	2188
171	1575961	14392966	8745	08/15/02	04:28:51pm	1-read	1	4	2	30	120	2352	2252
172	1575911	14392971	8726	08/15/02	04:33:07pm	1-read	1	3-50	2	30.5	130	2450	2397
173	1575865	14392979	8715	08/15/02	04:34:37pm	1-read	1	3-00	2	31	140	2520	2522
174	1575815	14392985	8698	08/15/02	04:37:58pm	1-read	1	2-50	2	31.5	163	2593	2653
175	1575762	14392991	8694	08/15/02	04:40:45pm	1-read	1	2-00	2	32	200	2580	2160
176	1575716	14393001	8686	08/15/02	04:46:24pm	1-read	1	1-50	2	32.5	300	2510	2850
177	1575669	14393012	8665	08/15/02	04:50:05pm	1-read	1	1-00	2	33	400	2544	2905
178	1575622	14393020	8657	08/15/02	04:53:05pm	1-read	1	0-50	2	33.2	400	2575	3016
179	1575573	14393030	8644	08/15/02	04:55:58pm	1-read	1	0-00	2	34	400	2636	3135
180	1575524	14393037	8632	08/15/02	04:58:06pm	1-read	1		2	34.5	400	2702	3290
181	1575470	14393048	8619	08/15/02	05:01:08pm	1-read	1		2	35	500	2740	3360
182	1575370	14393065	8597	08/15/02	05:03:09pm	1-read	1		2	36	525	2861	3700
183	1575281	14393086	8564	08/15/02	05:05:38pm	1-read	1		2	37	641	3078	3760

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_ E__W__	MIN	MAX	VERT
184	1575176	14393110	8561	08/15/02	05:08:08pm	1-read 1		2 38	631	3300	3770
185	1575068	14393139	8579	08/15/02	05:10:40pm	1-read 1		2 39	681	3450	3800
186	1574972	14393141	8575	08/15/02	05:12:31pm	1-read 1		2 40	676	3565	3830
187	1574878	14393149	8570	08/15/02	05:14:42pm	1-read 1		2 41	748	3740	3840
188	1574775	14393191	8557	08/15/02	05:17:12pm	1-read 1		2 42	802	3750	3850
189	1581200	14395438	9875	08/15/02	06:13:34pm	3-base 3			12	107	670
190	1581202	14395447	9883	08/16/02	11:49:52am	3-base 3			5	98	485
191	1577136	14396307	8841	08/16/02	12:39:41pm	1-read 1		a 0	925	3760	931
192	1577109	14396222	8848	08/16/02	12:48:26pm	1-read 1		a 2	865	3780	843
193	1577071	14396120	8866	08/16/02	12:51:19pm	1-read 1		a 3	695	3810	503
194	1576965	14396028	8838	08/16/02	12:55:31pm	1-read 1		a 4	67	3850	1463
195	1576935	14395952	8832	08/16/02	12:59:19pm	1-read 1		a 5	635	3860	2735
196	1576913	14395846	8837	08/16/02	01:03:39pm	1-read 1		a 6	1080	3850	2980
197	1576879	14395759	8823	08/16/02	01:06:45pm	1-read 1		a 7	1418	3840	3530
198	1576852	14395651	8830	08/16/02	01:12:44pm	1-read 1		a 8	1540	3830	3520
199	1576810	14395486	8814	08/16/02	01:16:40pm	1-read 1		a 9	1600	3800	3440
200	1576774	14395156	8805	08/16/02	01:22:06pm	1-read 1		a 10	1338	3530	2496
201	1576735	14395058	8815	08/16/02	01:26:29pm	1-read 1		a 11	1260	3280	2351
202	1576687	14394776	8765	08/16/02	02:00:00pm	1-read 1		a 12	908	2655	1812
203	1576677	14394692	8760	08/16/02	02:02:51pm	1-read 1	cross seep here	a 13	840	2551	1776
204	1576668	14394591	8760	08/16/02	02:05:26pm	1-read 1		a 14	770	2434	1720
205	1576658	14394487	8764	08/16/02	02:08:32pm	1-read 1		a 15	705	2315	1800
206	1576661	14394394	8763	08/16/02	02:11:20pm	1-read 1		a 16	610	2240	1650
207	1576657	14394294	8761	08/16/02	02:14:02pm	1-read 1		a 17	570	2162	1710
208	1576657	14394193	8754	08/16/02	02:17:24pm	1-read 1		a 18	500	2112	1670
209	1576654	14394090	8753	08/16/02	02:21:57pm	1-read 1		a 19	210	2070	1640
210	1576655	14393998	8753	08/16/02	02:24:57pm	1-read 1		a 20	140	2036	1610
211	1576651	14393898	8744	08/16/02	02:27:14pm	1-read 1		a 21	107	2018	1575
212	1576649	14393801	8733	08/16/02	02:29:57pm	1-read 1		a 22	80	2010	1550
213	1576647	14393760	8725	08/16/02	02:31:21pm	2-repeat 2		1 11+00	53	2010	1445
214	1576653	14394297	8778	08/16/02	02:40:53pm	2-repeat 2	a17	.5 3	610	2130	1590
215	1576755	14394294	8817	08/16/02	02:43:38pm	1-read 1		.5 2	620	2100	1515
216	1576847	14394315	8858	08/16/02	02:47:03pm	1-read 1		.5 1	640	2080	1475
217	1576958	14394321	8897	08/16/02	02:51:39pm	1-read 1		.5 0	650	2021	1413
218	1576652	14394290	8779	08/16/02	02:55:36pm	2-repeat 2	a17	.5 3	60	2229	1665
219	1576551	14394296	8736	08/16/02	03:00:05pm	1-read 1		.5 4	620	2285	1718
220	1576457	14394315	8705	08/16/02	03:04:39pm	1-read 1	marsh grass	.5 5	645	2370	1758
221	1576360	14394319	8676	08/16/02	03:07:11pm	1-read 1		.5 6	590	2380	1885
222	1576305	14394328	8658	08/16/02	03:09:14pm	1-read 1	james canyon bottom flat	.5 6.5	570	2370	1925
223	1576257	14394319	8663	08/16/02	03:11:58pm	1-read 1		.5 7	565	2420	2055
224	1576152	14394317	8721	08/16/02	03:19:06pm	1-read 1		.5 8	180	2478	2055
225	1576058	14394312	8762	08/16/02	03:22:16pm	1-read 1		.5 9	140	2510	2310
226	1575949	14394315	8794	08/16/02	03:27:09pm	1-read 1		.5 10	75	2500	2485
227	1575840	14394308	8838	08/16/02	03:30:25pm	1-read 1		.5 11	20	2475	2634

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_ E__W__	MIN	MAX	VERT
228	1575751	14394316	8883	08/16/02	03:33:17pm	1-read 1		.5 12	99	2465	2660
229	1575646	14394320	8924	08/16/02	03:36:07pm	1-read 1		.5 13	132	2441	3001
230	1575532	14394318	8932	08/16/02	03:39:02pm	1-read 1		.5 14	460	2452	3233
231	1575446	14394315	8916	08/16/02	03:44:06pm	1-read 1		.5 15	610	2492	3420
232	1575465	14393860	8797	08/16/02	04:01:04pm	1-read 1		1 48	790	2525	3190
233	1575518	14393861	8793	08/16/02	04:02:52pm	1-read 1		1 47.5	760	2495	3075
234	1575560	14393855	8780	08/16/02	04:04:51pm	1-read 1	0-00	1 47	790	2475	2805
235	1575620	14393860	8773	08/16/02	04:09:09pm	1-read 1	0-50	1 46.5	760	2430	2665
236	1575667	14393854	8749	08/16/02	04:11:26pm	1-read 1	1-00	1 46	712	2405	2570
237	1575714	14393849	8736	08/16/02	04:13:50pm	1-read 1	1-50	1 45.5	660	2365	2460
238	1575764	14393849	8728	08/16/02	04:15:48pm	1-read 1	2-00	1 45	630	2350	2380
239	1575813	14393842	8717	08/16/02	04:17:32pm	1-read 1	2-50	1 44.5	580	2335	2289
240	1575863	14393839	8706	08/16/02	04:19:34pm	1-read 1	3-00	1 44	550	2305	2195
241	1575916	14393834	8686	08/16/02	04:21:42pm	1-read 1	3-50	1 43.5	500	2325	2151
242	1575959	14393832	8673	08/16/02	04:23:50pm	1-read 1	4-00	1 43	500	2320	2090
243	1576007	14393825	8658	08/16/02	04:25:50pm	1-read 1	4-50	1 42.5	450	2360	2047
244	1576054	14393822	8650	08/16/02	04:27:38pm	1-read 1	5-00	1 42	460	2355	1995
245	1576103	14393814	8632	08/16/02	04:30:12pm	1-read 1	5-50	1 41.5	460	2370	1927
246	1576157	14393817	8617	08/16/02	04:32:09pm	1-read 1	6-00	1 41	160	2341	1870
247	1576206	14393804	8626	08/16/02	04:34:06pm	2-repeat 2	6-50	1 40.5	117	2283	1803
248	1576258	14393795	8628	08/16/02	04:36:14pm	2-repeat 2	7-00	1 40	85	2262	1776
249	1576301	14393796	8635	08/16/02	04:38:11pm	2-repeat 2	7-00	1 39.5	60	2241	1731
250	1581204	14395445	9872	08/16/02	05:20:05pm	3-base 3			6	107	520

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_ E__W__	MIN	MAX	VERT
1	1581200	14395441	9871	08/19/02	11:55:20am	3-base 3			3	50	8
2	1579990	14391837	9501	08/19/02	12:25:10pm	1-read 1		3 0	2	120	18
3	1579885	14391834	9495	08/19/02	12:28:08pm	1-read 1		3 1	2	128	20
4	1579839	14391820	9485	08/19/02	12:30:10pm	1-read 1		3 2	0	0	0
5	1579789	14391819	9483	08/19/02	12:33:13pm	1-read 1		3 3	3	139	21
6	1579683	14391841	9431	08/19/02	12:40:04pm	1-read 1		3 4	3	141	23
7	1579594	14391887	9400	08/19/02	12:43:33pm	1-read 1		3 5	2	153	26
8	1579486	14391844	9369	08/19/02	12:46:28pm	1-read 1		3 6	3	165	30
9	1579385	14391839	9337	08/19/02	12:50:20pm	1-read 1		3 7	2	171	30
10	1579287	14391832	9303	08/19/02	12:54:03pm	1-read 1		3 8	2	181	33
11	1579191	14391839	9271	08/19/02	12:56:54pm	1-read 1		3 9	2	194	35
12	1579086	14391844	9243	08/19/02	12:59:59pm	1-read 1		3 10	2	209	39
13	1578988	14391840	9189	08/19/02	01:02:48pm	1-read 1		3 11	3	224	44
14	1578883	14391844	9186	08/19/02	01:06:50pm	1-read 1		3 12	3	370	49
15	1578780	14391841	9152	08/19/02	01:09:55pm	1-read 1		3 13	4	390	54
16	1578681	14391851	9112	08/19/02	01:12:01pm	1-read 1		3 14	2	402	61
17	1578600	14391857	9097	08/19/02	01:14:31pm	1-read 1	31-00	3 15	4	410	65
18	1578594	14391857	9095	08/19/02	01:45:52pm	2-repeat 2		3 15	3	340	67
19	1578539	14391865	9089	08/19/02	01:49:24pm	1-read 1	30-50	3 15.5	3	350	71

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __		REPORT	N__S_	E__W__	MIN	MAX	VERT
20	1578500	14391865	9087	08/19/02	01:51:32pm	1-read	1	30-00	3	16	2	370	76
21	1578446	14391874	9089	08/19/02	01:54:25pm	1-read	1	29-50	3	16.5	2	380	81
22	1578397	14391884	9105	08/19/02	01:56:28pm	1-read	1	29-50 - excess noise MAX	3	17	2	365	87
23	1578347	14391877	9125	08/19/02	01:59:22pm	1-read	1	29-00 -excess noise max	3	17.5	4	390	91
24	1578306	14391888	9133	08/19/02	02:01:02pm	1-read	1	28-50	3	18	4	412	96
25	1578253	14391897	9140	08/19/02	02:02:29pm	1-read	1	27-50	3	18.5	4	417	100
26	1578203	14391897	9141	08/19/02	02:04:02pm	1-read	1	27	3	19	3	425	106
27	1578148	14391895	9143	08/19/02	02:05:31pm	1-read	1	26-5	3	19.5	3	444	114
28	1578101	14391912	9141	08/19/02	02:07:37pm	1-read	1	26-00	3	20	3	454	122
29	1578052	14391912	9136	08/19/02	02:09:14pm	1-read	1	25-50	3	20.5	4	465	128
30	1578010	14391923	9132	08/19/02	02:11:25pm	1-read	1	25-00	3	21	4	475	131
31	1577954	14391913	9113	08/19/02	02:14:06pm	1-read	1	24-50	3	21.5	3	442	141
32	1577910	14391922	9113	08/19/02	02:16:40pm	1-read	1	24-00	3	22	3	492	148
33	1577862	14391930	9098	08/19/02	02:19:15pm	1-read	1	23-5	3	22.5	4	499	156
34	1577812	14391936	9088	08/19/02	02:21:20pm	1-read	1	23-00	3	23	3	508	155
35	1577764	14391936	9079	08/19/02	02:23:02pm	1-read	2	22-50	3	23.5	4	506	171
36	1577709	14391942	9065	08/19/02	02:24:45pm	1-read	1	22-00	3	24	4	512	180
37	1577662	14391945	9054	08/19/02	02:26:21pm	1-read	1	21-50	3	24.5	3	518	192
38	1577609	14391953	9045	08/19/02	02:28:25pm	1-read	1	21-00	3	25	3	524	203
39	1577563	14391958	9040	08/19/02	02:31:00pm	1-read	1	20-50	3	25.5	2	535	215
40	1577511	14391967	9036	08/19/02	02:34:59pm	1-read	1	20	3	26	5	550	340
41	1577464	14391971	9035	08/19/02	02:37:10pm	1-read	1	19-50	3	26.5	2	531	330
42	1577416	14391992	9050	08/19/02	02:52:15pm	1-read	1	19-00	3	27	4	548	350
43	1577361	14391997	9058	08/19/02	02:54:40pm	1-read	1	18-50	3	27.5	4	174	360
44	1577314	14392002	9068	08/19/02	02:58:08pm	1-read	1	18-00	3	28	8	589	350
45	1577269	14392011	9069	08/19/02	03:01:04pm	1-read	1	17-50	3	28.5	7	605	350
46	1577212	14392013	9083	08/19/02	03:03:13pm	1-read	1	17	3	29	8	615	370
47	1577164	14392034	9085	08/19/02	03:04:54pm	1-read	1	16-50	3	29.5	10	630	413
48	1577114	14392030	9090	08/19/02	03:08:20pm	1-read	1	16-00	3	30	13	645	435
49	1577064	14392046	9130	08/19/02	03:12:38pm	1-read	1	15-50	3	30.5	12	665	455
50	1577021	14392063	9124	08/19/02	03:14:57pm	1-read	1	15-00	3	31	15	690	481
51	1576973	14392040	9155	08/19/02	03:19:36pm	1-read	1	14-50	3	31.5	15	691	503
52	1576925	14392053	9168	08/19/02	03:23:00pm	1-read	1	14-00	3	32	20	696	523
53	1576874	14392054	9170	08/19/02	03:26:21pm	1-read	1	13-50	3	32.5	23	712	551
54	1576824	14392059	9178	08/19/02	03:28:39pm	1-read	1	13-00	3	33	26	728	579
55	1576774	14392052	9167	08/19/02	03:31:56pm	1-read	1	12-50	3	33.5	30	751	602
56	1576723	14392038	9167	08/19/02	03:36:44pm	1-read	1	12-00	3	34	1	0	0
57	1576725	14392036	9176	08/19/02	04:17:38pm	1-read	1	12-00	3	34.0	34	780	651
58	1576657	14392038	9151	08/19/02	04:19:36pm	1-read	1	11-50	3	34.5	35	787	685
59	1581206	14395440	9863	08/19/02	06:13:46pm	3-base	3				3	51	8
60	1581203	14395446	9868	08/20/02	12:24:43pm	3-base	3	base tie			3	47	7
61	1580084	14393440	9490	08/20/02	12:39:11pm	2-repeat	2	base tie	1	0	4	105	22
62	1581203	14395446	9869	08/20/02	12:51:27pm	3-base	3	base tie			4	45	6
63	1580083	14393442	9490	08/20/02	01:05:05pm	2-repeat	2	base tie	1	0	3	107	23

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_	E__W__	MIN	MAX	VERT
64	1578968	14391017	9364	08/20/02	01:37:55pm	1-read 1		2.5	0	15	238	59
65	1578858	14391026	9358	08/20/02	01:44:06pm	1-read 1		2.5	1	22	425	70
66	1578711	14391046	9354	08/20/02	01:47:18pm	1-read 1		2.5	2	25	457	85
67	1578618	14391081	9360	08/20/02	01:52:24pm	1-read 1		2.5	3	28	475	94
68	1578522	14391138	9337	08/20/02	01:57:18pm	1-read 1		2.5	4	31	500	110
69	1578419	14391189	9337	08/20/02	02:00:55pm	1-read 1		2.5	5	31	513	120
70	1578321	14391245	9314	08/20/02	02:03:38pm	1-read 1		2.5	6	31	529	129
71	1578245	14391326	9314	08/20/02	02:06:24pm	1-read 1		2.5	7	33	546	136
72	1578141	14391361	9302	08/20/02	02:10:17pm	1-read 1		2.5	8	35	562	150
73	1578052	14391302	9290	08/20/02	02:13:49pm	1-read 1		2.5	9	40	582	171
74	1577942	14391292	9280	08/20/02	02:16:24pm	1-read 1		2.5	10	46	606	198
75	1577814	14391281	9278	08/20/02	02:19:19pm	1-read 1		2.5	11	48	620	232
76	1577705	14391254	9284	08/20/02	02:21:54pm	1-read 1		2.5	12	55	647	439
77	1577619	14391208	9295	08/20/02	02:26:27pm	1-read 1		2.5	13	58	651	467
78	1577510	14391193	9309	08/20/02	02:30:05pm	1-read 1		2.5	14	64	667	500
79	1577412	14391172	9320	08/20/02	02:33:12pm	1-read 1		2.5	15	69	681	535
80	1577309	14391185	9317	08/20/02	02:35:53pm	1-read 1		2.5	16	70	691	559
81	1577224	14391210	9328	08/20/02	02:39:37pm	1-read 1		2.5	17	66	695	567
82	1577130	14391278	9316	08/20/02	02:45:30pm	1-read 1		2.5	18	63	701	581
83	1577024	14391289	9291	08/20/02	02:49:52pm	1-read 1		2.5	19	71	723	626
84	1576992	14391389	9285	08/20/02	02:56:28pm	1-read 1		2.5	20	57	714	620
85	1576880	14391496	9258	08/20/02	03:02:18pm	1-read 1		2.5	21	51	717	627
86	1576769	14391510	9204	08/20/02	03:06:30pm	1-read 1		2.5	22	54	762	719
87	1576680	14391508	9163	08/20/02	03:09:08pm	1-read 1		2.5	23	56	825	796
88	1576586	14391495	9110	08/20/02	03:12:33pm	1-read 1		2.5	24	61	894	909
89	1576488	14391515	9062	08/20/02	03:15:50pm	1-read 1		2.5	25	66	960	1002
90	1576386	14391509	9010	08/20/02	03:19:18pm	1-read 1		2.5	26	70	1011	1105
91	1576286	14391506	8960	08/20/02	03:23:46pm	1-read 1		2.5	27	67	1069	1214
92	1576187	14391506	8917	08/20/02	03:27:18pm	1-read 1		2.5	28	70	1112	1324
93	1576083	14391503	8870	08/20/02	03:30:56pm	1-read 1		2.5	29	69	1151	1439
94	1575985	14391501	8831	08/20/02	03:33:50pm	1-read 1		2.5	30	60	1187	1559
95	1575884	14391503	8793	08/20/02	03:37:25pm	1-read 1	-	2.5	31	56	1229	1685
96	1575784	14391502	8752	08/20/02	03:41:19pm	1-read 1		2.5	32	50	1246	1746
97	1575683	14391506	8714	08/20/02	03:44:21pm	1-read 1		2.5	33	51	1306	1880
98	1575580	14391508	8677	08/20/02	03:49:11pm	1-read 1		2.5	34	31	1320	2004
99	1575482	14391506	8647	08/20/02	03:52:54pm	1-read 1		2.5	35	25	1345	2175
100	1575379	14391509	8613	08/20/02	03:57:15pm	1-read 1		2.5	36	19	1393	2483
101	1575280	14391509	8576	08/20/02	04:00:21pm	1-read 1		2.5	39	23	1514	2865
102	1575157	14392000	8568	08/20/02	04:28:52pm	1-read 1		3	50	39	1485	2755
103	1575274	14392005	8616	08/20/02	04:33:00pm	1-read 1		3	49	45	1340	2353
104	1575349	14392008	8643	08/20/02	04:34:27pm	1-read 1		3	48	48	1293	2173
105	1575425	14392015	8662	08/20/02	04:37:26pm	1-read 1		3	47	47	1301	2053
106	1575528	14392028	8697	08/20/02	04:46:52pm	1-read 1		3	47.25	47	1083	1616
107	1575588	14392029	8707	08/20/02	04:49:47pm	1-read 1	0-00	3	46.5	46	1110	1572

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__		REPORT	N__S_	E__W__	MIN	MAX	VERT
108	1575634	14392035	8723	08/20/02	04:52:03pm	1-read	1	0-50	3	45	50	1134	1552
109	1575682	14392034	8744	08/20/02	04:54:42pm	1-read	1	1-00	3	44.5	50	1114	1525
110	1575731	14392038	8762	08/20/02	04:56:35pm	1-read	1	1-50	3	44	51	1102	1503
111	1575780	14392039	8780	08/20/02	04:58:41pm	1-read	1	2-00	3	43.5	52	1102	1472
112	1575829	14392045	8800	08/20/02	05:00:27pm	1-read	1	2-50	3	43	53	1106	1437
113	1575869	14392046	8823	08/20/02	05:03:13pm	1-read	1	3-00	3	42.5	52	1105	1408
114	1575915	14392049	8835	08/20/02	05:05:16pm	1-read	1	3-50	3	42	60	1112	1375
115	1575970	14392052	8855	08/20/02	05:07:06pm	1-read	1	4-00	3	41.5	56	1114	1342
116	1576015	14392055	8873	08/20/02	05:10:19pm	1-read	1	4-50	3	41	54	1109	1320
117	1576059	14392058	8894	08/20/02	05:15:40pm	1-read	1	5-00	3	40.5	57	1146	1317
118	1576103	14392053	8906	08/20/02	05:20:57pm	1-read	1	5-50	3	40	58	1189	1320
119	1576153	14392049	8930	08/20/02	05:23:42pm	1-read	1	6-00		39.5	58	1180	1280
120	1576200	14392053	8954	08/20/02	05:25:17pm	1-read	1	6-50	3	39	54	1189	1230
121	1576241	14392054	8970	08/20/02	05:29:10pm	1-read	1	7-00	3	38.5	59	1153	1205
122	1576289	14392060	8989	08/20/02	05:31:33pm	1-read	1	7-50	3	38	55	1165	1198
123	1576336	14392062	9008	08/20/02	05:41:39pm	1-read	1	8	3	37.5	54	1171	1171
124	1576382	14392059	9027	08/20/02	05:44:37pm	1-read	1	8-50	3	37	56	1151	1124
125	1576431	14392059	9050	08/20/02	05:47:54pm	1-read	1	9	3	36-5	54	1139	1095
126	1576474	14392054	9069	08/20/02	05:53:11pm	1-read	1	9-50	3	36	50	1111	1039
127	1576519	14392049	9090	08/20/02	05:56:37pm	1-read	1	10-00	3	35.5	51	1086	996
128	1576562	14392041	9112	08/20/02	06:00:43pm	1-read	1	10-50	3	35	46	1052	965
129	1576614	14392046	9127	08/20/02	06:02:29pm	1-read	1	11	3	34.5	44	1033	915
130	1576660	14392036	9148	08/20/02	06:04:16pm	1-read	1	11-50	3	34	43	1003	847
131	1576721	14392038	9164	08/20/02	06:09:05pm	1-read	1	12	3	33.5	42	959	791
132	1576771	14392050	9174	08/20/02	06:11:33pm	1-read	1	12-50	3	33	35	935	753
133	1576821	14392050	9175	08/20/02	06:13:56pm	1-read	1.	13-00	3	32.5	29	907	698
134	1580085	14393442	9487	08/20/02	06:45:12pm	2-repeat	2	TIE	1	0	2	105	22
135	1581205	14395443	9869	08/20/02	06:54:48pm	3-base	3	RE-TIE			2	47	7

-- wgs 84 — zone 12 — feet

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__		REPORT	N__S_	E__W__	MIN	MAX	VERT
1	1581199	14395445	9871	08/21/02	02:03:48pm	3-base	3				6	60	9
2	1576153	14394312	8722	08/21/02	02:52:26pm	2-repeat	2		.5	8	87	1426	1214
3	1576304	14394323	8651	08/21/02	03:00:13pm	2-repeat	2		.5	6.5	132	1403	1134
4	1576656	14394303	8764	08/21/02	03:08:54pm	2-repeat	2	A17	.5	3	132	1263	932
5	1576959	14394327	8882	08/21/02	03:24:29pm	2-repeat	2		.5	3	122	1104	728
6	1577059	14394327	8923	08/21/02	03:30:46pm	1-read	1	SPRING HEAD	.5	-1	112	1046	657
8	1577165	14394324	8964	08/21/02	03:42:52pm	1-read	1		.5	-2	114	1106	670
10	1577267	14394328	9007	08/21/02	03:49:07pm	1-read	1		.5	-3	106	1088	643
11	1577375	14394333	9047	08/21/02	04:01:42pm	1-read	1		.5	-4	95	1027	588
13	1577489	14394305	9088	08/21/02	04:09:09pm	1-read	1		.5	-5	82	947	517
14	1577603	14394307	9137	08/21/02	04:18:41pm	1-read	1		.5	-6	68	862	452
15	1577712	14394307	9180	08/21/02	04:25:45pm	1-read	1		.5	-7	50	752	216
16	1577810	14394314	9216	08/21/02	04:34:03pm	1-read	1		.5	-8	42	698	179

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_	E__W__	MIN	MAX	VERT
17	1577911	14394270	9250	08/21/02	04:38:39pm	1-read 1		.5	-9	35	663	150
18	1578005	14394230	9280	08/21/02	04:42:18pm	1-read 1		.5	-10	32	627	145
19	1578100	14393571	9104	08/21/02	04:55:18pm	1-read 1	26-00	1		17	632	129
20	1577988	14393272	8986	08/21/02	05:07:44pm	1-read 1		1.3	25-00	18	646	134
21	1577878	14393274	8966	08/21/02	05:10:55pm	1-read 1		1.3	24-00	24	688	150
22	1577791	14393275	8948	08/21/02	05:13:49pm	1-read 1		1.3	23-00	26	736	171
23	1577690	14393282	8926	08/21/02	05:16:50pm	1-read 1		1.3	22-00	28	776	192
24	1577590	14393284	8903	08/21/02	05:20:31pm	1-read 1		1.3	21-00	30	778	221
25	1577491	14393284	8879	08/21/02	05:22:29pm	1-read 1		1.3	20-00	34	869	260
26	1577390	14393285	8850	08/21/02	05:26:04pm	1-read 1		1.3	19-00	35	894	471
27	1577285	14393324	8828	08/21/02	05:29:52pm	1-read 1		1.3	18-00	34	912	498
28	1577180	14393358	8805	08/21/02	05:34:32pm	1-read 1		1.3	17-00	34	928	536
29	1577073	14393398	8782	08/21/02	05:39:31pm	1-read 1		1.3	16-00	33	1017	595
30	1576967	14393401	8751	08/21/02	05:43:26pm	1-read 1		1.3	15	31	1038	604
31	1576870	14393400	8715	08/21/02	05:48:04pm	1-read 1		1.3	14 .	27	1022	640
32	1576768	14393429	8687	08/21/02	05:52:25pm	1-read 1		1.3	13-00	30	1054	684
33	1576661	14393497	8675	08/21/02	05:56:10pm	1-read 1		1.3	12-00	36	1117	749
34	1576548	14393516	8683	08/21/02	06:01:12pm	1-read 1		1.3	11-00	10	1169	811
35	1576441	14393516	8694	08/21/02	06:13:23pm	1-read 1		1.3	10-00	13	1236	878
36	1576334	14393489	8700	08/21/02	06:17:54pm	1-read 1		1.3	9-00	37	1328	994
37	1576229	14393472	8686	08/21/02	06:22:14pm	1-read 1		1.3	8-00	64	1380	1097
38	1576127	14393474	8661	08/21/02	06:26:37pm	1-read 1		1.3	7-00	87	1414	1186
39	1576029	14393474	8631	08/21/02	06:30:33pm	1-read 1		1.3	6	120	1473	1259
40	1575923	14393471	8605	08/21/02	06:33:28pm	1-read 1		1.3	5	143	1548	1374
41	1575815	14393483	8593	08/21/02	06:37:31pm	1-read 1		1.3	4	177	1558	1463
42	1575703	14393484	8606	08/21/02	06:40:58pm	1-read 1		1.3	3	198	1568	1555
43	1575588	14393484	8622	08/21/02	06:44:41pm	1-read 1		1.3	2	330	1586	1665
44	1575482	14393481	8637	08/21/02	06:51:05pm	1-read 1		1.3	1	470	1630	1799
45	1575379	14393477	8657	08/21/02	06:55:07pm	1-read 1		1.3	0	479	1634	1930
46	1575267	14393478	8653	08/21/02	06:57:17pm	1-read 1		1.3	-1-00	505	1705	2159
47	1575163	14393473	8641	08/21/02	07:00:04pm	1-read 1		1.3	-2-00	525	1765	2390
48	1575066	14393474	8629	08/21/02	07:02:06pm	1-read 1		1.3	-3-00	550	1814	2680
49	1574962	14393469	8606	08/21/02	07:04:53pm	1-read 1		1.3	-4-00	564	1898	3094
50	1581202	14395445	9874	08/21/02	07:42:43pm	3-base 3				22	53	9

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_	E__W__	MIN	MAX	VERT
1	1581207	14395445	9872	08/22/02	01:00:17pm	3-base 3				7	63	9
2	1575058	14393273	8589	08/22/02	02:29:59pm	1-read 1		1.6	-3	485	2105	3009
3	1575166	14393271	8596	08/22/02	02:32:18pm	1-read 1		1.6	-2-00	450	2042	2669
4	1575270	14393276	8580	08/22/02	02:35:35pm	1-read 1		1.6	-1-00	448	1950	2385
5	1575383	14393261	8566	08/22/02	02:38:48pm	1-read 1		1.6	0-00	335	1870	2170
6	1575479	14393262	8569	08/22/02	02:43:01pm	1-read 1		1.6	1-00	271	1705	2000
7	1575580	14393265	8585	08/22/02	02:47:16pm	1-read 1		1.6	2-00	240	1708	1833

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_	E__W__	MIN	MAX	VERT
8	1575679	14393242	8615	08/22/02	02:49:36pm	1-read 1		1.6	3-00	165	1630	1755
9	1575789	14393231	8639	08/22/02	03:09:47pm	1-read 1		1.6	4	146	1640	1640
10	1575890	14393229	8661	08/22/02	03:11:27pm	1-read 1		1.6	5	131	1637	1520
11	1575984	14393214	8702	08/22/02	03:14:13pm	1-read 1		1.6	6	145	1485	1415
12	1576076	14393176	8725	08/22/02	03:19:01pm	1-read 1		1.6	7	78	1485	1329
13	1576168	14393178	8742	08/22/02	03:22:35pm	1-read 1		1.6	8	69	1410	1199
14	1576274	14393209	8770	08/22/02	03:25:27pm	1-read 1		1.6	9	45	1380	1118
15	1576380	14393250	8780	08/22/02	03:29:16pm	1-read 1		1.6	10	33	1375	1038
16	1576475	14393221	8796	08/22/02	03:31:55pm	1-read 1		1.6	11	19	1370	945
17	1576574	14393166	8818	08/22/02	03:39:01pm	1-read 1		1.6	12	7	1255	861
18	1576672	14393104	8820	08/22/02	03:42:16pm	1-read 1		1.6	13	11	1184	773
19	1576790	14393113	8801	08/22/02	03:47:14pm	1-read 1		1.6	14	20	1125	686
20	1576914	14393150	8762	08/22/02	03:54:10pm	1-read 1		1.6	15	29	1075	45
21	1577027	14393105	8766	08/22/02	03:56:51pm	1-read 1		1.6	16	35	1020	597
22	1577129	14393128	8733	08/22/02	04:02:43pm	1-read 1		1.6	17	33	1003	550
23	1577239	14393102	8746	08/22/02	04:07:42pm	1-read 1		1.6	18	34	939	509
24	1577337	14393096	8780	08/22/02	04:11:31pm	1-read 1		1.6	19	33	910	488
25	1577434	14393099	8817	08/22/02	04:16:51pm	1-read 1		1.6	20	32	870	450
26	1577543	14393096	8848	08/22/02	04:24:42pm	1-read 1		1.6	21	32	820	215
27	1577643	14393094	8868	08/22/02	04:30:07pm	1-read 1		1.6	22	80	785	200
28	1577739	14393049	8874	08/22/02	04:35:12pm	1-read 1		1.3	23	23	760	173
29	1577831	14393061	8900	08/22/02	04:38:34pm	1-read 1		1.6	24	25	710	159
30	1577930	14393050	8907	08/22/02	04:44:44pm	1-read 1		1.6	25	37	660	142
31	1578038	14393034	8901	08/22/02	04:47:15pm	1-read 1		1.6	26	17	637	129
32	1578145	14393011	8892	08/22/02	04:49:51pm	1-read 1		1.6	27	13	610	117
33	1578149	14392969	8864	08/22/02	04:57:28pm	1-read 1		B	27	15	617	115
34	1578040	14392935	8842	08/22/02	05:00:16pm	1-read 1		B	26	14	645	129
35	1577938	14392913	8825	08/22/02	05:02:32pm	1-read 1		B	25	15	684	144
36	1577833	14392871	8822	08/22/02	05:07:02pm	1-read 1		B	24	19	745	160
37	1577735	14392868	8811	08/22/02	05:11:50pm	1-read 1		B	23	20	785	180
38	1577629	14392859	8793	08/22/02	05:15:04pm	1-read 1		B	22	26	815	210
39	1577531	14392885	8778	08/22/02	05:18:32pm	1-read 1		B	21	33	780	240
40	1577437	14392970	8765	08/22/02	05:21:14pm	1-read 1		B	20	38	915	485
41	1577309	14393042	8758	08/22/02	05:25:28pm	1-read 1		B	19	35	990	529
42	1577239	14393107	8746	08/22/02	05:28:55pm	2-repeat 2		1.6	18	37	1004	555
43	1577211	14393118	8744	08/22/02	05:31:16pm	1-read 1		B	18	37	1014	575
44	1577112	14393158	8726	08/22/02	05:36:25pm	1-read 1		B	17	40	1072	610
45	1577020	14393221	8713	08/22/02	05:39:41pm	1-read 1		B	16	36	1095	639
46	1576923	14393326	8701	08/22/02	05:43:48pm	1-read 1		B	15	36	1168	707
47	1576819	14393371	8685	08/22/02	05:46:51pm	1-read 1		B	14	28	1195	764
48	1576723	14393439	8682	08/22/02	05:51:43pm	1-read 1		B	13	26	1223	800
49	1576665	14393497	8676	08/22/02	05:57:15pm	2-repeat 2		B	12	15	1230	822
50	1576554	14393589	8663	08/22/02	06:00:40pm	1-read 1		B	11	8	1335	918
51	1576451	14393652	8647	08/22/02	06:04:46pm	1-read 1		B	10	15	1380	997

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE__	REPORT	N__S_E__W__	MIN	MAX	VERT
52	1576341	14393721	8640	08/22/02	06:08:25pm	1-read 1		B 9	40	1410	1058
53	1576255	14393802	8632	08/22/02	06:11:48pm	2-repeat 2		1 7-00	56	1430	1130
54	1576235	14393825	8630	08/22/02	06:16:29pm	1-read 1		B 8	54	1465	1160
55	1576158	14393817	8620	08/22/02	06:22:04pm	2-repeat 2		1 6-00	96	1500	1214
56	1576137	14393776	8618	08/22/02	06:24:07pm	1-read 1		B 7	100	1520	1237
57	1576048	14393677	8613	08/22/02	06:28:49pm	1-read 1		B 6	137	1575	1329
58	1575957	14393569	8604	08/22/02	06:31:43pm	1-read 1		B 5	167	1643	1429
59	1575859	14393496	8597	08/22/02	06:34:47pm	1-read 1		B 4	190	1680	1560
60	1575761	14393432	8592	08/22/02	06:37:47pm	1-read 1		B 3	203	1703	1670
61	1575652	14393370	8585	08/22/02	06:40:36pm	1-read 1		B 2	235	1769	1830
62	1575551	14393316	8576	08/22/02	06:43:44pm	1-read 1		B 1	240	1834	1992
63	1575447	14393265	8573	08/22/02	06:46:52pm	1-read 1		B 0	435	1885	2172
64	1575343	14393201	8568	08/22/02	06:49:23pm	1-read 1		B -1	458	2015	2410
65	1575217	14393099	8563	08/22/02	06:56:51pm	1-read 1		B -2	469	2125	2799
66	1575112	14393061	8556	08/22/02	06:59:22pm	1-read 1		B -3	444	2215	3094
67	1581205	14395445	9875	08/22/02	07:49:18pm	3-base 3			7	65	10
68	1581205	14395442	9873	08/23/02	10:02:58am	3-base 3			3	45	10
69	1575575	14390660	8574	08/23/02	11:49:06am	1-read 1		C 0	191	2365	3690
70	1575734	14390568	8573	08/23/02	11:56:09am	1-read 1		C 1	180	2190	3550
71	1575856	14390467	8578	08/23/02	11:58:47am	1-read 1		C 2	180	2128	3350
72	1575959	14390366	8576	08/23/02	12:03:08pm	1-read 1		C 3	230	2180	3220
73	1576052	14390255	8579	08/23/02	12:05:50pm	1-read 1	at spring head	C 4	225	2095	3218
74	1576110	14390141	8576	08/23/02	12:08:31pm	1-read 1		C 5	435	2075	3250
75	1576227	14390037	8576	08/23/02	12:11:59pm	1-read 1	Above cliffs	C 6	483	2070	3078
76	1576309	14389928	8576	08/23/02	12:15:33pm	1-read 1		C 7	490	2110	3050
77	1576359	14389828	8575	08/23/02	12:18:17pm	1-read 1		C 8	515	2155	3075
78	1576374	14389797	8578	08/23/02	12:20:47pm	2-repeat 2		5 8-50	531	2160	3059
79	1576244	14389808	8508	08/23/02	12:25:41pm	1-read 1	At the waters edge	5 7-00	510	2350	3320
80	1576286	14389805	8532	08/23/02	12:28:27pm	1-read 1		5 7-50	520	2340	3260
81	1576331	14389800	8560	08/23/02	12:31:14pm	1-read 1		5 8-00	527	2200	3165
82	1576377	14389794	8578	08/23/02	12:33:39pm	2-repeat 2		5 8-50	525	2140	3053
83	1576421	14389795	8608	08/23/02	12:35:27pm	1-read 1		5 9-00	549	2100	2932
84	1576467	14389790	8623	08/23/02	12:37:19pm	1-read 1		5 9-50	570	2079	2815
85	1576513	14389782	8641	08/23/02	12:39:16pm	1-read 1		5 10-00	555	2050	2690
86	1576558	14389777	8661	08/23/02	12:41:11pm	1-read 1		5 10-50	568	1972	2540
87	1576607	14389775	8677	08/23/02	12:42:52pm	1-read 1		5 11-00	568	1915	2425
88	1576655	14389765	8694	08/23/02	12:44:13pm	1-read 1		5 11-50	573	1929	2299
89	1576702	14389759	8706	08/23/02	12:45:23pm	1-read 1		5 12-00	579	1875	2189
90	1576751	14389754	8723	08/23/02	12:46:49pm	1-read 1		5 12-50	570	1818	2090
91	1576796	14389745	8737	08/23/02	12:49:20pm	1-read 1		5 13-00	565	1785	2020
92	1576845	14389740	8749	08/23/02	12:50:45pm	1-read 1		5 13-50	568	1755	1244
93	1576894	14389736	8773	08/23/02	12:52:19pm	1-read 1		5 14-00	554	1722	1863
94	1576941	14389730	8782	08/23/02	12:56:45pm	1-read 1		5 14-50	555	1705	1785
95	1576988	14389718	8800	08/23/02	12:58:58pm	1-read 1		5 15-00	540	1670	1695

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_ E__W__	MIN	MAX	VERT
96	1577035	14389718	8818	08/23/02	01:00:07pm	1-read 1		5 15-50	530	1630	1610
97	1577081	14389708	8832	08/23/02	01:01:52pm	1-read 1		5 16-00	521	1595	1550
98	1577130	14389702	8845	08/23/02	01:04:05pm	1-read 1		5 16-50	509	1550	1460
99	1577181	14389699	8858	08/23/02	01:05:43pm	1-read 1		5 17-00	491	1515	1360
100	1577229	14389694	8867	08/23/02	01:07:22pm	1-read 1		5 17-50	475	1470	1290
101	1577276	14389694	8875	08/23/02	01:08:53pm	1-read 1		5 18-00	466	1460	1215
102	1577330	14389681	8880	08/23/02	01:10:34pm	1-read 1		5 18-50	470	1415	1136
103	1577376	14389675	8875	08/23/02	01:12:17pm	1-read 1		5 19-00	450	1403	1085
104	1577425	14389669	8862	08/23/02	01:14:36pm	1-read 1		5 19-50	450	1390	1025
105	1577473	14389664	8844	08/23/02	01:18:09pm	1-read 1		5 20-00	239	1343	960
106	1577519	14389655	8826	08/23/02	01:20:25pm	1-read 1		5 20-50	248	1285	901
107	1577568	14389654	8808	08/23/02	01:22:28pm	1-read 1		5 21-00	218	1255	855
108	1577618	14389655	8791	08/23/02	01:24:28pm	1-read 1		5 21-50	206	1212	826
109	1577659	14389650	8767	08/23/02	01:28:13pm	1-read 1		5 22-00	190	1192	800
110	1577710	14389643	8754	08/23/02	01:29:49pm	1-read 1		5 22-50	198	1170	760
111	1577760	14389635	8741	08/23/02	01:32:07pm	1-read 1		5 23-00	177	1139	720
112	1577805	14389626	8726	08/23/02	01:33:45pm	1-read 1		5 23-50	168	1109	695
113	1577862	14389625	8743	08/23/02	01:36:12pm	1-read 1		5 24-00	159	1075	685
114	1577905	14389613	8757	08/23/02	01:37:46pm	1-read 1		5 24-50	145	1069	668
115	1577952	14389608	8768	08/23/02	01:39:24pm	1-read 1		5 25-00	141	1043	649
116	1576418	14389789	8601	08/23/02	01:55:36pm	2-repeat 2		5 9-00	520	2045	2875
117	1581205	14395447	9867	08/23/02	02:46:17pm	3-base 3			3	60	9

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_ E__W__	MIN	MAX	VERT
1	1581200	14395440	9873	08/27/02	01:02:56pm	3-base 3	UNIT 1		1	10	2
2	1577013	14391622	9277	08/27/02	01:27:45pm	0-topo 0	well head at 3.5 -- UNIT 1	3.5 0	10	99	81
3	1576881	14391496	9263	08/27/02	01:38:30pm	2-repeat 2	UNIT 1	3.5 21	15	105	96
4	1576983	14391375	9283	08/27/02	01:44:08pm	2-repeat 2	UNIT 1	3.5 20	12	99	88
5	1577030	14391291	9286	08/27/02	01:49:42pm	2-repeat 2	UNIT 1	3.5 19	13	95	83
6	1577125	14391273	9296	08/27/02	01:55:17pm	1-read 1	UNIT 1	3.5 18	17	88	73
7	1581201	14395442	9868	08/27/02	02:26:37pm	3-base 3	UNIT 1		1	10	2
8	1576152	14394310	8726	08/27/02	04:15:07pm	2-repeat 2	TRANSIT BASE-- CHANGED TO REC. 3	.5 8	118	1430	1278
9	1576223	14394807	8749	08/27/02	04:26:41pm	1-read 1		0 7	598	1919	1521
10	1576116	14394804	8779	08/27/02	04:29:53pm	1-read 1		0 6	595	1925	1614
11	1576012	14394808	8812	08/27/02	04:32:56pm	1-read 1		0 5	605	1905	1739
12	1575910	14394807	8858	08/27/02	04:37:32pm	1-read 1		0 4	540	1870	1845
13	1575813	14394800	8892	08/27/02	04:42:02pm	1-read 1		0 3	342	1833	1967
14	1575709	14394789	8937	08/27/02	04:47:33pm	1-read 1		0 2	166	1756	2063
15	1575613	14394789	8978	08/27/02	04:51:04pm	1-read 1		0 1	95	1708	2207
16	1575510	14394801	8995	08/27/02	04:55:20pm	1-read 1		0 0	25	1679	2369
17	1575607	14395309	9063	08/27/02	05:03:34pm	1-read 1		-.5 1	223	2130	3490
18	1575715	14395307	9036	08/27/02	05:19:52pm	1-read 1		-.5 2	572	2191	3350
19	1575820	14395302	8992	08/27/02	05:27:04pm	1-read 1		-.5 3	689	2645	3270

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_	E__W__	MIN	MAX	VERT
20	1575924	14395298	8945	08/27/02	05:33:51pm	1-read 1		-.5	4	812	2822	3060
21	1576034	14395294	8903	08/27/02	05:37:29pm	1-read 1		-.5	5	933	3010	2918
22	1576159	14395291	8862	08/27/02	05:44:13pm	1-read 1		-.5	6.25	980	3002	2623
23	1576232	14395278	8836	08/27/02	05:46:52pm	1-read 1		-.5	7	999	2981	2427
24	1576188	14395279	8841	08/27/02	05:49:08pm	0-topo 0	SPRING HEAD			0	0	0
25	1576331	14395277	8808	08/27/02	05:51:21pm	1-read 1		-.5	8	1016	2901	2253
26	1576382	14395277	8783	08/27/02	05:55:01pm	1-read 1		-.5	8.5	998	2860	2127
27	1576442	14395282	8764	08/27/02	05:59:05pm	1-read 1		-.5	9	988	2814	2003
28	1576543	14395289	8721	08/27/02	06:06:01pm	1-read 1		-.5	10	1022	2746	1938
29	1576642	14395287	8759	08/27/02	06:10:13pm	1-read 1		-.5	11	988	2557	1855
30	1576734	14395269	8798	08/27/02	06:18:12pm	1-read 1		-.5	12	824	2360	1670
31	1576858	14395259	8837	08/27/02	06:24:31pm	1-read 1		-.5	13.3	890	2095	1450
32	1576967	14395229	8880	08/27/02	06:29:44pm	1-read 1		-.5	14.4	611	1813	1299
33	1577042	14395236	8903	08/27/02	06:33:36pm	1-read 1		-.5	15	588	1740	1219
34	1577142	14395251	8940	08/27/02	06:37:39pm	1-read 1		-.5	16	478	1638	1089
35	1577128	14394802	8953	08/27/02	06:47:32pm	1-read 1		0	16	213	1322	936
36	1577033	14394806	8910	08/27/02	06:52:44pm	1-read 1		0	15	450	1419	1029
37	1576930	14394804	8869	08/27/02	06:57:55pm	1-read 1		0	14	500	1496	1095
38	1576820	14394810	8832	08/27/02	07:02:32pm	1-read 1		0	13	555	1608	1179
39	1576721	14394814	8800	08/27/02	07:06:08pm	1-read 1		0	12	591	1690	1258
40	1576671	14394787	8777	08/27/02	07:08:36pm	2-repeat 2		A	12	598	1704	1278
41	1576616	14394807	8764	08/27/02	07:12:05pm	1-read 1		0	11	646	1770	1320
42	1576516	14394806	8734	08/27/02	07:14:40pm	1-read 1		0	10	677	1798	1362
43	1576427	14394801	8698	08/27/02	07:18:50pm	1-read 1		0	9	665	1729	1336
44	1576328	14394804	8708	08/27/02	07:24:57pm	1-read 1		0	8	628	1717	1331
45	1576222	14394810	8756	08/27/02	07:29:14pm	2-repeat 2		0	7	564	1698	1352
46	1575511	14393741	8645	08/27/02	07:33:17pm	2-repeat 2	transit base	.5	8	87	1249	1111
47	1581200	14395440	9875	08/27/02	08:16:53pm	3-base 3	sun has set			5	55	8
48	1581204	14395445	9876	08/28/02	11:11:00am	3-base 3				4	60	9
49	1575225	14390934	8525	08/28/02	01:07:22pm	1-read 1		4	-2.7	154	2995	3780
50	1575327	14390916	8547	08/28/02	01:11:12pm	1-read 1		4	-1.7	73	2516	3760
51	1575432	14390893	8571	08/28/02	01:14:38pm	1-read 1		4	-.7	83	2314	3720
52	1575504	14390885	8594	08/28/02	01:17:57pm	1-read 1		4	0	95	2180	3700
53	1575557	14390878	8604	08/28/02	01:21:24pm	1-read 1		4	.5	102	2134	3680
54	1575603	14390871	8610	08/28/02	01:23:41pm	1-read 1		4	1	109	2084	3600
55	1575652	14390859	8627	08/28/02	01:25:41pm	1-read 1		4	1.5	122	2014	3410
56	1575701	14390851	8639	08/28/02	01:27:28pm	1-read 1		4	2.00	125	1958	3249
57	1575750	14390845	8650	08/28/02	01:29:45pm	1-read 1		2	2.50	165	1922	3126
58	1575800	14390835	8664	08/28/02	01:33:41pm	1-read 1		4	3.00	162	1872	3018
59	1575842	14390840	8683	08/28/02	01:38:26pm	1-read 1		4	3.5	147	1797	2822
60	1575886	14390825	8701	08/28/02	01:40:30pm	1-read 1		4	4.00	152	1742	2689
61	1575938	14390817	8723	08/28/02	01:43:03pm	1-read 1		4	4.5	158	1689	2532
62	1575985	14390807	8736	08/28/02	01:45:21pm	1-read 1		4	5	159	1665	2429
63	1576032	14390803	8748	08/28/02	01:47:14pm	1-read 1		4	5.5	156	1620	2316

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_	E__W__	MIN	MAX	VERT
64	1576075	14390791	8767	08/28/02	01:49:38pm	1-read 1		4	6	162	1559	2224
65	1576123	14390784	8784	08/28/02	01:52:31pm	1-read 1		4	6.50	172	1509	2142
66	1576173	14390786	8809	08/28/02	01:55:14pm	1-read 1		4	7	176	1479	2096
67	1576218	14390779	8820	08/28/02	01:57:57pm	1-read 1		4	7.5	174	1459	2031
68	1576266	14390769	8842	08/28/02	01:59:51pm	1-read 1		4	8	185	1459	1959
69	1576310	14390761	8861	08/28/02	02:07:02pm	1-read 1		4	8.50	179	1383	1837
70	1576360	14390756	8876	08/28/02	02:11:33pm	1-read 1		4	9	170	1326	1161
71	1576407	14390751	8893	08/28/02	02:13:41pm	1-read 1		4	9.5	167	1302	1681
72	1576458	14390744	8908	08/28/02	02:17:19pm	1-read 1		4	10	170	1293	1639
73	1576506	14390741	8929	08/28/02	02:18:36pm	1-read 1		4	10.5	165	1291	1579
74	1576553	14390737	8942	08/28/02	02:20:29pm	1-read 1		4	11	165	1259	1520
75	1576601	14390728	8960	08/28/02	02:22:09pm	1-read 1		4	11.50	170	1255	1468
76	1576648	14390726	8974	08/28/02	02:23:58pm	1-read 1		4	12.00	166	1224	1394
77	1576695	14390718	8992	08/28/02	02:25:49pm	1-read 1		4	12.50	168	1195	1346
78	1576741	14390707	9003	08/28/02	02:32:42pm	1-read 1		4	13	164	1206	1314
79	1576791	14390703	9022	08/28/02	02:36:02pm	1-read 1		4	13.50	161	1200	1266
80	1576838	14390692	9030	08/28/02	02:39:00pm	1-read 1		4	14	162	1184	1212
81	1576886	14390688	9043	08/28/02	02:40:58pm	1-read 1		4	14.50	168	1159	1159
82	1576939	14390678	9056	08/28/02	02:43:22pm	1-read 1		4	15	157	1135	1114
83	1576986	14390672	9067	08/28/02	02:46:12pm	1-read 1		4	15.50	161	1090	1054
84	1577035	14390665	9078	08/28/02	02:49:22pm	1-read 1		4	16	150	1109	999
85	1577083	14390657	9095	08/28/02	02:52:28pm	1-read 1		4	16.50	145	1065	939
86	1577131	14390649	9110	08/28/02	02:55:10pm	1-read 1		4	17	141	1032	879
87	1577179	14390642	9123	08/28/02	02:57:16pm	1-read 1		4	17.50	131	979	828
88	1577234	14390636	9135	08/28/02	03:01:41pm	1-read 1		4	18.00	125	940	775
89	1577283	14390627	9139	08/28/02	03:04:33pm	1-read 1		4	18.50	119	909	737
90	1577334	14390622	9134	08/28/02	03:06:31pm	1-read 1		4	19.00	121	905	708
91	1577386	14390617	9122	08/28/02	03:08:09pm	1-read 1		4	19.50	128	930	688
92	1577429	14390612	9106	08/28/02	03:22:53pm	1-read 1		4	20.00	125	900	660
93	1577475	14390608	9095	08/28/02	03:24:55pm	1-read 1		4	20.50	125	889	636
94	1577529	14390606	9089	08/28/02	03:27:56pm	1-read 1		4	21.00	126	890	621
95	1577579	14390600	9077	08/28/02	03:30:38pm	1-read 1		4	21.50	122	871	598
96	1577626	14390591	9066	08/28/02	03:33:16pm	1-read 1		4	22.00	137	848	570
97	1577677	14390590	9069	08/28/02	03:37:57pm	1-read 1		4	22.50	118	829	560
98	1577727	14390581	9060	08/28/02	03:40:19pm	1-read 1		4	23.00	111	805	529
99	1577776	14390587	9065	08/28/02	03:52:09pm	1-read 1		4	23.50	108	784	520
100	1577826	14390578	9053	08/28/02	04:03:46pm	1-read 1		4	24.00	108	773	497
101	1577881	14390570	9057	08/28/02	04:08:28pm	1-read 1		4	24.50	104	753	478
102	1577930	14390562	9048	08/28/02	04:10:30pm	1-read 1		4	25	98	740	454
103	1577978	14390559	9070	08/28/02	04:12:47pm	1-read 1		4	25.50	92	718	432
104	1578026	14390555	9076	08/28/02	04:22:08pm	1-read 1		4	26.50	82	669	333
105	1578081	14390546	9070	08/28/02	04:25:39pm	1-read 1		4	27	84	661	237
106	1578192	14390535	9096	08/28/02	04:30:02pm	1-read 1		4	28	68	623	195
107	1578300	14390523	9109	08/28/02	04:31:56pm	1-read 1		4	29	62	597	165

ID	EASTING	NORTHING	ELEVA	DATE	TIME	__TYPE __	REPORT	N__S_ E__W__	MIN	MAX	VERT
108	1578411	14390511	9115	08/28/02	04:34:28pm	1-read 1		4 30	51	572	146
109	1578513	14390505	9135	08/28/02	04:38:03pm	1-read 1		4 31	51	562	129
110	1578628	14390488	9143	08/28/02	04:40:23pm	1-read 1		4 32	45	535	113
111	1578727	14390484	9156	08/28/02	04:43:05pm	1-read 1		4 33	46	508	96
112	1578834	14390492	9188	08/28/02	04:46:17pm	1-read 1		4 34	37	485	80
113	1578943	14390493	9236	08/28/02	04:50:51pm	1-read 1		4 35	46	434	69
114	1579041	14390503	9276	08/28/02	04:53:46pm	1-read 1		4 36	25	260	64
115	1579151	14390502	9314	08/28/02	05:04:51pm	1-read 1		4 37	25	230	55
116	1579232	14390485	9336	08/28/02	05:08:04pm	1-read 1		4 38	18	208	48
117	1579329	14390475	9339	08/28/02	05:11:56pm	1-read 1		4 39	16	188	43
118	1579209	14389946	9194	08/28/02	05:20:16pm	1-read 1		4.5 38	20	245	51
119	1579178	14389839	9165	08/28/02	05:23:19pm	1-read 1		4.65 37.5	19	265	51
120	1579111	14389740	9136	08/28/02	05:25:52pm	1-read 1		4.8 36	34	452	57
121	1579039	14389642	9112	08/28/02	05:29:32pm	1-read 1		4.9 35.5	26	465	61
122	1579028	14389544	9097	08/28/02	05:32:42pm	1-read 1		5 35.5	24	474	61
123	1578914	14389537	9085	08/28/02	05:36:25pm	1-read 1		5 34.5	29	510	77
124	1578816	14389541	9057	08/28/02	05:41:50pm	1-read 1		5 33.5	43	531	88
125	1578723	14389542	9020	08/28/02	05:44:30pm	1-read 1		5 32.5	41	562	108
126	1578614	14389544	8978	08/28/02	05:47:40pm	1-read 1		5 31.5	42	583	131
127	1578512	14389555	8946	08/28/02	05:52:25pm	1-read 1		5 30.5	48	625	149
128	1578409	14389556	8904	08/28/02	05:56:29pm	1-read 1		5 29.5	62	689	185
129	1578315	14389563	8876	08/28/02	06:01:05pm	1-read 1		5 28.5	70	739	229
130	1578211	14389573	8845	08/28/02	06:03:36pm	1-read 1		5 27.5	92	795	459
131	1578144	14389584	8824	08/28/02	06:07:29pm	1-read 1		5 27	96	848	507
132	1578094	14389593	8810	08/28/02	06:09:16pm	1-read 1		5 26.5	109	877	534
133	1578042	14389603	8796	08/28/02	06:11:41pm	1-read 1		5 26	114	902	553
134	1577995	14389606	8783	08/28/02	06:14:22pm	1-read 1		5 25.5	120	932	577
135	1577953	14389611	8773	08/28/02	06:16:16pm	2-repeat 2		5 25	130	977	605
136	1577904	14389619	8762	08/28/02	06:19:04pm	1-read 1		5 24.5	139	998	623
137	1577858	14389627	8744	08/28/02	06:21:07pm	1-read 1		5 24	152	1022	656
138	1577429	14388286	8578	08/28/02	06:33:49pm	1-read 1		C 24	202	1598	923
139	1577397	14388389	8581	08/28/02	06:41:13pm	1-read 1		C 23	413	1659	1092
140	1577336	14388499	8571	08/28/02	06:43:26pm	1-read 1		C 22	493	1730	1171
141	1577275	14388595	8554	08/28/02	06:47:12pm	1-read 1	canyon bottom - water flow	C 21	561	1812	1305
142	1577174	14388664	8578	08/28/02	06:50:12pm	1-read 1		C 20	603	2144	1448
143	1577081	14388720	8578	08/28/02	06:52:57pm	1-read 1		C 19	669	2375	1798
144	1576983	14388806	8580	08/28/02	06:55:57pm	1-read 1		C 18	688	2563	2080
145	1576887	14388879	8579	08/28/02	07:01:07pm	1-read 1		C 17	738	2672	2448
146	1576794	14388983	8580	08/28/02	07:05:43pm	1-read 1		C 16	750	2639	2776
147	1576724	14389086	8581	08/28/02	07:09:08pm	1-read 1		C 15	731	2537	2749
148	1576651	14389199	8580	08/28/02	07:14:44pm	1-read 1		C 14	689	2399	2838
149	1576609	14389304	8579	08/28/02	07:17:34pm	1-read 1		C 13	641	2293	2789
150	1576535	14389408	8580	08/28/02	07:19:58pm	1-read 1		C 12	609	2207	2839
151	1576475	14389513	8581	08/28/02	07:22:27pm	1-read 1		C 11	598	2139	2867

ID	EASTING	NORTHING	ELEVA	DATE	TIME	TYPE	REPORT	N	S	E	W	MIN	MAX	VERT
152	1576437	14389607	8580	08/28/02	07:25:01pm	1-read 1		C			10	519	2057	2831
153	1576404	14389706	8582	08/28/02	07:28:47pm	1-read 1		C			9	479	1963	2785
154	1576373	14389793	8583	08/28/02	07:31:28pm	2-repeat 2		5	8.5			435	1891	2715
155	1576358	14389827	8578	08/28/02	07:32:49pm	2-repeat 2		C	8			460	1865	2686
156	1576308	14389924	8580	08/28/02	07:34:41pm	2-repeat 2		C	7			227	1813	2668
157	1581202	14395439	9874	08/28/02	08:29:48pm	3-base 3						2	48	8
158	1581199	14395445	9876	08/29/02	10:47:38am	3-base 3						3	61	11
159	1576656	14389200	8578	08/29/02	12:21:46pm	2-repeat 2	line c *k	5.5	11			747	2517	2948
160	1576554	14389199	8541	08/29/02	12:27:42pm	1-read 1		5.5	10			731	2652	3320
161	1576505	14389196	8517	08/29/02	12:31:33pm	1-read 1		5.5	9.5			709	2799	3470
162	1576659	14389200	8579	08/29/02	12:36:08pm	2-repeat 2		5.5	11			707	2458	2904
163	1576658	14389201	8579	08/29/02	12:50:17pm	2-repeat 2	line c *k	5.5	11			713	2539	3010
164	1576755	14389191	8610	08/29/02	12:54:29pm	1-read 1		5.5	12			698	2376	2637
165	1576861	14389192	8644	08/29/02	12:58:23pm	1-read 1		5.5	13			662	2179	2296
166	1576955	14389194	8671	08/29/02	01:01:57pm	1-read 1		5.5	14			660	2068	2037
167	1577033	14389208	8694	08/29/02	01:06:46pm	1-read 1		5.5	15			608	1968	1798
168	1577154	14389204	8724	08/29/02	01:10:43pm	1-read 1		5.5	16			577	1783	1531
169	1577261	14389208	8746	08/29/02	01:13:58pm	1-read 1		5.5	17			526	1660	1333
170	1577375	14389214	8756	08/29/02	01:19:00pm	1-read 1		5.5	18			481	1507	1149
171	1577489	14389215	8731	08/29/02	01:24:22pm	1-read 1		5.5	19			454	1381	1006
172	1577588	14389213	8691	08/29/02	01:27:04pm	1-read 1		5.5	20			247	1311	907
173	1577686	14389215	8657	08/29/02	01:30:16pm	1-read 1		5.5	21			216	1227	822
174	1577716	14389165	8641	08/29/02	01:33:17pm	1-read 1	canyon bottom	5.5	21.3			206	1211	837
175	1577801	14389190	8684	08/29/02	01:36:24pm	1-read 1		5.5	22			169	1185	601
176	1577895	14389210	8714	08/29/02	01:39:08pm	1-read 1		5.5	23			144	1126	701
177	1577988	14389195	8740	08/29/02	01:42:21pm	1-read 1		5.5	24			141	1053	647
178	1578091	14389156	8780	08/29/02	01:44:29pm	1-read 1		5.5	25			112	998	586
179	1578196	14389124	8813	08/29/02	01:46:57pm	1-read 1		5.5	26			91	925	514
180	1578313	14389107	8857	08/29/02	01:50:17pm	1-read 1		5.5	27			77	851	437
181	1578449	14389032	8896	08/29/02	01:53:33pm	1-read 1		5.5	28			87	747	195
182	1578558	14389006	8930	08/29/02	01:58:13pm	1-read 1		5.5	29			63	696	168
183	1578632	14388990	8944	08/29/02	02:02:43pm	1-read 1		5.5	30			48	673	148
184	1578720	14389975	9086	08/29/02	02:14:22pm	1-read 1		4.5	31			46	622	123
185	1578626	14390007	9032	08/29/02	02:16:43pm	1-read 1		4.5	30			48	639	137
186	1578526	14390075	9013	08/29/02	02:18:25pm	1-read 1		4.5	29			57	659	161
187	1578450	14390162	9003	08/29/02	02:23:08pm	1-read 1		4.5	28			57	645	162
188	1578338	14390223	8995	08/29/02	02:25:30pm	1-read 1		4.5	27			63	657	187
189	1578233	14390225	8971	08/29/02	02:27:28pm	1-read 1		4.5	26			74	681	221
190	1578092	14390241	8952	08/29/02	02:30:22pm	1-read 1		4.5	24.5			91	757	469
191	1578015	14390247	8938	08/29/02	02:32:50pm	1-read 1		4.5	23.75			98	806	505
192	1577936	14390252	8935	08/29/02	02:34:23pm	1-read 1		4.5	23			108	849	545
193	1577828	14390268	8956	08/29/02	02:36:54pm	1-read 1		4.5	22			127	889	596
194	1577708	14390237	8945	08/29/02	02:39:26pm	1-read 1		4.5	21			136	959	645
195	1577599	14390172	8941	08/29/02	02:41:57pm	1-read 1		4.5	20			157	1039	705

ID	EASTING	NORTHING	ELEVA	DATE	TIME	TYPE		REPORT	N	S	E	W	MIN	MAX	VERT
196	1577489	14390106	8953	08/29/02	02:45:03pm	1-read	1		4.5		19		174	1151	812
197	1577381	14390038	8960	08/29/02	02:47:14pm	1-read	1		4.5		18		188	1242	957
198	1577262	14390048	8957	08/29/02	02:51:04pm	1-read	1		4.5		17		206	1328	1136
199	1577154	14390063	8936	08/29/02	02:52:43pm	1-read	1		4.5		16		225	1379	1289
200	1577057	14390070	8908	08/29/02	02:55:07pm	1-read	1		4.5		15		251	1415	1415
201	1576955	14390078	8875	08/29/02	02:57:56pm	1-read	1		4.5		14		269	1459	1559
202	1576839	14390102	8852	08/29/02	03:00:32pm	1-read	1		4.5		13		350	1483	1653
203	1576731	14390099	8812	08/29/02	03:05:29pm	1-read	1	at top of land sluff	4.5		12		444	1547	1821
204	1576621	14390090	8765	08/29/02	03:10:38pm	1-read	1		4.5		11		406	1652	1978
205	1576525	14390106	8732	08/29/02	03:12:56pm	1-read	1		4.5		10		396	1671	2173
206	1576423	14390112	8692	08/29/02	03:16:20pm	1-read	1		4.5		9		441	1751	2379
207	1576318	14390109	8645	08/29/02	03:20:08pm	1-read	1		4.5		8		398	1849	2723
208	1576227	14390110	8605	08/29/02	03:23:00pm	1-read	1		4.5		7		251	1887	2898
209	1576132	14390111	8578	08/29/02	03:25:37pm	1-read	1		4.5		6		238	1951	3114
210	1576023	14390156	8554	08/29/02	03:27:29pm	1-read	1		4.5		5		242	2029	3335
211	1575915	14390208	8506	08/29/02	03:29:48pm	1-read	1	water edge	4.5		4		172	2245	3570
212	1581202	14395452	9868	08/29/02	04:13:23pm	3-base	3						4	64	10

Appendix F

Work Plan - Dye Tracing Program

REVIEW DRAFT

WORKPLAN FOR A GROUNDWATER TRACING STUDY AT ELECTRIC LAKE, EMERY COUNTY, UTAH.

April 15, 2003

Thomas Aley, PHG and PG
President and Senior Hydrogeologist
Ozark Underground Laboratory, Inc.

Introduction

Electric Lake is located in Emery County, Utah. The lake impounds Huntington Creek and provides water for cooling of two PacifiCorp power plants plus water for other downstream uses. Normal lake capacity is about 33,000 acre feet, but the present volume of water in the lake is about 5,000 acre feet.

The Skyline Mine is a long-wall underground coal mine with a main portal in Eccles Canyon. The mine extends south and west from the main portal, and portions of the mine are located in very close proximity to Electric Lake. Electric Lake is several hundred feet higher in elevation than the workings in the Skyline Mine. The primary discharge of water from the mine is through the mine workings and into Eccles Creek, which flows through Eccles Canyon. A much smaller water discharge from the mine is through a well known as JC-1. This well ultimately yields water, via a tributary canyon, to Electric Lake.

Based on information provided by Rodger Fry, portions of the Skyline coal mine adjacent to Electric Lake intercepted large quantities of water in August 2001. The water was entering through a fault system at a rate of about 8,000 gallons per minute (gpm); a high inflow rate from this source has continued to the present time. Two other sections of the mine also intersected the same fracture system and are flowing at about 1,000 gpm each. The encountered fractures are mapped as part of a diagonal fault system which intersects Electric Lake about a mile south of the southern limit of the mine workings.

PacifiCorp has done water balance studies of Electric Lake which indicate that the lake is leaking at a rate of about 650 acre feet per month. It is the opinion of Mr. Fry and others that the lake is leaking into the Skyline Mine primarily along the Diagonal and Connelsville fault systems, and that this leakage accounts for most of the water now being pumped from the mine. There are various other data which support Mr. Fry's professional opinion. I reviewed underwater video from the floor of Electric Lake in the vicinity of the

Diagonal and Connelsville faults. The video clearly shows water moving from the bottom of the lake into underlying fractures.

Objective

The Ozark Underground Laboratory, Inc. (OUL) has been retained by the firm of Hansen, Allen, and Luce of Midvale, Utah to design, direct, and provide analytical services for a groundwater tracing investigation at Electric Lake. During our work effort Mr. Rodger Fry has provided support and arranged logistical support. The objective of our investigation is to determine if water tagged with fluorescent tracer dyes follows a direct fracture flow route which moves water rapidly from sinking points in Electric Lake into the Skyline Mine. For the purposes of calculating dye quantities for this study we have assumed that such a flow connection would permit water to move from Electric Lake into the mine within a period of approximately four months.

Fluorescent tracer dyes are routinely used as groundwater tracers in karst and fractured rock aquifers. The dyes are most useful where preferrential flow system exist (such as through a dissolutional karst conduit or an open fault). As a general rule (and among other things), the amount of dye needed for a groundwater traces increases with increases in the travel distance and/or the travel time. Many other considerations such as the volume of water to be dyed and the extent of contact between dyed water and geologic units also affect the amount of tracer dyes needed.

Dye Type, Quantity, and Method of Introduction

I (Tom Aley) reviewed data provided by Rodger Fry and David Hansen of Hansen, Allen, and Luce prior to visiting the site. Based upon this information 35 pounds of fluorescein dye mixture containing approximately 75% dye and 25% diluent plus 50 pounds of eosine dye mixture containing approximately 75% dye and 25% diluent was shipped from the OUL to David Hansen. The amount of dye to be used was based upon the data and somewhat similar groundwater traces conducted by the OUL. On April 1, 2003, I visited Electric Lake to make a final decision relative to the adequacy of the dye quantities and, if quantities were deemed reasonable, and to supervise the dye introduction. It was my conclusion that the dye quantities were reasonable for the conditions present and for a trace designed to yield positive dye recoveries in water from the mine if water tagged with fluorescent tracer dyes follows a direct fracture flow route which moves water rapidly from sinking points in Electric Lake into the Skyline Mine within a period of approximately four months.

The 50 pounds of eosine dye mixture was mixed with cold lake water and introduced six inches above the bottom of Electric Lake at a location known as Way Point 26 (Longitude 39° 37.135'N, Latitude 111° 13.552'W). Water depth in the lake at this point was approximately 14.5 feet. Previous work and videos indicated that water was sinking into the subsurface from the bottom of the lake in the vicinity of this dye introduction point. A hole was cut through about 18 inches of ice cover on the lake and

the dye solution was pumped to the bottom of the lake through a piece of 1 inch plastic pipe. The dye introduction began on April 1, 2003 at 1205 hours and was completed at 1300 hours. Samples of lake water were collected from nearby holes drilled through the ice. These samples indicated that the dyed water was effectively stratified on the bottom of the lake.

The 35 pounds of fluorescein dye mixture was mixed with cold lake water and introduced six inches above the bottom of Electric Lake at a location known as Way Point 16 (Longitude 39° 37.135' N, Latitude 111° 13.552'W). Water depth in the lake at this point was approximately 19.5 feet. Previous work and videos indicated that water was entering the subsurface strata from the bottom of the lake in the vicinity of this dye introduction point. A hole was cut through about 18 inches of ice cover on the lake and the dye solution was pumped to the bottom of the lake through a piece of 1 inch plastic pipe. The dye introduction began on April 1, 2003 at 1413 hours and was completed at 1433 hours. Samples of lake water were collected from nearby holes drilled through the ice. These samples indicated that the dyed water was effectively stratified on the bottom of the lake.

Both dye introductions were deemed highly successful. Access to the dye introduction points from the paved road required snowmobiles, a boat, and travel on foot. Personnel involved with the dye introduction included Rodger Fry (consultant), Dr. Kip Solomon (consultant), Darce Guymon (PacifiCorp), Kerry Larsen (PacifiCorp), and Tom Aley (OUL).

Dye Sampling and Sampling Stations

All dye sampling and analysis will be consistent with the general approaches outlined in the OUL's Procedures and Criteria document which is attached to this workplan as Attachment A.

Primary (long-term) sampling stations established for this groundwater trace are shown on the map which accompanies this workplan. The long term sampling stations are as follows:

- Eccles Creek 1/4 mile below Skyline Mine
- South Fork Eccles Creek
- Clear Creek above Eccles Creek
- Clear Creek below Eccles Creek
- Huntington Creek 1
- Huntington Creek 2
- JC-1
- Huntington Creek 3
- Boulger Creek
- Huntington Creek Below 1
- Huntington Creek Below 2

- When new well JC-3 is completed (near JC-1) it will also be sampled as a long term primary sampling station.
- A sampling station will also be established on Electric Lake a short distance upstream of the dam with activated carbon samplers placed in the water near the bottom of the lake, near the top of the lake, and at a mid-point.

A number of short-term sampling stations were established near the two dye introduction points to detect movement of dye in the lake around the introduction points.

Sampling for tracer dyes at long term sampling stations will place primary reliance upon activated carbon samplers and secondary reliance upon grab samples of water. Both carbon and water samples will be collected at each sampling stations each time the station is sampled. The OUL will analyze all water samples from the following five long term sampling stations:

- Eccles Creek 1/4 mile below Skyline Mine
- JC-1
- New Well near JC-1
- Huntington Creek Below 1
- Huntington Creek Below 2

The OUL will analyze other water samples as requested or as the OUL deems appropriate. Many of the sampling stations are control stations where the detection of tracer dyes is not anticipated. There will be approximately 5% duplicate and replicate samples analyzed for QA/QC purposes.

Sampling Frequency and Study Duration

Sampling for tracer dyes at long term sampling stations will occur approximately once per week during the course of this study. Slight deviations can be made to avoid holidays, bad weather, or for logistical reasons. The dye quantities selected are appropriate for a groundwater trace where dye detections in the Skyline Mine would first occur within approximately four months of dye introduction (i.e., on or before about August 1, 2003). Weekly sampling will continue until about November 1, 2003. If both of the dyes are detected in waters derived from the Skyline Mine prior to November 1, 2003 the duration of the sampling may be decreased. The decision to terminate sampling will be made after all parties involved in hydrogeologic investigations of Electric Lake have had an opportunity to review data and have input into the decision.

Other Tracer Dye Related Investigations

The loss of fluorescein and eosine dye onto various geologic materials existing between the lake and the mine will be assessed by the OUL by following an approach similar to that employed by Smart and Laidlaw (1977).

Data and Reports

Periodic reports on sampling results will be submitted. Other reports on the project will be produced as requested by the client.

References

Smart, P.L. and I.M. S. Laidlaw. An evaluation of some fluorescent dyes for water tracing. Water Resources Research, Vol 13:1, pp. 17-35

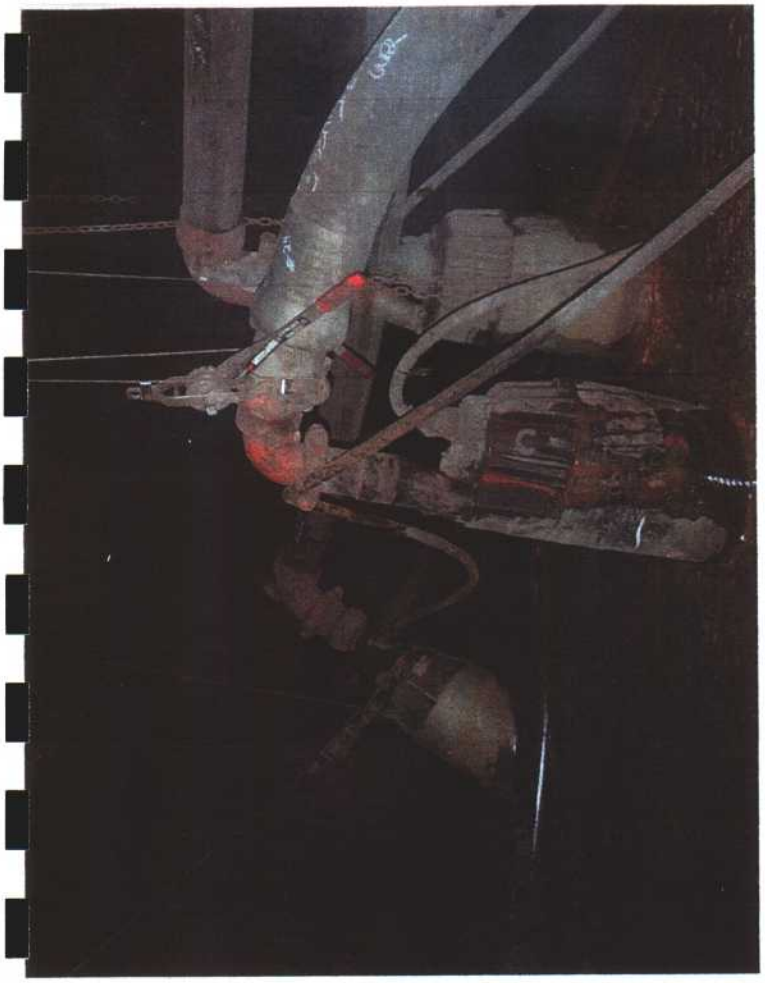
Submitted:

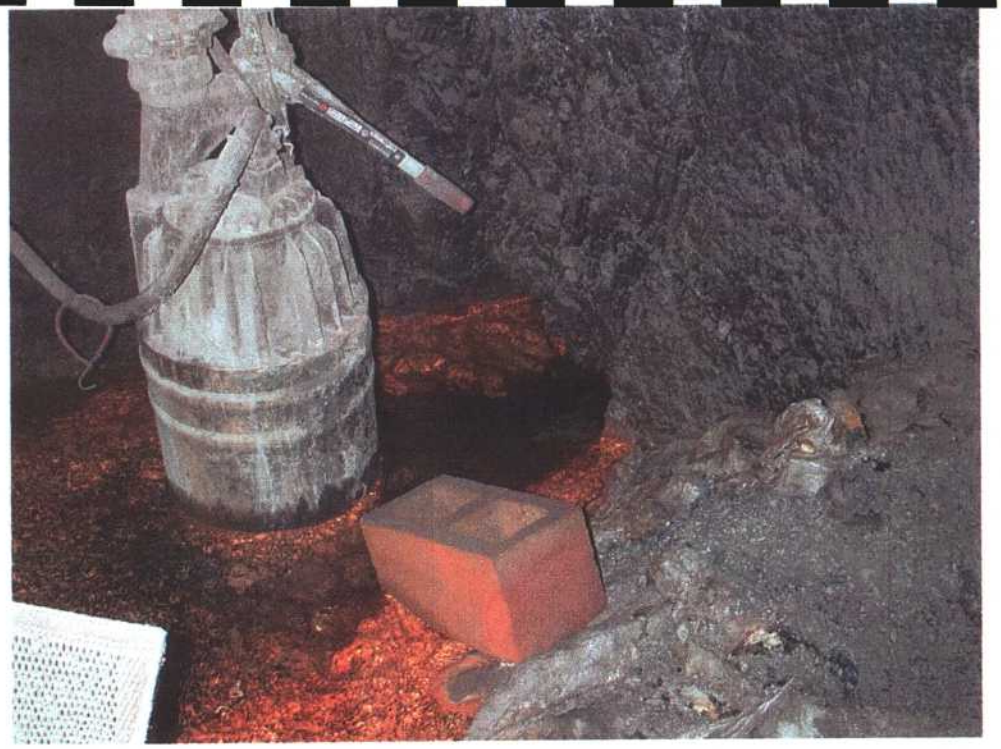
Thomas Aley, PHG & PG
President, Ozark Underground Laboratory, Inc.

F:\shared\tom\hansen1.doc
F:\shared\internet\plan1.doc

Appendix G

In-Mine and Surface Features Photographs





Electric Lake Dive Highlights
Feb. 15 – 21 2003